Pain Perception and Experience from a Psychological Perspective

Thesis Portfolio

Rosanna Wing Lam Lau

Primary supervisor: Prof. Ken Laidlaw

Secondary supervisor: Prof. Sheung-Tak Cheng

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Thesis Overview

This thesis portfolio consists of three parts which aims to examine the pain perception and experiences of people with chronic pain from a psychological perspective. The three parts are: a systematic review and meta-analysis; an empirical research study; and a bridging chapter, with an expanded method section for each individual paper in this thesis.

The systematic review and meta-analysis (Chapter 2) examines the efficacy of structured psychological interventions on pain severity, pain catastrophizing and depression in community-dwelling individuals diagnosed with chronic pain. The meta-analysis is submitted in the format of the journal Clinical Psychology Review (see appendix A for author guidelines).

The bridging chapter (Chapter 3) links the research coherently within the thesis as a whole and provides a rationale for the empirical study. Due to the word limit restriction of the selected journals, the bridging chapter also provides the opportunity to provide more exploratory data analyses and elaboration of the methodological approach adopted in each submission forming this thesis portfolio.

The empirical research paper (Chapter 4) examines hypothesized underlying mechanisms of pain severity on depression through pain catastrophizing and pain self-efficacy in older adults (≥ 60 years) with chronic pain. This paper also examines the comparative levels of pain severity, depression, pain catastrophizing and pain self-efficacy between the HK and UK dwelling participants. The article is presented in the format of the Journal of Pain (see appendix B for author guidelines).

Lastly, Chapter 5 presents the overall discussion which integrates the findings and implications from the meta-analyses and empirical study. It also presents the discussion

regarding the strengths and weakness of the study, and the suggestions for further research. References and appendices are presented in Chapter 6.

Thesis Portfolio Abstract

Introduction: Chronic pain is a debilitating problem worldwide and has been found to be strongly associated with negative psychosocial consequences for both individual and society.

Aim: To understand the pain experiences of chronic pain patients from a psychological perspective.

Method: A systematic review and meta-analysis was conducted to appraise the quality of structured psychological intervention for adult chronic pain patients, and to examine the efficacy of psychological intervention on pain severity, pain catastrophizing and depression. An empirical study was conducted to examine the indirect relationship between pain severity and depression through the interaction of pain catastrophizing and pain self-efficacy in the sample of HK Chinese (n = 664) and UK British (n = 29) community-dwelling older people with chronic pain. Mediation analyses and moderated mediation analyses using bootstrapping sample procedures were performed. Independent samples T-test was conducted to examine levels of pain self-efficacy and pain catastrophizing between HK and UK participants.

Results: The meta-analysis results revealed that psychological intervention had a significant small to moderate effect size on pain catastrophizing and depression, but not on pain severity as compared to the control groups. The empirical study results indicated a significant mediating effect in the relationship between pain severity and depression through pain catastrophizing. A significant moderated mediating effect was found, indicating that pain severity increases the level of depression indirectly through increasing pain catastrophizing when pain self-efficacy is low. Results demonstrated that HK participants had lower pain catastrophizing and higher pain self-efficacy levels than the UK participants.

Discussion: Cognitive factors played important roles in understanding pain experiences for people with chronic pain. Psychological interventions targeting on addressing pain catastrophizing and enhancing pain self-efficacy should be considered for chronic pain patients. Further investigation is needed to clarify the influence of cultural factors on pain catastrophizing and self-efficacy.

PART 1

A SYSTEMATIC REVIEW AND META-ANALYSIS

Chapter 2: A systematic review and meta-analysis

Does structured psychological intervention reduce the level of pain severity, depression and pain catastrophizing in chronic pain adult populations? A systematic review and meta-analysis.

R.W.L. Lau[a], S-T. Cheng[b] , & K. Laidlaw[a]

[a] University of East Anglia

[b] Hong Kong Education University

Address correspondence to:

Rosanna Lau

Department of Clinical Psychology

Norwich Medical School

University of East Anglia

NR4 7TJ

Rosanna.lau@uea.ac.uk

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For submission in Clinical Psychology Review with authors guidance in appendix A.

Abstract

Objectives. The purpose of this systematic review and meta-analysis is to critically appraise the quality of structured psychological interventions for patients with chronic pain. It also aims to investigate the efficacy of structured psychological interventions on the outcomes of pain severity, pain catastrophizing and depression, and to examine if the efficacy of psychological interventions differs with regard to different intervention types.

Method. Comprehensive literature searches of databases Medline, CINAHL, Psyinfo, EMBASE and Science Direct were performed and the articles published between 1997 and 2017 were reviewed. Eleven randomised controlled trials (RCT) studies (n = 1549) were included in the systematic review. Nine RCT studies (n = 943) were entered in the meta-analysis.

Results. The findings demonstrated a significant moderate effect of psychological interventions on the reduction of pain catastrophizing (SMD = 0.56, $p < .001$) and a significant small effect on pain severity (SMD = 0.29, $p < .001$) and depression (SMD = 0.28. $p < .001$) at immediate post-intervention. When compared to the non-active control group, psychological intervention indicated a significant difference in pain catastrophizing ($p < .001$) and depression ($p = .01$), but no significant difference was found in pain severity ($p = .79$). There is no significant subgroup difference between Cognitive Behavioural (CBT) intervention and other psychological approaches (non-CBT).

Conclusion. Psychological interventions were efficacious in the reduction of pain catastrophizing and depression but it did not show any evidence of benefit from pain reduction when compared to the control group. A review of the current pain intervention paradigms is needed in order to achieve greater effect in pain reduction.

1. Introduction

Chronic pain is a complex and widespread health condition (International Association for the Study of Pain [ISAP], 1994; Meucci, Fassa, & Faria, 2015; Vos et al., 2012), which has been characterized as one of the leading causes of disability worldwide (Murray & Lopez, 2013). Pain meeting criteria for chronicity affects between thirty to fifty percent of the population worldwide (Fayaz, Croft, Lanford, Donaldson, & Jones, 2015) and has been found to negatively impact upon individual's physical, emotional and social functioning (Itz, Geurts, van Kleef, & Nelemans, 2013; Juniper, Le, & Mladsi, 2009; Meucci et al., 2015; Vos et al., 2012). People with chronic pain have a higher risk of developing anxiety disorders and depression, have a poorer self-rated health quality (Butchart, Kerr, Heisler, Piette, & Krein, 2009) and report poorer quality of life (Pérez, Margarit, Sánchez-Magro, de Antonio, Villoria, 2017). Chronic pain also causes a significant socio-economic burden (Park et al., 2016) due to the increased societal health care costs (Bruehl, Chung, Jirjis, & Birfrpalli, 2005) and reduced work productivity among people with chronic pain (Agaliotis, Mackey, Jan, & Fransen, 2014; Langley et al., 2010).

While pain is defined as a multidimensional construct with sensory, affective, cognitive and evaluative components (ISAP, 1994), the chronicity and severity of pain is influenced by the interplay of psychosocial and physiological processes (Melzack & Wall, 1965). A growing base of research (Amatya, Young, & Khan, 2017; Ondrejkovicova, Petrovic, Svitkova, & Balogh, 2017) supports the contention that in addition to conventional pharmacological interventions, a wide range of psychological interventions are empirically supported for managing chronic pain. These include cognitive behaviour therapy (Turk, Meichen-baum, & Genest, 1983), mindfulness-based therapy (Chiesa & Serretti, 2011), behaviour therapy (Keefe et al., 1990), acceptance and commitment therapy (Trompetter, Bohlmeijer, Veehof, & Schreurs, 2015), each of which have been

shown to have efficacy for the management of chronic pain in a range of conditions. In general, structured evidence-based psychological interventions for chronic pain patients not only focus on pain reduction, but also on reducing pain-related distress and cognition (Hadjistavropoulos & Craig, 2004). As such, these interventions may result in individuals developing coping strategies and reporting having more positive idiosyncratic appraisals of pain experience, thus improving individuals' psychological well-being. The efficacy of pain interventions has been investigated and has been found to reduce negative emotions (Wicksell et al., 2013), improve individuals' pain responses and emotional functioning (Keefe et al., 1989; Tota-Faucette, Gil, Keefe, & Goli, 1993; Turk & Okifuji, 2002), and improve the quality and satisfaction of life (Johnston, Foster, Shennan, Starkey, & Johnson, 2010; Thorsell et al., 2011).

1.1. Pain Severity, Pain Catastrophizing and Depression

When reviewing commonly targeted outcomes of psychological interventions for chronic pain, pain catastrophizing and depression are related to the experience of pain and are included as primary outcome indices for treatment success in randomized controlled trials (Miller & Cano, 2009).

Pain is highly associated with depression (Fishbian, Cutler, Rosomoff, & Rosomoff, 1997) and can be described as a stress state that predicts the onset of depression (Aguera-Ortiz, Failde, Mico, Cervilla, & Lopez-Ibor, 2011). Pain and depressive symptoms often coexist, with up to 77 percent patients with chronic pain reporting depressive symptoms (American Academy of Pain Association, 2016).

Pain catastrophizing, is characterized by the tendency to ruminate upon a noxious stimulus (Sullivan, Bischok, & Pivik, 1995) and is one of the most common psychological risk factors for pain severity and depression. It is described as a cognitive distortion that exaggerates perception of painful stimuli rooted in the activation of maladaptive beliefs

(Michael & Burns 2004; Sullivan, Rodgers, & Kirsch, 2001), thus leading to the development or exacerbation of symptoms of depression (Beck,1967). Pain catastrophizing has also been found to influence the relationship between pain severity and depression. A study (Wood, Nicholas, Blyth, Asghari, & Gibson, 2016) examining a sample of 141 older people with chronic pain found that pain catastrophizing mediated the connection between pain severity and depression.

Whereas pain severity, pain catastrophizing and depression are consistently correlated with poorer quality of life and health (Börsbo, Peolsson, & Gerdle, 2008), physical disability and poor treatment outcomes (Edwards, Cahala, Mesing, Smith, & Haythornthwaite, 2011), there has been interest in considering psychological interventions to reduce the levels of these outcome variables associated with chronic pain. Sullivan (1995) suggested that interventions introducing coping strategies and addressing the negative beliefs that occur through pain catastrophizing may be beneficial to improve individuals' unpleasant pain experience and negative affect. However, there remains a limited evidence-base for systematic reviews and meta-analyses for examining the efficacy of psychological intervention for the outcomes of pain catastrophizing and depression (Roditi & Robinson, 2011).

1.2. Existing systematic reviews and meta-analyses

A very limited number of systematic reviews and meta-analyses (Bawa et al., 2015; Kent & Kjaer, 2012; Song, Lu, Chen, Geng, & Wang, 2014) have reported on the efficacy of psychological interventions with regard to pain catastrophizing and depression outcomes. These reviews have notable methodological limitations such as small sample sizes and chosen outcome measures restrict the generalizability and validity of the results. A meta-analysis conducted by Song et al. (2014) investigated whether mindfulness is efficacious for alleviation of pain and to improve psychological comorbidity. However,

only four studies were included in this analysis so that there was insufficient evidence to meaningfully assess the efficacy of psychological intervention for pain catastrophizing and depression. Given the small number of studies included, the meta-analysis cannot be generalised to the populations, so it remains inconclusive of whether mindfulness is efficacious for pain alleviation. Similarly, Williams, Eccleston and Morley (2012) conducted a meta-analysis examining the efficacy of psychological therapies for low mood, anxiety symptoms and pain catastrophizing in adult chronic pain patients. However, only few studies included in the analyses examined the efficacy of CBT for pain catastrophizing and therefore the results from this review cannot be generalised to chronic pain patients. A meta-analysis by Morley, Eccleston, and William (1999) examined the efficacy of CBT and behaviour therapy for pain experience, cognitive coping and appraisal. However, pain catastrophizing was grouped into a general domain representing "negative coping and appraisal". The combination of different outcomes into one domain might increase the risk of inconclusive results, as the effect sizes might be different between the overall domains and the discrete outcome domains. Thus, the efficacy of the psychotherapies on the construct of pain catastrophizing cannot be accurately assessed.

In general, clinical outcomes of pain related belief and cognition are rarely the focus in many published meta-analyses and systematic reviews. While peer-reviewed and published systematic reviews and meta- analyses examining the efficacy of pain intervention studies have mainly investigated outcome with regard to pain severity from the perspective of different delivery means of interventions (e.g. internet-delivered), types of psychological intervention , e.g. cognitive behavioural therapy, (Eccleston, Williams, & Morley, 2009), or the types of pain, e.g. musculoskeletal pain, (Palermo, Eccleston, Lewandowski, Williams, & Morley, 2010), the number of studies included in previous reviews investigating the impact of interventions on pain catastrophizing and depression

remains small. Thus evidence for the efficacy of psychological interventions for pain catastrophizing and depression remains to be established conclusively.

To address this gap in knowledge, the published trials and applied meta-analyses were systematically reviewed to examine the overall effect of psychological interventions for pain severity, pain catastrophizing and depression. In order to examine the outcome variables (i.e., pain severity, pain catastrophizing and depression) in more detail, the adopted approach avoided aggregating a number of separate outcome variables as previous reviews have done (Morley et al., 1999). Instead, in the current paper, the effect of the outcome variables of pain severity, pain catastrophizing and depression was evaluated separately by using validated psychometric measures.

1.3. Purpose of the Review

The primary aim of the current meta-analysis is twofold. Firstly, to perform a systematic review of the literature to critically appraise the characteristics and quality of structured psychological interventions for patients with chronic pain; and secondly, to conduct a meta-analysis to investigate the efficacy of structured psychological interventions for pain severity, pain catastrophizing and depression. In terms of secondary analyses, it is intended to examine whether different types of psychological interventions differ with respect to levels of pain severity, pain catastrophizing and depression in adults with chronic pain. The psychological interventions were categorized into two groups for analyses, that is, traditional CBT interventions (tCBT) and third-wave and other behavioural and cognitive interventions (twBCI). In this study, the tCBT intervention was defined as the use of techniques to change both cognitions and behaviours which was explicitly stated in the study (Richmond et al., 2015), while twBCI included the third waves CBT (e.g. ACT), or other therapies which involve techniques to change either cognitions (e.g. cognitive therapy) or behaviours aspect (e.g. behavioural therapy).

2. Methods

2.1. Systematic Search Strategy

Studies were identified by searching the electronic databases Medline, CINAHL, Psyinfo, EMBASE and Science Direct. Data were searched from the fully peer-reviewed journals written in English or with English translation between the period of 1997 and 2017.

Four facets to cover the issue to be searched: 1. Chronic Pain “chronic” AND “pain” 2. Categories of Populations “adult” (including all search engine variants, OR “elderly”(including all search engine variants) 3. Outcome measures “depression”, OR “catastrophizing”, OR “ catastrophising ” 4. Structured psychological intervention “ psychothera*” OR “psycholog* intervention” OR “ psycholog* treatment” OR “ psycholog*management”. In order to identify the respective types of psychological intervention condition consisting of the cognitive, behavioural or psychosocial elements, the following terms were used: “CBT” OR “cognitive behav*” OR “ct” OR “cognitive thera*”, OR “bt”, OR “behav* thera*”, OR “dbt”, OR dialectical behav* thera*”, OR “act”, OR “acceptance and commitment thera*”, OR “mindful*”. The search term “random*” OR “RCT” was used to identify randomised controlled trials. Manual searches in the reference lists and bibliographies were completed to detect any potential missing articles. When studies reported the same data in different publications, the study with the most recent samples was used (Nicholas, 2013; Nicholas, 2017).

2.2. Study Selection

Studies were included if

1) Participants were aged 18 years or above, with no age limit;

2) Participants with chronic pain condition for at least three months duration. Studies were included if chronic pain could be reported by a clinical diagnosis or self-report, and the duration of symptoms were confirmed through participants' self-report. Given that most of the participants involved in the RCT studies for pain interventions were recruited via various settings such as community, pain clinics or advertisements in order to enable recruitment, clinical diagnoses may not be available and therefore self-reported chronic pain patients were also included in this review;

3) Outcome measures were primarily to assess pain severity or intensity, depression and pain catastrophizing. Included studies were those which consisted of the validated psychometric self-report measures. Studies had to report pre-and post-intervention results;

4) Participants were randomly assigned to a psychological intervention condition or non-active control condition (psychotherapeutic content in which the primary focus was on alleviating chronic pain, and was designed to modify or promote biosocial, behavioural, emotional and cognitive functioning. They referred to treatment protocols or practice guidelines (Bracken & Thomas, 2005; Callaghan & Crawford, 2009; Cooper, 2009) which were based on existing conceptual and theoretical psychological frameworks such as behavioural, cognitive, psychodynamic, humanistic or systemic models (Gournay, 2009; Paley & Shapiro, 2001; Smith, 2012). Interventions could be delivered either face-to-face by health-care professionals or self-delivered such as guided-self-help (e.g. internet-based interventions).

Articles were excluded on the following criteria,

1) Studies where participants with only chronic headache, migraine, insomnia or cancer pain . The reason for adopting this exclusion criteria was that the target of

psychological intervention, as well as the nature and causes of these conditions, are sufficiently different from the other causes of chronic pain included in this study (Harris, Loveman, Clegg, Easton, & Berry, 2015; Newell, Sanson-Fisher, Savolainen, 2002; Nicholson et al., 2004; Randell, 2017; Williams, Eccleston, & Morley, 2002). In addition, for the purposes of focus in the current systematic review, headache and insomnia, by themselves are too broad to be included here.

2) Studies whose primary focus was an acute presentation of pain are excluded.
3) Studies whose primary focus was a comorbid condition (e.g. depression, smoking, substance abuse);
4) Studies where the primary outcomes measured were not adequately psychometrically robust (reliability and validity);
5) Studies where the psychological intervention condition is compared to an active control condition (e.g., exercise, education); this was in order to avoid the possibility that categorizing active and inactive controls into a generic control conditions might lead to biased conclusions regarding the estimated effect of treatment efficacy (Karlsson & Bergmark, 2015).

The first reviewer (RL) performed the first screening by removing duplicates and screening the abstracts and titles from the articles. If the study was not clear from the abstract, the full-text article was retrieved. Following the first screening, full-text review was conducted by the first reviewer (RL) and any queries regarding whether a study ought to be included were discussed with the second reviewer (KL). The first reviewer (RL) completed the final review and identified the studies for the systematic review.

In order to minimize the risk of discarding studies incorrectly, the screening process was piloted. Two full-text articles were independently reviewed for eligibility by two reviewers (RL & KL), in order to ensure that both of the reviewers (RL & KL)

reliably interpreted the eligibility of the selected studies based on the inclusion and exclusion criteria. The two studies were independently rated and scores used to calculate an inter-rater reliability co-efficient. Kappa was used and the result can be interpreted as follows: values ≤0 indicating no agreement and 0.01–0.20 as none to slight, 0.21–0.40 as fair, 0.41–0.60 as moderate, 0.61–0.80 as substantial, and 0.81–1.00 as almost perfect agreement (Landis & Koch, 1977). The Kappa co-efficient of the agreement was 0.91, indicating an almost perfect agreement.

2.3. Data Extraction

The extraction form was based on the Cochrane review of interventions (Higgins, 2011) and the relevant data were (a) sample size (b) age (mean, standard deviation) (c) gender (d) pain location (e) pain durations and (f) recruitment method.

In addition, we extracted the following information from each study in order to conduct a content analysis of interventions: (a) types of psychological intervention, (b) intervention conditions, (c) intervention duration (d) outcome measures (e) length of follow up and (f) delivery method. When the information was not clearly reported, we contacted the authors of the study for further details (Broderick, 2016; Smeets, 2006).

Two reviewers (RL & KL) selected a random set of two articles from the included studies and independently completed the extraction form in order to ensure the coding accuracy of the studies selected for analysis. The percentage of the agreement of study characteristic data was 0.96. Following the pilot-testing, data extraction of the studies was conducted by the first reviewer (RL) and queries were discussed with the second reviewer (KL).

2.4. Quality Assessment

The methodological quality assessment was performed by completing risk of bias

assessment schedule recommended by the Cochrane Back Review Group (Higgins & Green, 2011) and the Quality Rating Scale of psychological interventions in Pain (Yates, 2005).

Risk of Bias. All trials were rated using the Cochrane Collaborative tool for assessing risk of bias (Higgins & Green, 2011). It covers six specific domains: random sequence generation, allocation concealment, blinding of participants, blinding of personnel/care providers, blinding of outcome assessor, incomplete outcome data, and any other bias not covered elsewhere. A judgement of "yes" indicated a low risk of bias, of "no" a high risk of bias, and 'unclear' indicated insufficient information.

Quality Rating Scale for psychological interventions in pain. The Quality Rating Scale for psychological interventions in pain (Yates, 2005) was designed for assessing the quality of the randomized controlled trials for psychological treatments in pain. The overall total score is 35 and consists of two subscales- a treatment quality scale (range, 0 - 9) and the quality of study design and methods (range, 0 - 26). The items cover treatment rationale, manualisation, therapist training and patient engagement, inclusion and exclusion criteria, attrition, description of the sample, minimization of biases steps, outcomes justification, length of follow up, analysis and control group.

Two reviewers (RL & KL) independently evaluated and rated study quality from three randomly selected studies in order to determine inter-rate reliability and to rectify any potential misinterpretation. Inter-rater reliability was calculated on the items and the overall quality score. The overall agreement on the risk of assessment domains across two raters (RL & KL) was high (k =0. 89). The inter-rater agreement level on the Quality Rating Scale for Psychological Intervention in pain was high (k = 0. 91). Discrepancies and disagreement were resolved through discussion. Following the pilot testing, the first

reviewer (RL) completed the method quality ratings for all included studies. The second reviewer (KL) reviewed and checked the process for potential inconsistencies.

2.5. Meta-analysis

In order to investigate the efficacy of psychological intervention, a meta-analysis was conducted to examine the pre-and post-intervention effects on the outcomes of pain severity, pain catastrophizing and depression between active structured psychological interventions (i.e., CBT, BT, ACT or mindfulness based approaches) and non-active control (i.e. waitlist or usual care) in clinical samples. Due to the significant differences in the baseline scores between the control and experimental conditions at the pre-intervention in the included studies, comparing the results of the post intervention between groups may produce a reporting bias and increase type II error. Therefore this study conducted separate pre-and post-intervention analyses for the treatment outcomes.

In addition, subgroup analyses were performed to investigate whether the psychological intervention groups (i.e. CBT intervention versus other psychological intervention) differ with respect to levels of pain severity, pain catastrophizing and depression at post-intervention.

Statistical analyses. Meta-analysis was performed using the Cochrane Collaboration software program Review Manager (Revman v5.30). Effect sizes were calculated to statistically denote a magnitude and a direction of a difference between two groups or variables (Borenstein, Hedges, Higgins, & Rothstein, 2009). In order to assimilate effect sizes from different studies that use different measures and sample characteristics, effect sizes from different studies were aggregated together to determine an overall effect size by using the standardized mean difference (SMD) (i.e. *Hedges' g*) in the current meta-analysis. *Hedge' g* were interpreted as small effects at the value of

0.2,medium effect at 0.5 and large effect at 0.8 (Cohen, 1992). The 95% confidence interval (95% CI) for all estimates were calculated. Forest plot graphs were generated and the area to the right of midline (>0) indicates a result favouring the efficacy of the post psychological interventions.

Heterogeneity was assessed using the Chi-square (Cochran's Q) and I^2 statistic test. Heterogeneity was considered statistically significant if the *p*-value for the Chi-square test was less than 0.1 and I^2 values are greater than 50%. Given the likelihood of high heterogeneity between studies, a random effect model was employed in the current analyses.

To examine publication bias, funnel plots were completed with the effect size on the horizontal axis and the standard error on the vertical axis (Cuijpers, 2016). Small studies will appear towards the bottom of the graph and tend to be spread across a broader value of ranges and large studies appear at the top and tent to be closest to the mean effect thus the pattern forms a funnel shape (Light & Pillemer, 1984). A visual inspection was done to assess symmetry. Additionally, Rosenthal's Fail-safe N approach (Rosenthal, 1979) was used to compute the number of missing studies averaging a z-value of zero that should be incorporate in the analysis to reduce the combined effect size to a non-significant level. If only a few studies were need to nullify the effect, it would be a concern as the true effect might not be robust.

(For further details of the statistical analysis please refer to the extended methodology in bridging chapter, i.e., chapter three).

3. Results

Comprehensive database searches yielded 1412 studies and review of the relevant journals on the topics added another one study. After duplicates were removed, 1106

studies remained (see figure 1). Articles' titles and abstracts which did not mention pain severity, pain catastrophizing or depression as outcome measures were excluded, yielding 190 studies for full text article review. A further 164 studies were excluded as they violated inclusion criteria. Of the remaining 26 studies, a further review led to 15 exclusions; five because no validated outcomes measures were utilized for either pain severity, pain catastrophizing or depression, two studies were excluded as outcomes of pain catastrophizing were not reported, an additional two studies were excluded as they did not utilize a randomization protocol, and six studies were excluded as they compared the psychological interventions with active control group conditions including the exercise or education components. Therefore, eleven studies remained in the systematic review (See Figure 1 for PRISMA flow diagram).

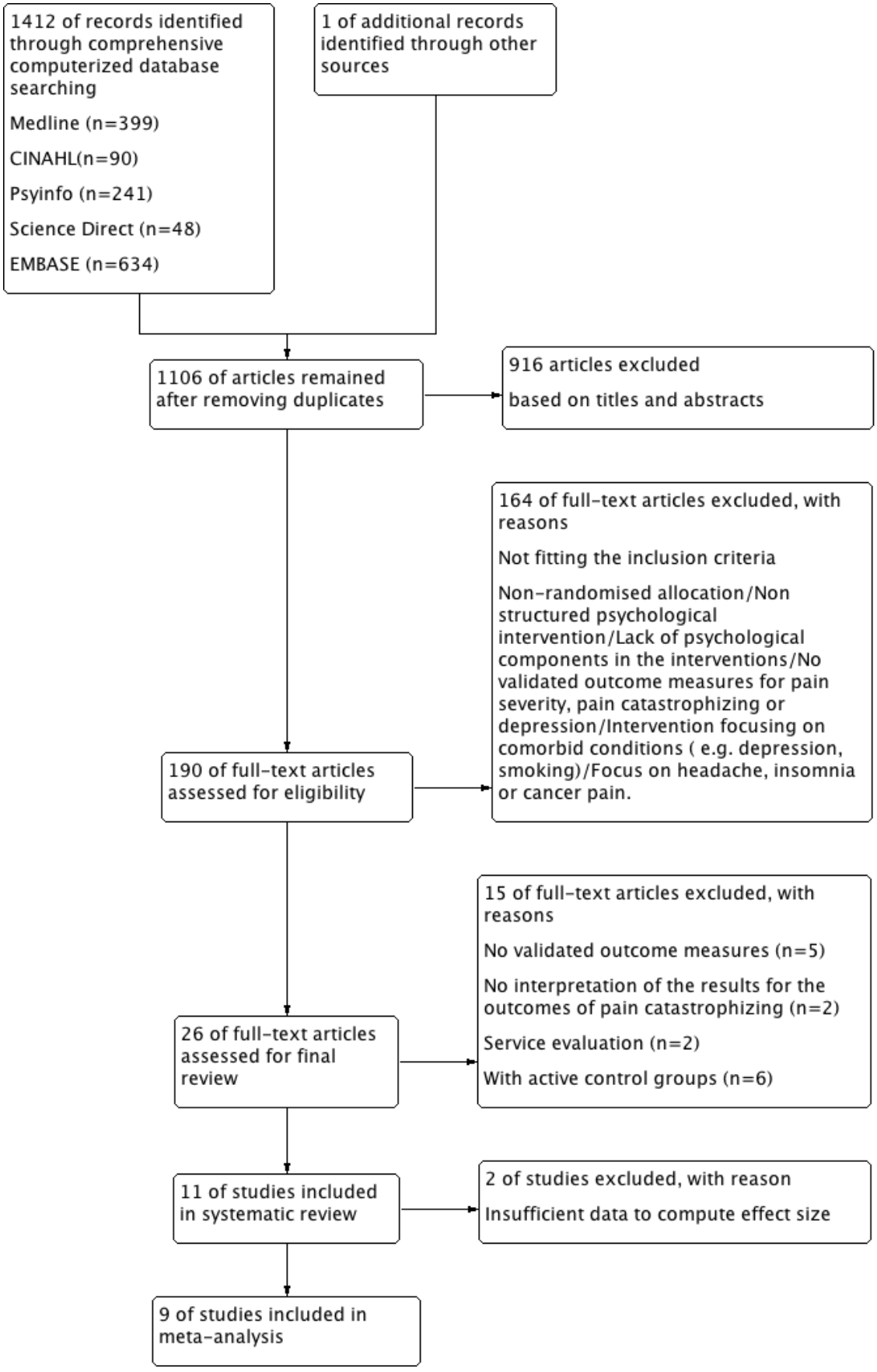

Figure 1. PRISMA flow diagram.

3.1. Characteristic of the Included Studies

Participants. Eleven studies with a total of 1549 participants published between 2004 and 2017 met criteria for inclusion in the current meta-analysis. Table 1 shows the main characteristics of the included studies. Sixty-eight percent of the participants were female (n = 1047), the mean age of participants was 50.58 years (SD = 10.62) with only seven studies reporting the mean duration of pain, with an average of 10.74 years (SD = 9.72). The summary of the study characteristics is presented in table 1.

In terms of the pain location, approximately 19 percent of the total participants (n=302) from four studies reported back pain, one study (n = 257, 17 %) included a patient group with osteoarthritis and one study (n = 228, 15%) had a patient group with general arthritis condition such as osteoarthritis and rheumatoid arthritis. Approximately 49 percent of the total participant (n = 762) from five studies reported unspecified chronic pain.

Recruitment strategies and settings. Of the eleven studies in the systematic review, three studies were from the Netherlands, two studies were from Sweden, two studies were from USA and two studies were from Australia. One study was from Canada and one was from Denmark.

Six studies (n = 683, 44%) recruited samples via advertisements such as through newspaper articles, emails, flyers or webpage or online platforms for health. The remaining participants (n = 866, 56%) from five studies were recruited from hospital or clinic settings such as the referral from general practitioners or clinicians.

Content and implementation of psychological interventions. Of the eleven studies in the systematic review, six studies (n = 757, 49%) had two treatment arms of

either psychological intervention groups or non-active control groups (i.e., waitlist or usual care). Four studies (n = 571, 37%) had three arms and one study (n = 211, 14%) had four arms which derive from at least one psychological intervention groups and one non-active control group.

In terms of the psychological intervention approaches, six studies (n = 1158, 75%) included interventions in Cognitive Behavioural Therapy (CBT) approaches, one study (n = 44.3%) utilized behavioural approaches (graded activity and vivo exposure), one study (n = 109, 7%) utilised a mindfulness approach and one study (n = 238, 15%) adopted an Acceptance and Commitment (ACT) approach to pain management.

Six studies with 910 participants (59%) were therapist-delivered interventions while five studies (n = 639, 41%) reported self-delivered interventions in which the internet-delivered strategy was adopted.

Eleven studies had an average number of nine sessions for psychological interventions, with a range of five to twelve sessions. Seven studies reported treatment duration with a mean number of 101 minutes of contact at each session (range: 20 minutes to 180 minutes). The summary of the content for psychological interventions are presented in table 2.

3.2. Outcomes Measures

Pain catastrophizing. Of the eleven studies included in the current systematic review, four studies each utilised separate validated and psychometrically robust catastrophizing questionnaires. Five studies (45%) utilized a coping strategies questionnaire (CSQ; Rosentiel & Keefe, 1983) with a good internal consistency (α = 0.84) as reported in a sample of 152 patients (Robinsen et al. 1997). Three studies (27%) used the Pain Catastrophizing Scale (PCS; Sullivan, 1995) and were found to have good internal

consistency (α = 0.87) to a sample of 429 adults (Osman et al., 2000). Two studies (18%) utilised the Pain Response Self-Statements Scale (PRSS; Flor, Behle, & Birbaumer,1993) catastrophizing subscale and the catastrophizing subscale reported good psychometric properties with a high internal consistency (α = *0*.92) (Flor et al.,1993). Two remaining studies (18%) used the pain catastrophizing subscale of the Pain Coping and Cognition List (PCLL; Stomp-van den Berg et al. 2001) which has been proved to have good internal consistency (α = 0.85) and the construct validity of the subscales was satisfactory (Stomp-van den Berg et al., 2001).

Pain severity. Seven different psychometrically robust pain severity questionnaires were used across eleven studies entered into the current systematic review, which demonstrated heterogeneity in the measurement of pain. Of the studies entered into the current systematic review, three studies (27%) utilised the Brief Pain Inventory (BPI; Cleeland & Ryan, 1994) with a high internal consistency (α = 0.89) in a sample of 256 adult chronic pain patients (Broderick, 2016). Three studies of the eleven studies in the current systematic review (27%) used the Multidimensional Pain Inventory (MPI; Kerns, Turk, & Rudy, 1985) with a good internal consistency of 0.67–0.81 when used with chronic pain patients (Buhrman, 2013). Three studies used the Roland–Morris Disability Questionnaire (RMDQ; Rolan & Morris, 1983) with good internal consistency (α = 0.86) in a sample of 490 adult chronic pain patients (Dear et al., 2015). Two studies (18%) used the McGill Pain Questionnaire - Short Form (MPQ-SF; Melzack, 1987) with an acceptable internal consistency of 0.75 in osteroarthritis patients (Grafton, 2005).

One study (9%) used the Pain Disability Index (PDI; Pollard, 1984) which consists of seven questions to assess the degree to which patients perceive their pain to interfere with daily functioning. It had a good internal consistency (α = 0.86) with a sample of 180 chronic pain patients (Tait, Pollard, Margolis, Suckro, & Krause, 1987).

In addition, four studies (Buhrman, 2004; Lacour, 2015; Smeets, 2006; Trompetter, 2015) adopted more than one measure of pain in their battery of tests and created a composite score to measure pain severity. Alongside other pain measures the Visual Analogue Scale (VAS; Woodforde & Merskey, 1972), the Numeric Rating Scale (NRS; Farrar, Young, LaMoreauz, Werth, & Poole, 2001) and the Wisconsin Brief Pain Questionnaire (WBPQ; Daut, Cleeland, and Flanery, 1983) were used. Both of the VAS and NRS measures demonstrated a high internal consistency(r=0.94-0.96) among the patients in a rheumatology outpatient clinic (Ferraz et al., 1990). The WBPQ has been validated with a sample 452 patients and demonstrates an acceptable internal consistency ($\alpha > 0.70$) (Mphahlele, Mutchell, & Kameran, 2008).

Depression. Of the eleven studies, four different validated psychometric measures were utilised in examining the level of depressive symptoms. Five studies (45%) used the Hospital Anxiety and Depression scale (HADS; Zigmond & Snaith, 1983) with a high internal consistency for the depression scale ($\alpha = 0.81–0.90$) in a sample of 72 chronic pain patients (Lisspers, Nygren, & Soderman, 1997). Three studies (27%) using the Beck Depression Inventory-II (BDI; Beck, Ruch, Shaw, & Emery1979) with strong psychometric properties (Beck, Steer, & Garbin, 1988), demonstrated good sensitivity and specificity in patients with chronic pain (Geisser et al., 1997; Turner & Romano, 1984). Two studies (28%) used the depression subscale of Depression Anxiety Stress Scale (DASS-21; Lovibond & Lovebond, 1995). The depression subscale of the DASS-21 has been found to have good internal consistency ($\alpha = 0.84$) in a sample of 221 community based adults (Tran, Tran, & Fisher, 2013). One study (9%) used the Patient Health Questionnaire 9-Item (PHQ-9; Spitzer, Kroeke, & Williams, 1999) designed as a diagnostic and symptom-severity measure for depression. The PHQ-9 reports good psychometric properties and is sensitive to treatment-related change.

In sum, there is heterogeneity in the number and types of measures for pain severity, pain catastrophizing and depression in the eleven included pain trials. However, the outcome measures used in the trials were all validated and with an acceptable to high internal consistency. These indicated that the outcomes of pain severity, pain catastrophizing and depression were accurately measured so that the results regarding the efficacy of the psychological intervention on these three outcomes are valid and reliable.

Table 1.

Summary of study characteristics of the selected studies.

Study/Country	Sample (n)	Mean Age (SD) (Years)	Female (n, %)	Pain location	Pain duration in years M (SD)	Recruitment Method
Broderick (2016) USA	257	E:68.00 (8.67) C: 66.37 (10.26)	E: 96 (74.4) C: 101(78.9)	Osteoarthritis	E:13.95 (10.63) C:13.59 (9.09)	Clinical & community settings
Buhrman (2004) Sweden	56	44.6 (10.4)	35 (62.5)	Back	10.1(9.2)	Advertisement (newspaper articles & webpage)
Buhrman (2011) Sweden	54	43.2 (9.8)	37(68.5)	Back	12.1 (8.5)	Advertisement (newspaper articles & webpage
Dear (2013) Australia	63	E:47 (13) C:51 (12)	E: 27 (87) C: 26 (84)	Unspecified	Not reported	Advertisement (newsletters and webpage)
Le Cour (2015) Denmark	109	E: 46.52 (12.42) C:48.84 (12.50)	E: 37 (91) C: 42 (93)	Unspecified	E: 7.83 (5.52) C:11.82 (11.09)	Clinical settings/ referral
Nicholas (2017) Australia	141	73.90 (6.5)	89 (63)	Unspecified	14.83 (17.33)	Clinical settings/referral
Smeets (2006) Netherland	211	E_1- APT: 43.00 (8.84) E_2 - CBT: 42.02 (9.47) E_3- APT+CBT : 41.58 (10.07) C: 40.63 (11.29)	E_1: 21 (40.4) E_2: 33 (60) E_3: 21 (38.2) C: 25 (51)	Unspecified	E_1: 4.82 (6.35) E_2 :5.82 (6.32) E_3: 4.68 (5.89) C:3.72 (6.01)	Clinical settings/ referral

Spinhoven (2004) Netherland	148	39.8 (9.1)	94 (63.5)	Low back	9.8 (8.7)	Clinical settings/referral
Trompetter (2015) Netherland	238	E_1- ACT: 52.9 (13.3) E_2-EW: 52.3 (11.8) C:53.2 (12.0)	E_1: 63 (76.8) E_2: 60 (75.9) C: 55 (75.3)	Unspecified	Durations of complaints >5 years E_1: 58.5%, E_2: 69.6% C:61%	Advertisements (newspaper and online patient platforms)
Trudeau (2015) USA	228	49.9 (11.6)	156 (68.4)	Arthritis	Not reported	Advertisement (doctors' offices, senior citizen service organizations, events conducted by the Arthritis Foundation, email announcements and web posts)
Wood (2008) Canada	44	E_1-GIVE: 46.13 (11.9) E_2- GA: 47.23 (12.0) C: 46.12 (12.5)	29 (65.9)	Low back	Not reported	Advertisement in clinical settings

Note. All are randomized controlled trials. n: Numbers of sample. SD: Standard deviation. E, E_1, E_2, E_3: Experimental groups. C: Control group. APT: Active physical treatment group. CBT: Cognitive-behavioural treatment group. ACT: Acceptance Commitment Therapy group, EW: Expressive Writing group. GIVE: Graded in vivo exposure group. GA: Graded activity group.

Table 2.

Summary table of intervention details of the selected studies

Study	Intervention	Psychological Intervention sessions/duration per each session(mins)	Outcomes	length of follow up, in months (m)
Broderick (2016)*^	1. E: Pain Coping Skills Training 2. C: Usual Care	10 /30–45 mins	1. health status: AIMS 2. Pain severity: BPI 3. pain, stiffness, and physical function: WOMAC 4. Coping and catastrophizing: CSQ subscale 5. Self-efficacy: ASES 6. Quality of life: QOLS 7. Fatigue: BFI 8. depression: BDI	Post-intervention, 6m & 12m
Buhrman (2004)*^^	1. E: Cognitive behavioural-based intervention 2. C: Waitlist control	6/not reported	1. Coping and catastrophizing: CSQ 2. Pain severity: MPI, NRS 3. Thoughts, attitudes and opinions about pain: PAIRS 4. Depression and Anxiety: HADS 5. Treatment credibility: The credibility scale	post-intervention & 3m
Buhrman (2011)*^^	1. E: Cognitive behavioural-based intervention 2. C: Waitlist control	12/not reported	1. Pain catastrophizing: CSQ 2. Pain severity: MPI 3. Thoughts and attitude about pain: PAIRS 4. Depression and Anxiety: HADS 5. Life satisfaction: QOLS	post-intervention
Dear (2013)*^^	1. E: Pain Course 2. C: Waitlist Control	5 / not reported	1. Depression: PHQ-9 2. Anxiety: GAD-7 3. Pain severity: RMDQ, WBPQ 4.. Self-efficacy: PSEQ	post-intervention & 3m

			5.. Fear avoidance belief: TSK 6.. Pain catastrophizing and coping: PRSS	
La cour (2015)**^	1. E: MBSR mindfulness programme 2. C: Waitlist control	8/180 mins +1/270 mins Follow up session after 2 months: 45 mins meditation everyday A follow-up session was conducted 2 months after the last session 45 minutes over 8 weeks	1. Pain severity: BPI,VAS 2. Health, level of function, well-being and quality of life: The SF36 3. Anxiety and Depression: HADS 4. Catastrophizing: CSQ 5. Pain acceptance: CPAQ	post-intervention & 6m
Nicholas (2017) *^	1. E_1: The Pain Self-Management group 2. E_2: Exercise-attention control group 3. C: Waitlist control	8/120 mins twice weekly basis for 4 weeks	1. Pain severity: RMDQ 2. Distress: DASS-21 3. Pain catastrophizing: PRSS 4. Fear avoidance belief: TSK 5. Pain self-efficacy: PSEQ	post-intervention, 1m, 6m &12m
Smeets (2006)*^	1. E_1: Active physical treatment 2. E_2: Cognitive-behavioural treatment 3. E_3: APT+CBT 4. C: Waitlist control	10 weeks/not reported E_1: 3 times per week during 10 weeks E_2: 10 /90mins E_3: 19 / 35mins were given.	1. Pain severity: RMDQ, VAS 2. Depression: BDI 3.. Pain Catastrophizing: CSQ 4.. Locus of Control: MHLC	post-intervention at 2.5 m
Spinhoven (2004)*^	1. E_1: Operant-behavioural treatment & cognitive coping 2. E_2: Group discussion 3. C: Waitlist control	12/ 90 mins	Primary outcomes: 1. Pain severity: MPQ-SF 2. Pain Behavior: PBS 3. Depression: BDI 4. Activity Tolerance: BAT 5. Pain Catastrophizing and coping: PCCL	post-intervention, 1 m & 10 weeks OPCO :6m & 12m post-

				intervention, 6m &12m
Trompetter (2015)***^^	1. E_1: Acceptance and Commitment therapy 2. E_2: Expressive writing group 3. C:Waitlist control	9/not reported	1. Pain severity: MPI, PDI, NRS 2. Depression and Anxiety: HADS 3. Mental health well-being: MHC-SF 4. Psychological inflexibility: The Psychological Inflexibility in Pain Scale 5. Mindfulness: FFMQ-SF 6. Engaged living: ELS 7. Pain catastrophizing: PCCL	post-intervention & 3m
Trudeau (2015)*^^	1. E_1: Online self-management programme 2. C: Waitlist Control	8 / 20 mins plus a minimum of 5 sessions/ 20-min (one session/month for 5 months)	1. Self-efficacy: ASES 2. Pain Catastrophizing: PCS 3. Pain awareness: PAQ 4. Symptom Management: CSMQ. 5. Pain intensity: BPI 6. Depression and Anxiety: DASS-21 7. Coping: CPCI-42 8. Health status: AIMS 9. Impression of improvement: PGIC	1m, 3m & 6m
Woods (2008)****^	1. E_1:Graded in vivo exposure group 2. E_2: Graded activity 3. Waitlist control	8/ 45 mins 8/not reported	1. Pain severity: MPQ-SF 2. Depression and Anxiety: HADS 4. Pain self-efficacy: PSEQ 5. Fear avoidance belief: TSK & FABQ 6. Pain anxiety: The PASS-20 7. Pain catastrophizing: PCS 8. working alliance and treatment credibility: WAI	the 2nd, 4th & 8th week

Note. * Cognitive Behavioural approach ** Mindfulness approach *** Acceptance and Commitment Therapy approach **** Behavioural approach. ^therapy-delivered interventions ^^ self-delivered interventions. E, E_1, E_2, E_3: Experimental groups. C: Control group. APT+CBT : Active physical treatment and Cognitive-behavioural treatment group. AIMS: The Arthritis Impact Measurement Scale. BPI: the Wisconsin Brief Pain Inventory. WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index. CSQ: Coping Strategies Questionnaire. ASES: Arthritis Self-Efficacy Scale. QOLS: The Quality of Life Scale. BFI: Brief

Fatigue Inventory. BDI: The 21-item Beck Depression Inventory. MPI: Multi Dimensional Pain Inventory. PAIRS: Pain and Impairment Relationship Scale. MPI: Multi-Dimensional Pain Inventory. HADS: The Hospital Anxiety and Depression Scale. NRS: Numerical rating scale. PHQ-9:Patient Health questionnaire-9. GAD-7: Generalized Anxiety Disorder-7. RMDQ: Roland & Morris Disability Questionnaire. WBPQ: Wisconsin Brief Pain Questionnaire. PSEQ: The Pain Self-Efficacy Questionnaire. TSK: The Tampa Scale for Kinesiophobia. PRSS: The Catastrophizing scale of the Pain Response Self-statements Scale. VAS: visual analog scales. The SF36: The Short Form (36) Health Survey. CPAQ: Chronic Pain Acceptance Questionnaire. DASS-21: The Depression scale of the Depression Anxiety Stress Scales. BAT the Behavioral Approach Tests. RDQ: Roland Morris Disability Questionnaire. MHLC: Multidimensional health locus of control scale. PRI: Pain Rating Index. PBS: the Behavioral Approach Tests. PCCL**:** pain coping and cognition list. MHC-SF: The Psychological Inflexibility in Pain Scale. FFMQ-SF: Five Facet Mindfulness Questionnaire**.** ELS: The Engaged Living Scale. PAQ: The Pain Awareness Questionnaire. CSMQ: Cognitive Symptom Management questionnaire. PCS: The Pain Catastrophizing Scale. CPCI-42: the Chronic Pain Coping Inventory. PGIC: Patients' Global Impression of Change scale**.** SF-MPQ: The McGill Pain Questionnaire – Short Form. FABQ: The Fear Avoidance Belief Questionnaire. PASS-20: the Pain Anxiety Symptoms Scale. WAI: The Working Alliance Inventory.

3.3. Overall Study Quality

Risk of bias. The risk of bias summary of the included studies was presented in Figure 2.With regard to the selection bias, in terms of reviewing the robustness of procedure used in generating the allocation sequence, seven studies (64%) were rated as “low risk” as random components in the sequence generation process were described. The remaining four studies (36%) were rated as “unclear risk” due to the lack of description in the generation process. With regard to allocation concealment, three studies (27%) were considered as “ low risk” because of the adequate concealment of allocations. Eight studies (73%) were considered as “ unclear risk of bias” due to concealment process not being mentioned in the articles.

With regard to performance bias, in terms of expectation for treatment outcome, two studies (18%) were in the category of high risk of bias because of poor attempts at blinding of allocation. Two studies (18%) were considered as low risk of bias and seven studies (64%) were rated as unclear risk of bias due to insufficient information about the allocation procedure.

With regard to detection bias, in terms of blinding of outcome assessment, four studies (36%) were rated as low risk of bias as the assessors were blinded or self-administered measures were used. Seven studies (64%) were rated as unclear risk of bias due to insufficient information on describing the blinding procedure.

With regard to attribution bias, in terms of the description of the completeness of outcome data, eight studies (73%) were considered to be of low risk since there were good descriptions of attribution rate and an intention to treat analysis for data was reported. Two studies (18%) were rated as high risk of bias as some data was omitted from reports of analyses. One study (9%) reported insufficient information on

describing the completeness of the outcome data therefore this study was marked as unclear risk of bias.

For selective reporting bias, all studies (100%) were rated as low risk of bias as the outcomes were all reported. All studies (100%) were also rated as low risk of other bias.

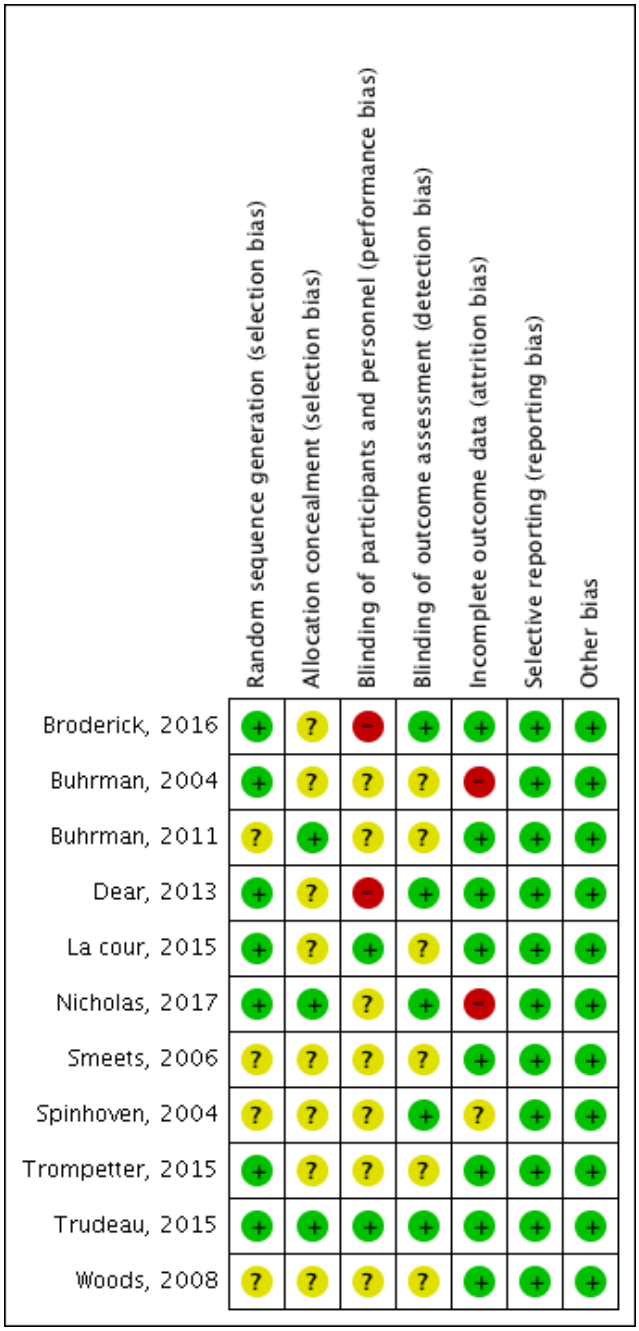

Figure 2. The risk of bias summary of the included studies

Table 3.

Summary of Quality Rating Scale for psychological interventions in pain.

	Treatment quality					**Quality of study design and methods**								
Study	Treatment content	Duration	Manual	Therapist training	Patient engagement	Sample criteria	Attrition	Sample	Minimise bias	Outcomes	Follow up	Statistical analysis	Control group	Total
Broderick, 2016	2/2	1/1	3/3	2/2	0/1**	1/2**	0/3**	2/2	3/5*	6/6	1/1	4/5**	2/2	27/35
Buhrman, 2004	2/2	1/1	3/3	2/2	1/1	2/2	2/3**	2/2	4/5*	6/6	1/1	3/5**	2/2	31/35
Buhrman, 2011	2/2	1/1	3/3	2/2	0/1**	2/2	2/3**	2/2	5/5	5/6**	1/1	4/5**	2/2	31/35
Dear,2013	2/2	1/1	3/3	2/2	0/1**	2/2	3/3	2/2	3/5*	6/6	1/1	3/5**	2/2	30/35
La cour, 2015	2/2	1/1	3/3	2/2	0/1**	2/2	3/3	2/2	3/5*	6/6	1/1	5/5	2/2	32/35
Nicholas, 2017	2/2	1/1	3/3	2/2	1/1	2/2	3/3	2/2	5/5	6/6	1/1	4/5**	2/2	34/35
Smeets, 2006	2/2	1/1	2/3**	2/2	1/1	2/2	3/3	2/2	4/5*	5/6**	1/1	4/5**	2/2	31/35
Spinhoven, 2004	2/2	1/1	2/3**	1/2**	1/1	2/2	2/3**	1/2**	3/5*	5/6**	1/1	3/5**	2/2	26/35
Trompetter, 2015	2/2	1/1	3/3	2/2	1/1	2/2	2/3**	2/2	4/5*	5/6**	1/1	5/5	2/2	32/35
Trudeau, 2015	2/2	1/1	3/3	2/2	0/1**	1/2**	2/3**	2/2	5/5	5/6**	1/1	4/5**	2/2	30/35
Woods, 2008	2/2	1/1	3/3	2/2	0/1**	2/2	2/3**	2/2	3/5*	6/6	1/1	3/5**	2/2	29/35

Note. * The domain criteria is not fully met. ** The domain criteria is not fully reported or unclearly specified. Treatment content: a clear rationale for the treatment has been given and an adequate description of its content. Duration: total treatment duration has been reported. Manual: The active components of treatment has been described and the adherence to manual has been demonstrated. Therapist training: Therapists have been appropriately trained. Patient engagement: Evidence that the patients have actively engaged in the treatment. Sample criteria: Inclusion and exclusion criteria are clearly specified and evidence for the criteria met. Attrition: Evidence that CONSORT guidelines for reporting attribution have been followed. Sample: Good description of the sample in the trial. Minimise bias: Including randomization and adequate steps to minimize allocation bias, measurement biases and treatment expectations. Outcomes: The outcomes are justified, valid and reliable. Follow up: Measure of sustainable chance between the treatment and control groups. Statistical analyses: Report of power calculation, sufficient sample size, planned data analysis, statistics reporting and intention to treat analysis. Control group: A well-matched control group is used.

Quality Rating Scale for psychological intervention in pain. The mean overall quality rating (Yates, 2005) score was 30.3 (SD = 2.18). There is no cutoff score for this scale. Thus the quality of the studies was determined by the scores in each domain. Studies which cannot reach the full score of the domain indicate that the quality of the domain is not fully met or is not fully reported.

Of the eleven studies (Table 3), six studies (55%) could not reach the full score within the domain of patient engagement, due to lack of evidence in reporting patients' engagement with the treatments. Two studies (18%) could not reach the full score in the domain of sample criteria as the inclusion and exclusion criteria were unclearly specified. Seven studies (64%) did not reach the full criteria on the domain of attrition, due to the drop-out rates with reasons for drop-out insufficiently reported. Seven studies (64%) did not meet the full criteria of "minimise bias' domain, as there was possible risk of bias in either randomisation, allocation or measurement bias. Five studies (45%) did not meet the full criteria of "outcomes" domain as the justification of the use of the outcome variables were not reported. Nine studies (82%) did not reach the full score on statistical analysis domain, due to the calculation of power not being reported.

3.4. Results of the meta-analysis

Of the eleven studies meeting inclusion criteria for the systematic review, two studies (Broderick et al, 2016; Smeets,Valeyen, Kester, , & Knottnerus,2006) were subsequently excluded due to outcome results being in a format incompatible for computing effect sizes. Specifically, the study of Smeet et al (2006) and Broderick et al (2006) did not report the means of the post intervention outcomes. As such it was not possible to calculate the standardised mean difference for the meta-analyses. Emails were sent to primary authors to request the missing details, despite reminder emails being sent

no replies were received from the researchers resulting in the exclusion of these two studies. This yielded nine studies for the meta-analysis.

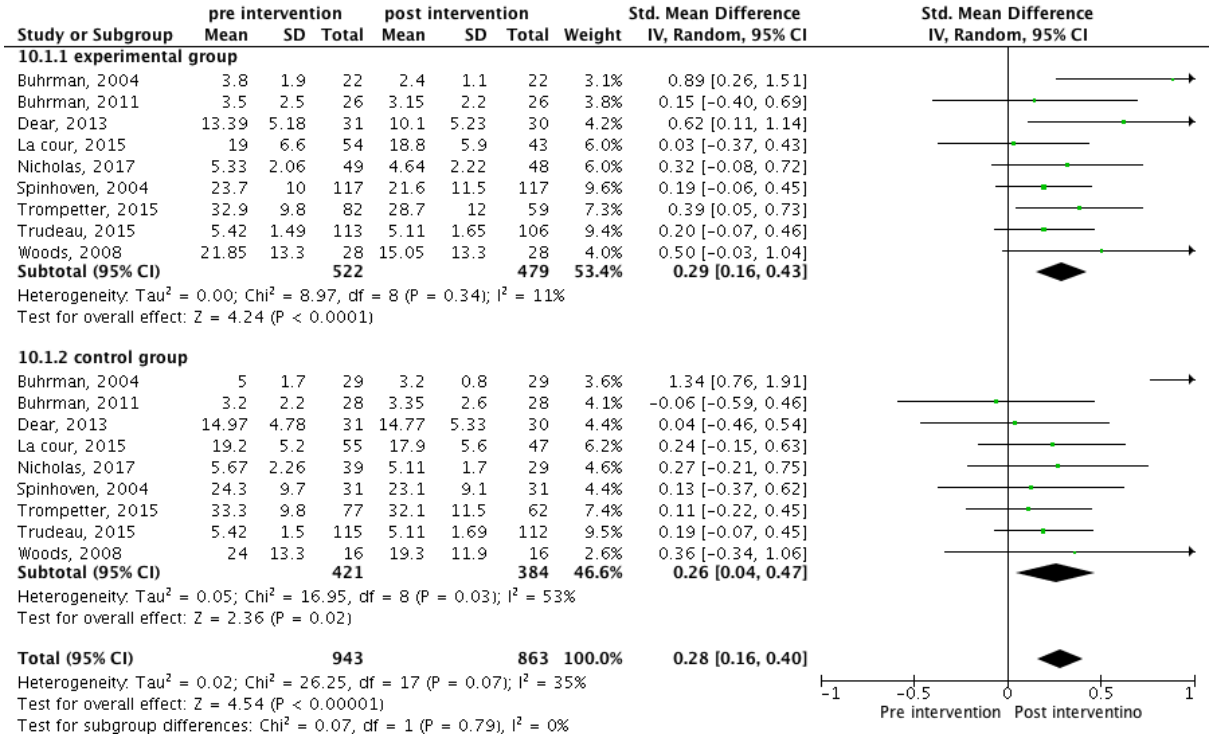

Figure 3. Results of pre- and post-intervention effect on pain severity between psychological intervention (experimental) groups and control groups.

Effect on Pain severity. As can be seen from the results of the psychological intervention (experimental) group in Figure 3, nine studies with a number of 522 participants at pre-intervention and 479 participants at post-intervention were entered into the analysis to examine the pre- and post- intervention effect on pain severity, The Chi-squared test and I^2 analyses revealed non-significant heterogeneity across the studies (I^2 = 11%; Q = 8.97, *df* = 8, p = .34) and the overall effect size comparing pain severity was statistically significant (SMD = 0.29, 95% CI [0.16,0.43], z = 4.24, p < .001), indicating a significant small effect on the reduction of pain severity at the post intervention for the psychological intervention group.

Nine studies were entered into the meta-analysis to investigate pre- and post- effect sizes for pain severity for the non-active control groups. The Chi-squared test and I^2 analyses revealed significant heterogeneity across the studies (I^2 =53%; Q = 16.95, *df* =8, *p* = .03). The overall effect size comparing pain severity was statistically significant (SMD = 0.26, 95% CI [0.04, 0.47], *z* = 2.36, *p* = .03), indicating a significant small effect of pain severity at post intervention for the non-active control group.

The result revealed that the difference between psychological intervention groups and control groups was non-significant with minimal overall heterogeneity (I^2 =0 %, Q = 0.07, *p* = .79). When compared to the effect size of participants in the control groups (SMD = 0.26), participants in the psychological intervention (SMD = 0.29) did not perform better in the reduction of pain severity as there was no significant difference in pain severity.

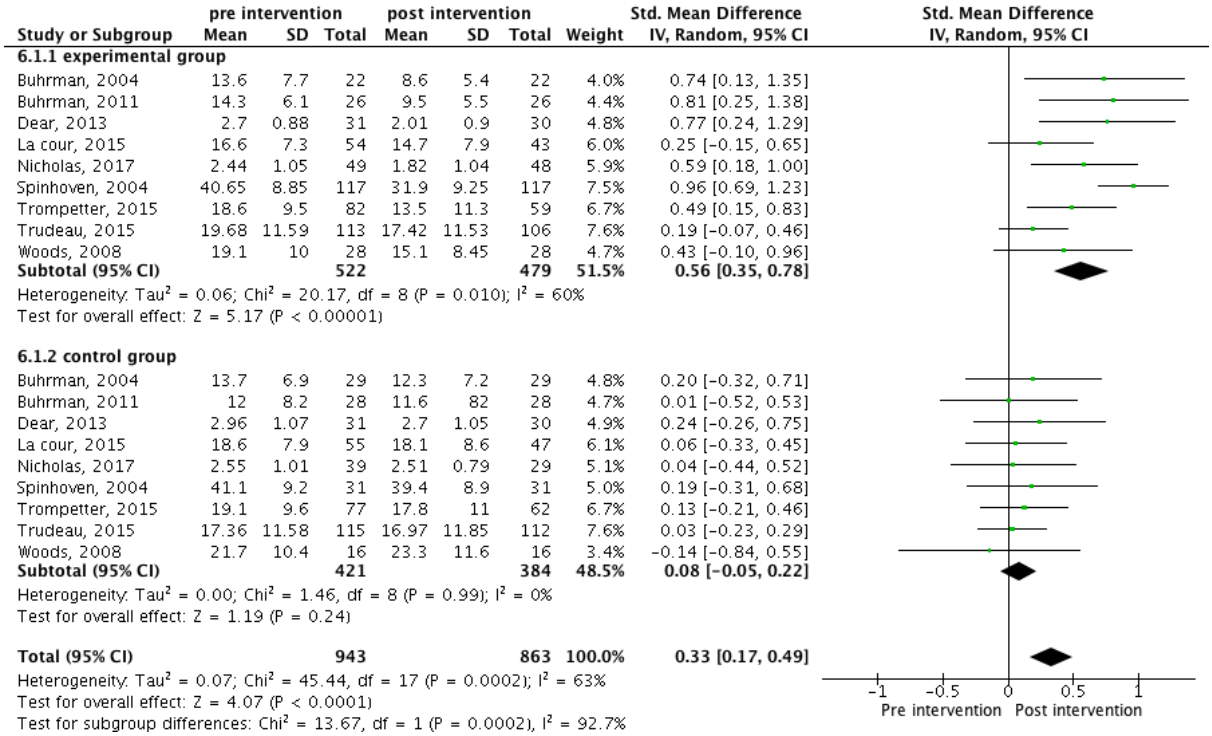

Figure 4. Results of the pre and post intervention effect on levels of pain catastrophizing between psychological intervention (experimental) and control groups.

Effect on pain catastrophizing. As can be seen from the Figure 4, nine studies, with a total number of 522 participants at the pre-intervention and 479 participants at the post-intervention, provided sufficient data for the analysis of the pre and post intervention effect on pain catastrophizing in the psychological intervention groups. The Chi-squared test and I^2 analyses reveal significant moderate heterogeneity across the studies (I^2 =60%; Q = 20.17, df = 8, p = .01). The results demonstrated that participants in the psychological intervention groups showed a significant moderate effect size for the reduction of pain catastrophizing at post-intervention (*SMD* = 0.56, 95% CI [0.36, 0.78], z = 5.27, p < .001).

For the non-active control groups, nine studies were included in the analysis to investigate pre and post effect on pain catastrophizing, with a sample of 421 participants at pre-intervention and 384 participants at post-intervention. A Chi-squared test and I^2 analyses for homogeneity was conducted. Results did not reveal significant heterogeneity across studies (I^2 = 0%; Q = 1.39; p = .99). The results revealed no significant overall effect at the pre- and post-intervention (*SMD* = 0.09, 95%CI [-0.05, 0.23], z = 1.23, p = .22), indicating that the control groups did not significantly reduce the level of pain catastrophizing at post- intervention in comparison to the pre-intervention.

When comparing the results of experimental groups (*SMD* = 0.56) to the control groups (*SMD* = 0.09), the differences were significant with a high heterogeneity (I^2 = 92.7%, Q=13.67, p < .001), indicating that a significant moderate effect on reduction of pain catastrophizing favouring the psychological intervention groups.

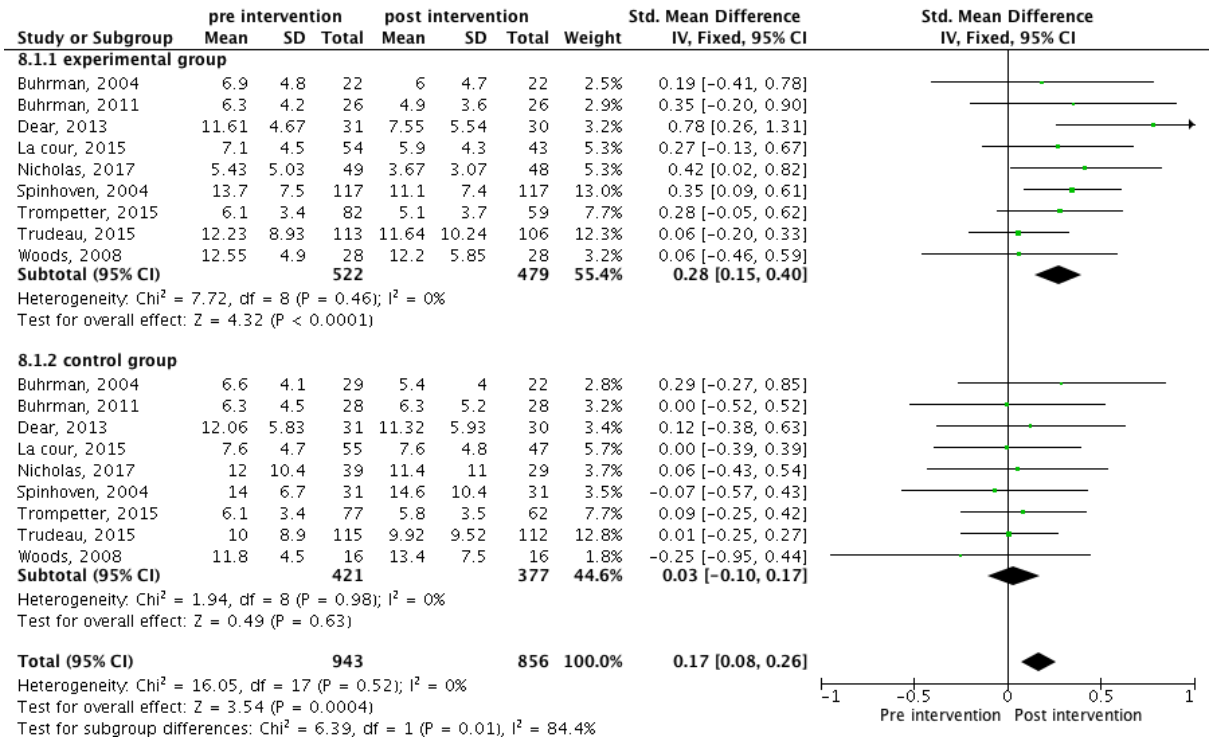

Figure 5. Results of pre- and post- intervention effect of depression between structured psychology intervention (experimental) and control groups.

Effect of depression. As can be seen from the Figure 5, nine studies were entered into the analysis to investigate the effects of structured psychological interventions for depression at pre- and post- intervention. I^2 analyses and Chi-squared test revealed no significant heterogeneity between studies (I^2 = 0 %; Q= 7.72, df = 8, p = .46). Participants in the psychological interventions condition for treating depression reported a statistically significant small effect size at post-intervention in comparison to pre-intervention (*SMD* = 0.28, 95% CI [0.15, 0.40], z = 4.32, p < .001).

Nine studies were also included to investigate pre-and post-effect sizes for the non-active control groups. I^2 analyses and the Chi-squared test reveal no significant heterogeneity between studies (I^2 = 0 %; Q= 1.94, df = 8, p = .98). The results revealed no significant difference in depression between pre-and post-intervention (*SMD* = 0.03, 95% CI [-0.10, 0.17], z = 0.49, p = .63), indicating that non-active control did not demonstrate

any effect on the reduction of depression.

Results examining the difference between psychological intervention groups (*SMD* = 0.28) and control groups (*SMD* = 0.03) were statistically significant (I^2 = 84.4 %, *Q* = 6.39, *p* = .01), indicating a small effect on the reduction of depression favouring the psychological intervention group.

3.5. Subgroup Analyses

Comparative effects of different intervention approaches (traditional CBT interventions (tCBT) versus third-wave and other behavioural and cognitive interventions (twBCI)). Nine studies were included in the subgroup analyses to investigate the possible impact of different intervention approaches (tCBT versus twBCI) on pain severity, pain catastrophizing and depression. As there were only three number of studies using other psychological intervention approaches, interventions including mindfulness, Acceptance and Commitment therapy approach and Behavioural approach were combinedinto the twBCI group, for the purposes of analyses.

Pain severity. As shown in Table 4, the subgroup analyses showed a non-significant effect size (*p* = .87) on pain severity between tCBT (*SMD* = 0.32, 95% CI [0.10, 0.54]) and twBCI (*SMD* = 0.29, 95% CI [0.02, 0.56]). This indicated that efficacy of intervention on reduction of pain severity did not statistically differ between tCBT and other psychological interventions.

Pain catastrophizing. The subgroup analyses (table 4) revealed no statistically significant differences in the effect size of pain catastrophizing (*p* =.18) between tCBT (SMD =0.66, 96% CI [0.36, 0.96]) and twBCI (*SMD* = 0.40, 95 %CI [0.17, 0.63]). This indicated that the efficacy of intervention on reduction of catastrophizing did not statistically differ between tCBT and other psychological interventions.

Depression. Both tCBT (*SMD* = 0.31, 95 %CI [0.13, 0.50]) and twBCI (*SMD* = 0.24, 95% CI [0.00, 0.47]) demonstrate a small effect on reduction of depression. The analyses revealed no significant difference in the effect size between two groups (p = .61), indicating that efficacy of intervention on reduction of depression did not statistically differ between tCBT and tother psychological interventions.

Table 4.

Subgroup analyses of the psychological intervention on pain catastrophizing, depression and pain severity.

Outcome	Subgroup	K	Total N	SMD	95% CI	z	*p*	I^2	Q
Pain catastrophizing	tCBT	6	349	0.66	0.36 to 0.96	4.26	<.001***	70%	16.93
	twBCI	3	130	0.4	0.17 to 0.63	3.35	<.001***	0%	0.84
	subgroup difference						.18	43%	1.78
Depression	tCBT	6	349	0.31	0.13 to 0.50	3.28	.001**	29%	7.04
	twBCI	3	130	0.24	0.00 to 0.47	1.99	.05*	0%	0.51
	subgroup difference						.61	0%	0.27
Pain severity	tCBT	6	349	0.32	0.10 to 0.54	2.83	.005**	37%	6.39,
	twBCI	3	130	0.29	0.02 to 0.56	2.14	.03*	21%	2.54
	subgroup difference						.87	0%	0.03,

Note. tCBT: Traditional Cognitive Behavioural Therapy approach. twBCI: third-wave and other behavioural and cognitive interventions including Mindfulness, Acceptance and Commitment therapy and Behavioural therapy. * Significant at p <.05, **significant at p <.01, ***significant at p <.001.

3.6. Publication Bias

Rosenthal's failed safe N. With regard to pain severity, Rosenthal's failed safe N (Rosenthal, 1979) suggested that 64 missing studies are required before the p value becomes non-significant (p >.05, two-tailed). In terms of pain catastrophizing, Rosenthal's failed safe N suggested that 182 missing studies are required before the p value becomes non-significant (p >.05, two-tailed). For depression, Rosenthal's failed safe N suggested that 48 missing studies are required before the p value becomes non-significant (p >.05, two-tailed).These results demonstrated that it would not be a concern to nullify the effect and therefore the overall effect on pain severity, pain catastrophizing and depression is likely to be robust.

Funnel plots. Funnel plots (Higgins & Green, 2011) were used to assess the publication bias. The funnel plot of pain severity and pain catastrophizing are asymmetrical. The funnel plots of pain severity (Figure 6) and of pain catastrophizing (Figure 7) have shown that more studies were on the left than the right, indicating that a possibility of either publication bias or other explanations such as poor methodological design, reporting bias or study heterogeneity. However, based on the visual cues, the symmetric shape of the funnel plot for depression (Figure 8) suggested that there is no significant publication bias.

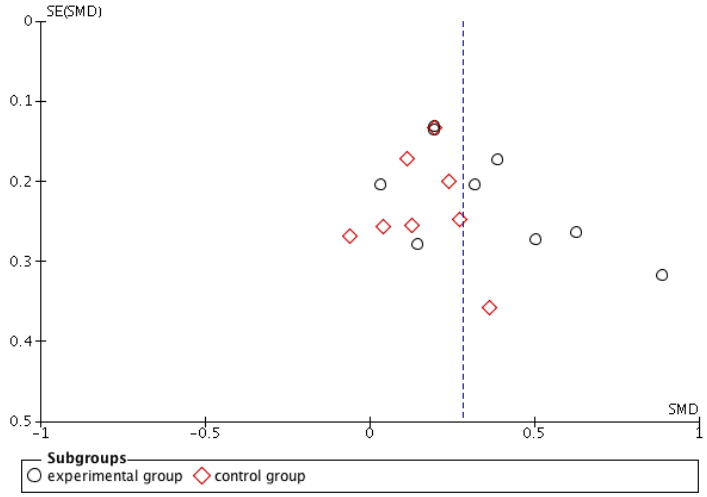

Figure 6. Funnel plot of pain severity.

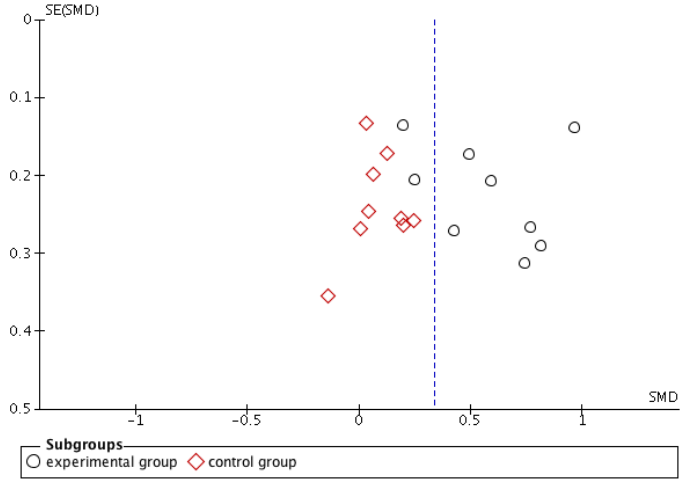

Figure 7. Funnel plot of pain catastrophizing.

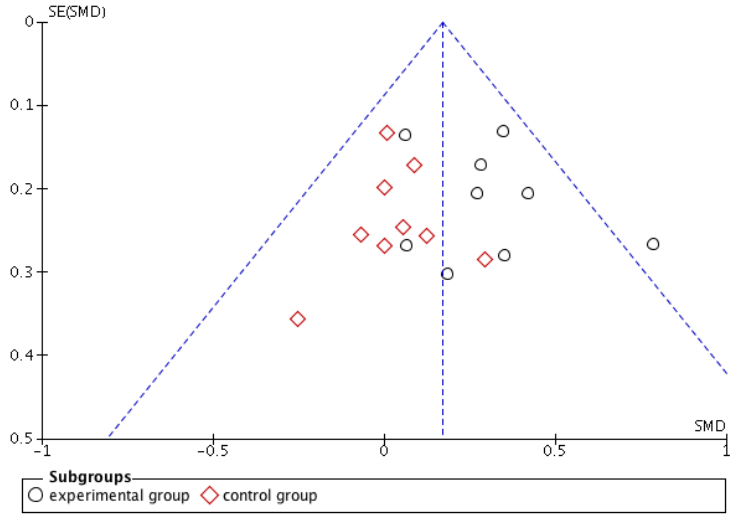

Figure 8. Funnel plot of pain depression

4. Discussion

4.1. Summary of Main Findings

The current systematic review examined the quality of structured psychological interventions for patients with chronic pain. In this regard, eleven randomized controlled studies with a total number of 1549 participants were included in the review. tCBT, which was utilised by eight studies, remained the dominant evidence-based approach in psychological pain interventions. The remaining three studies utilised other psychological evidence-based approaches; mindfulness, behavioural therapy and acceptance and commitment therapy.

In terms of the quality of the included studies, the evidence for the risk of bias in some domains was unclear. Of the eleven studies included in the systematic review, eight studies did not state the concealment process and seven studies did not report the blinding process. Therefore, it is impossible to provide a complete and balanced evidence of the quality of all the included studies by using the risk of bias assessment criteria. As such, the overall methodology quality using the risk of bias assessment was unclear.

In addition, the Quality Rating Scale (Yates, 2005) was used to rate the quality of psychological intervention for pain management. The review indicated that six out of eleven included studies did not provide the evidence for the participant engagement. While participant engagement is related to participants' attendance, knowledge, skills, ability and attitudes to participate in interventions (Nock & Kazdin, 2005), the greater quality of participation has been associated with improved treatment outcome (Bamberger, Coatsworth, Fosco, & Ram, 2014). In order to improve the quality of psychological intervention for pain management in the future

research, there is a need to monitor participant engagement such as using precise records on participants' presence during treatment and on the homework compliance (Smeets et al., 2006; Trudeau et al., 2015), or providing questionnaires to evaluate the treatment acceptability and satisfaction (Buhrman et al., 2004, Dear et al., 2013; Nicholas et al., 2017; Woods & Asmundson, 2008).

The trials included in the current systematic review demonstrated better overall quality when compared to the results of similar systematic reviews in psychological interventions for chronic pain patients in (Bawa et al., 2015; Williams et al., 2012). Specifically, the mean of the overall scores in this review was 30.3 (*SD* =2.18) while the mean of a previous systematic review (Williams et al., 2012) in examining the efficacy of psychological therapy in adult population reported overall quality using the same index was 21.2 l (*SD* = 5.9).

To explain the difference in the scores of the Quality Rating Scale (Yates, 2005) between current systematic review and the previous review of William et al. (2002), it was possible that psychological intervention designs for chronic pain patients have improved over the years. In support of this argument, the systematic review reported by William et al. (2012), suggesting there is an association between the year of the study and quality of study. When compared to previous reviews (Williams et al. 2012) in which the included studies were published over thirty years, more than half of the studies included in this review were published within 5 years and as such it is considered that the methodological quality of psychological interventions have improved. Another explanation for the higher quality rating scores in the current systematic review is that the inclusion criterion of the selected studies for this review are robust and sensitive to a number of important domains indexing methodological quality (e.g. randomization, training contents and manual).

For instance, in the current systematic review, in order to be entered into analysis, studies had to meet inclusion criteria for randomized controlled trials and had to utilise psychological interventions based on manualised evidence-based treatment protocols.

4.2. Summary of Meta-analysis Findings

The purpose of the current meta-analysis is to examine the extent to whether structured psychological interventions are efficacious in pain severity, pain and depression in comparison to control condition. To our knowledge, this review is the first study to examine the efficacy of psychological interventions on the outcomes of pain severity, pain catastrophizing and depression separately, based on the validated psychometrically robust measures. Of the eleven studies included in the systematic review, two studies (Broderick, 2016; Smeets, 2006) did not report data in a format that allowed effect size calculations and as such the meta-analysis sample size was reduced to nine studies. The study of Broderick (2016) recruited 256 osteoarthritis patients and they were randomized into either CBT intervention group or usual care control group. Instead of reporting the pre- and post- effect between control and intervention groups, the study aimed at investigating the moderating effect of pain coping response. Similarly, the randomized controlled study of Smeets (2006) focused on the mediating role of pain catastrophizing in the sample of 211 chronic lower back pain patients and did not compare the pre- and post-intervention effect between control and intervention groups. Thus, the efficacy of the psychological intervention on pain severity, pain catastrophizing and depression were under-reported in these two studies.

Of the meta-analysis results from nine studies, the results revealed the

psychological intervention group had a significant but small effect on the reduction of pain severity. The minimal impact of psychological intervention on pain severity is consistent with the previous review which also found a small size of effect on pain reduction at post-intervention (Scascighini, Toma, Dober-Spielmann, & Sprott, 2008*)*. The non-active control groups also demonstrated a significant small effect on pain severity and the subgroup analysis results (p = .79) revealed no significant difference in pain severity between the two groups. This indicated that psychological interventions did not show any evidence of benefit from reduction of pain severity when compared to the usual care or waitlist control conditions. To explain this, one possible reason was that there was no clear definition for "usual care" for the control group. It is possible that usual care may involve physiotherapy or pharmacotherapy (Eccleston et al., 2009) which aims to relieve pain severity, so that patients who received the usual care treatment might also benefit from reduction of pain. Therefore, the effect of pain severity could be similar between psychological intervention and non-active control groups. The other possible explanation may be related to the design and contents of the psychological pain intervention. When reviewing the rationale of psychological intervention for chronic pain patients (Henschke, 2011; Vlaeyen, 1995), the aim of the psychological intervention may not be to treat the pain directly, but the attempt to modify patients' unhelpful cognition and behaviours may improve their psychosocial functioning. Thus, the psychological interventions may not demonstrate a great effect on pain relief. Further, the review of Eccleston (2013) highlighted that chronic pain is a complex condition in which there are no promising treatment for chronic pain, whether pharmacological, surgical, physic or rehabilitation, that contribute to complete success. As such it should be no surprise of the modest effect on pain severity through psychological intervention, as

the management for pain is actually challenging for all fields.The current meta-analysis results did not demonstrate any evidence of benefit from structured psychological intervention in pain reduction, in addition with the unclear risk of bias in the quality of intervention, it therefore cannot be concluded whether psychological intervention is efficacious in reducing pain severity in the adults with chronic pain.

In addition, the meta-analysis results demonstrated no significant effect on pain catastrophizing and depression in the control group, but there was a significant moderate reduction of pain catastrophizing and a small reduction of depression at the pre-and post-test in the structured psychological intervention groups. The results supported the view that the structured psychological interventions are efficacious on the reduction of pain catastrophizing and depression. The current result was consistent with the findings from previous meta-analyses in this field in which a small to moderate significant effect was found on reduction of pain catastrophizing and depression at post- treatment by using Cognitive Behavioural therapy of general chronic pain (Williams et al., 2012). These analyses results confirmed that the focus of current psychological interventions for pain management was the pain-related distress and was successful in addressing catastrophizing and depression.

The other purpose of the meta-analysis was to examine the effect of different psychological intervention approaches with respect to pain severity, pain catastrophizing and depression. The results found no significant difference on pain severity, pain catastrophizing and depression between traditional CBT intervention approaches and other psychological intervention approaches. This result was supported by the previous meta-analysis (Monticone et al., 2015) in which CBT intervention did not differ from other types of interventions in terms of effect on pain

(p = .65) among chronic neck pain patients at short term follow-up. The meta-analysis results of Henschke et al (2011) also demonstrated no significant difference between operant, cognitive and combined behavioural therapy for short term pain belief.

To explain the lack of difference between the tCBT and twBCI, one of the possible reasons may be related to the way the intervention approaches being categorized for analyses. While tCBT is the most commonly used approach for the included pain intervention study, the number of studies using other interventions are relatively small. Therefore other psychological interventions using behavioural, acceptance and commitment and mindfulness approach were grouped together as twBCI in order to increase the strength of the overall effect pooled in the current analysis. Despite there are differences in how clinical experience in terms of cognitions is treated between twBCI and tCBT approaches, there are overlaps in philosophy and interventions between tCBT and the broad class of mindfulness, ACT and behavioural interventions. As such, the twBCI which shared some characteristics of CBT may contribute to the lack of differences in the subgroup analyses when compare to the tCBT. As a result, which specific type of psychological approach contributes most to the reduction of pain severity, pain catastrophizing and depression, compared to tCBT, is as yet unknown and cannot be concluded in the current study.

4.3. Strengths

There are some strengths in the current review. When compared to the prior systematic reviews and meta-analyses in which a small number of studies were included, this review successfully quantified the effect of psychological intervention using a relatively large sample size, and provided sufficient statistical evidence on

the efficacy of pain intervention on the outcomes of pain severity, pain catastrophizing and depression.

In addition, it is the first study to include validated psychometric robust measures to examine the efficacy of psychological intervention on the outcomes, pain severity, pain catastrophizing and depression. In the previous meta-analysis, studies usually combined the outcome measures in one domain to report the overall effect size in which this might increase the risk of leading to inconclusive results. As such, this review which included separate validated psychometric measures have provided better evidence on the efficacy of psychological intervention on the outcomes.

4.4. Limitations

The systematic review showed several important limitations. Firstly, the initial stage of search process (i.e. title and abstract screening) was carried by one reviewer. Though the pilot selection procedures had been completed and the uncertainties of the decision had been discussed with second reviewer throughout the process, some studies may have been missed. Secondly, some studies did not provide long-term follow ups and the duration of the follow up varied across the studies (range from 1 month to 13 months), therefore the focus of this review was on the immediate effect at post intervention. For this reason, this is unable to draw a conclusion on the efficacy of psychological interventions on pain, pain catastrophizing and depression in the long-term.

4.5. Clinical Implication

The current meta-analysis results revealed no significant difference in pain severity between psychological intervention and non-active control groups, therefore

it was unable to give a clear evidence in the efficacy of psychological intervention on pain severity (Williams et al, 2012; Sturgeon, 2014). There is growing increasing evidence confirming that pain severity can be explained from a psychological perspective and psychological factors play an important role in understanding and changing the perception of pain. For instance, the Gate Control Theory of pain (Melzack & Wall, 1965) proposed that pain itself not only presents the damage of the biological tissue, psychological, emotional components would also contribute to the prolong experience of pain. This implied that pain may not only be related to the organic aspect, and is itself a subjective experience. The state of being severe depends on how individuals evaluate the experience rather than actual organic or tissue damage. With the support from other studies, intervention focusing on the psychological components such as thoughts and feelings that maintain, or exacerbate suffering has shown promising effects in the reduction of the pain severity level. (Eccleston, Morley, & Williams, 2013). As such, the reduction in pain severity should be remained as one of the targeted components in psychological intervention for chronic pain patients.

In order to bring about maximal pain severity reduction in chronic pain management, the aforementioned result calls into question as to whether the design and implementation of psychological treatments for pain management may need to be reviewed at different levels. First, further research to examine which psychological components should be targeted in the interventions for pain management. It can be that componential analyses of pain management approaches may be useful in establishing which elements of structured psychological interventions are most efficacious and with which populations of pain patients (Jacobson et al., 1996). Secondly, the quality and the design of the intervention for

pain management should be improved. For instance, the unclear risk of this current studies such as patient's engagement may affect the effect of treatment outcomes and that it has to be addressed. Thirdly, the heterogeneous patient samples ,treatment duration and goals may show distinct treatment efficacy on pain severity outcomes. Trials including specific type of patients and consistent treatment doses and goals may be useful.

Further, the meta-analysis results indicated that the psychological interventions are efficacious on improving pain catastrophizing and depression when compared to control groups for adults with chronic pain. The analyses showed that psychological interventions for adults with chronic pain may not solely target on pain relief, but also targeted on psychological functioning and distress level. This results offer insight for healthcare professionals to include factors related to pain, such as pain catastrophizing and depression, in the design and implementation of psychological interventions for people with chronic pain.

4.6. Research Implications

This review shows evidence on the efficacy of psychological interventions on pain severity, depression and pain catastrophizing. However, the results indicated that no significant difference exists between CBT and non-CBT intervention on outcomes. Therefore, which psychological intervention approach crucially contributes best to the improvement of the outcomes is still unknown. In addition, which treatment components contributes to the improvement in pain catastrophizing and depression, and how, were also unexplored in this review. Therefore, further research is needed to clarify the underlying mechanism of how components of psychological intervention have contributed to thon reduction of pain catastrophizing and depression among chronic pain patients.

In addition, the participants of the reviews were mostly from Western culture. Therefore it remains unclear of whether the pain interventions targeted on reducing pain catastrophizing and depression are as efficacious as in people with different cultural or ethnic backgrounds. Further research, which includes the participants from other countries would be needed to determine this.

5. Conclusion

In summary, our findings appear to lend support for the efficacy of psychological intervention on pain severity, pain catastrophizing and depression. However, there was no difference between the effect of psychological intervention and non-active control groups on pain, indicating that there is no evidence to support that psychological intervention for pain management is more efficacious than control groups. Therefore, further work is needed to determine what components of psychological interventions are essential to improve the effect on pain severity. In addition, there was no significant difference between CBT intervention and non-CBT intervention, to indicate which psychological components of intervention most likely benefit from, and this needs further investigation.

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PART 2

BRIDGING CHAPTER

Chapter 3: Bridging chapter

The link between SR/MA and ERP

The systematic review and meta-analyses (SR/MA) and the empirical research paper (ERP) are linked together coherently in this thesis. First, the SR/MA outlined in chapter two (pp 6-67) examines the efficacy of structured psychological interventions on pain severity, depression and catastrophizing for chronic pain adults. The results successfully provide the evidence that structured psychological intervention is efficacious in the reduction of pain catastrophizing and depression among chronic pain patients. Therefore, it can be concluded that pain catastrophizing and depression are two important targeted components in the psychological intervention for chronic pain in adult populations. However, it is unable to conclude what and how the psychological components of the pain intervention contribute to the reduction of pain catastrophizing and depression in chronic pain patients. In order to improve our understanding in this aspect, the relationship between chronic pain, pain catastrophizing and depression is needed to investigate further.

To fill this gap, the aim of the ERP is to build upon the data provided in the SR/MA by directly addressing the question of the relationship between chronic pain and depression in an individual cross-cultural examination of pain cognition. Specifically, the underlying mechanism of how the interaction of the cognitive factors of pain (i.e. pain catastrophizing and pain self-efficacy) influence the relationship between pain and depression is explored. A better understanding of the relationship between pain and depression through examining the cognitive factors should help to develop a more psychologically sophisticated implementation of pain interventions.

Secondly, the SR/MA results outlined in chapter two provide evidence on the efficacy of psychological intervention on pain severity, catastrophizing and depression for chronic pain patients aged 18 years or above. However, none of the RCT studies in the SR/MA in chapter 2 examined the psychological intervention for older people populations. In order to extend our knowledge of understanding the pain experiences of older people, the targeted participants are on the adults who are aged 60 years or above in the EPR in chapter three.

In comparison with adults of working age with similar pain characteristics, older people often perceive pain as a normal physiological deterioration associated with normal ageing and that they were more passive in managing their pain condition. Further, older people often have lower priority and inadequate assess of health care in pain treatment (Gibson & Lussier, 2012), As a result, this population with chronic pain condition is frequently under-treated and under-reported (Arthritis research UK, 2012; Maxwell et al., 2008).

In addition, since there has been rising concern regarding medical intolerance, drug accumulation and side effects leading to health risks (McLachan et al., 2011) in older people, psychological interventions have become attractive treatments for chronic pain management. Considering the disadvantages of having limited access in pain treatment and medication intolerance among older adults, there is a need to improve healthcare quality and treatment recommendations in pain interventions for this population. To this end, the aim of the EPR in chapter three is to investigate the relationship between chronic pain and cognitive factors, in order to inform the design of psychological intervention for the older people with chronic pain.

Lastly, the analyses of SR/MA outlined in chapter two of this thesis were based on the chronic pain patients from Western countries such as Europe and

America; it was therefore unable to conclude if the pain intervention is also efficacious for the patients from eastern countries. In the EPR in chapter three, it is examined whether there is any difference in pain experiences of chronic pain patients between Western (i.e. Britain) and Eastern countries (i.e., Hong Kong). There is a need to have a better understanding about the pain experiences for people from varying racial and ethnic so that treatment applications and strategies can be adapted appropriately for different populations.

According to the biopsychosocial model, pain is shaped by interactions among biological, psychological and social factors, and people from different ethnic or cultural backgrounds may report differences in responses and belief in pain (Edwards, Moric, Husfelft, Buvanendran, & Ivankocih, 2005). A meta-analysis conducted by Meints, Miller, and Hirsh (2016) examined differences in pain coping between Black and White Americans. The results indicated that black Americans used more pain coping strategies such as praying and reported higher pain catastrophizing than white Americans, suggesting that the differences in pain coping may result from ethnic differences in the pain experience. Other studies (Campbell & Edwards, 2012; Chan, Malhotra, Malhotra, & Ostbye, 2011; Somers, Wren, & Shelby, 2012) also supported the notion that pain responses such as pain intensity ratings, behavioural and emotional responses may vary with ethnicity. In order to move pain cultural studies forward, the purpose of the EPR in chapter three is to conduct an exploratory analysis in looking at pain experience and its associated outcomes between the samples of Hong Kong Chinese and UK British participants.

Extended Methodology for SR/MA

This part presents an extended methodology for the SR/MA in chapter two.

Understanding and calculating Effect Size Statistics. Effect sizes are calculated to statistically denote a magnitude and a direction of a difference between two groups or variables (Borenstein et al., 2009). Effect sizes are obtained by subtracting two group means that are divided by a pooled standard deviation of the means. The following formula represents how effect sizes are calculated:

$$\overline{ES} = \frac{\overline{M}_e - \overline{M}_c}{SD_{pooled}}.$$

Effect sizes can be expressed in a variety of ways, such as difference between means (e.g. raw or standardized mean difference), correlation coefficient or as a percentage (Card & Casper, 2013). In the current meta-analysis, the conventional rules of thumb are applied to interpret magnitude of effect size where small is represented by $d \leq .2$; medium $d = .50$; large $d \geq .80$ (Lipsey &Wilson, 2001).

In meta-analysis, effect sizes from individual studies are aggregated together to determine an overall effect size (Borenstein et al., 2009). In order to assimilate effect sizes from different studies that use different measures and sample characteristics, effect sizes need to be comparable (Card & Casper, 2013). In the current meta-analysis effect sizes from different studies are aggregated together using the standardized mean difference (SMD) (i.e. *Hedges' g*). *Hedges' g* was chosen over an alternative metric, the sample estimate of the standardised mean difference, also known as *Cohen's d*, because there is an inherent positive bias in small sample sizes (Cooper, Hedges & Valentine, 2009). *Hedges' g* is calculated based on difference between the means of two groups (e.g. intervention and control/ pre-and post-intervention) (Card & Casper, 2013). A positive value of *Hedges' g* indicates that the intervention group obtained higher mean scores and the negative value depicts a higher score for the control group.

Formula for adjusted *Hedges'g* is:

$$g_{adjusted} = 1 - \left(\frac{3}{4df-1}\right).$$

In the current SR/MA in chapter two, the study of Trudeau et al (2005) did not report the means and standard deviations, therefore, a correction has been applied to calculate *Hedges' g.* Card & Casper (2013) suggested that effect sizes can be calculated from *t* and *F* statistics. The standard error can be converted into the standard deviation using the following formula:

$$SD = SE \times \sqrt{N}$$

Random effects model. The random effects model estimates the overall mean of different parameter values that different studies could estimate. It takes account of the uncertainty of the heterogeneity by recognizing the possible uncertainty about where the overall mean of all possible parameter values lies. Its mean is a weighted average of study means.

A random-effects model assumes measurement error beyond subject sampling error is randomly distributed and not from systematic differences among studies. When there is no heterogeneity (i.e. I^2 < 50%), fixed-effects and random-effects models produce the same results (Cumming, 2014). Therefore, random-effects models were used for all the analyses in the EPR in chapter three.

Heterogeneity. Heterogeneity refers to the variation in study outcomes between studies. The classical measure of heterogeneity is Cochran's Q which is calculated by the weighted sum of squared differences between individual study effects and the pooled effect across studies, with the weights being those used in the pooling method. Q is distributed as a chi-square statistic with k number of studies minus 1 degrees of freedom.

The other measure of heterogeneity is I^2 statistic which describes the

percentage of variation across that is due to heterogeneity rather than chance (Higgins, Thompson, Deeks, & Altman, 2003). I^2 values above 50% indicate high heterogeneity, between 25% and 50% indicate medium heterogeneity, and below 25% indicate low heterogeneity. The formula of I^2 is presented.

$$I^2 = 100\% \times (Q-df)/Q$$

Extended methodology and analysis for ERP

This part presents an extended outline of the methodology for the empirical study paper in chapter three. It provides more exploratory data analyses and elaboration of the methodological approach.

Procedure.

Respondent rate in HK participants. Nine hundred forty-one community dwelling Chinese older adults who were on the waitlist of the pain intervention programme (Cheng et al., 2017) have been identified, 277 of them has been excluded such as those who are not community dwelling old people or the pain condition was less than 3 months, leaving 664 Chinese older adults (mean age = 74.79; SD = 7.20; range = 60-95) were included for the ERP.

*Respondent rate in UK participants***.** Two hundreds questionnaire packs were given out by post or by the clinicians, thirty-six participants returned the packs and completed the screening, seven participants were not eligible for this study due to not having chronic pain for at least 3 month, leaving 29 British older people (mean age=70.90; SD=7.60) were included for the following ERP.

Data analysis.

Unequal sample sizes between UK and HK participants. As a small sample of UK participants (n = 29) were included in this study, we were unable to compare

it with the large sample of HK participants (n = 664) directly due to the high possibility to obtain Type I error (Keppel & Wickens, 1993). As such, stratified random sampling were used in this study. Stratified random sampling is a probability sampling technique which the populations are divided into different strata, then the final samples from the different strata are randomly selected (Cochran, 1977). This method of sampling from a population improves the representativeness of the sample by reducing sampling error and selection bias as it helps to ensure that the samples used for stratification can reflect the populations accurately.

In this study, HK participants were subdivided into different strata based on the age, gender and pain duration. The strata were compared with the key variables of UK participants. The strata that in effect the best possible matches on the key variables of UK participants were chosen. This yielded the total numbers of 29 strata. The final subsamples of 29 participants were taken from each stratum randomly.

Mediating analysis. Mediation model is used to examine the underlying mechanism by which an independent variable influences a dependent variable through the inclusion of a mediator variable. Rather than the direct relationship between independent variable and the dependent variable, a mediation model proposes that the independent variable influences the mediator which in turns influence the dependent variable. In the ERP in chapter three, simple mediation was used to examine the indirect relationship between pain severity (X) and depression (Y) through pain catastrophizing (M).

According to Baron and Kenny (1986), four conditions are necessary to establish mediation so a series of regressions was conducted to determine whether the pre-conditions of mediation were met. Condition 1, that is, the independent variable is significantly associated with dependent variables. Condition 2, that is, the

independent variable and the mediator must be significantly related. Condition 3, that is, the mediators and dependent variables must be significantly related. And condition 4, that is, the relationship between the independent variable and dependable variable should be non-significant or weakened when the mediator is added. However, there are growing critics about the necessity of testing the overall association in condition 1 (MacKinnon, 2000; MacKinnon, Krull, & Lockwood, 2000; Shrout & Boldger, 2002), suggesting that condition 1 is not necessarily required for the mediation analyses. Taking both concepts into consideration, the mediation analysis in the EPR in chapter three would be conducted even if the condition 1 was not met. In other words,

The mediating role of catastrophic cognition proposed in EPR in chapter three would be considered to exist if (a) pain catastrophizing was associated with depression, and (b) pain catastrophizing was associated with depression and (c) the direct relationship between pain severity and depression was weakened after the inclusion of pain catastrophizing.

Moderated mediation analyses. Moderated mediation (Muller, Judd & Yzerbyt, 2005; Preacher, Rucker, and Hayes, 2007), also known as conditional indirect effects, occurs when the strength of the indirect effect of an independent variables on an outcome via a mediator variable differs on the level of moderator. In order to have moderated mediation, the effect of independent variable on the mediator depends on the moderator or/and the effect of mediator on the outcome depends on the level of moderator. If there is no overall moderation of the treatment effect, it implies that the residual direct treatment effect on the outcome, controlling for the mediator, is moderated. In the ERP in chapter three, it is hypothesized that the indirect effect of independent variable (i.e. pain severity) on outcome (i.e. depression)

though the mediator (i.e. pain catastrophizing) depends on the level of moderator (i.e. pain self-efficacy).

Bootstrapping. Bootstrapping is a non-parametric resampling method to test hypotheses about the strength of the conditional indirect effects (Preacher & Hayes, 2004; Preacher et al., 2007). The concept of bootstrapping is to perform inference about a population from sample data by resampling the sample data with replacement. Bootstrapping estimates the sampling distribution of the conditional indirect effect non-parametrically and use information from the bootstrap sampling distribution to generate Confidence Intervals (CIs) for the conditional indirect effect. For hypothesis testing, the null hypothesis of no indirect effect is rejected at the α level of significance if CI does not across zero.

As the sampling distribution of the statistic is formulated through constructing a number of resamples with replacement, no assumption is required for the normal distribution. The advantage of using bootstrapping is to overcome the power problems (Preacher & Hayes, 2004, 2008; Preacher, Rucker, & Hayes, 2007; Hayes & Preacher, 2010). It is commonly used in testing direct and indirect effects in single and multiple mediation models for small sample sizes (Efron & Tibshirani, 1993). It has also been widely used in general psychology research studies (Chan, Ho, Leung, Chan, & Yung, 1999; Efron, 1998; Lee & Rodgers, 1998). To implement the bootstrapping method, PROCESS is one of an observed variable path analysis modeling tool for SPSS to estimate the direct and indirect effects with bootstrapping resampling procedures (Hayes, 2002).

Sobel test. In order to determine the statistical significance of the indirect effect , a statistic based on the indirect effect must be compared to its null sampling distribution. The Sobel test (Sobel, 1982) is used to assess whether a mediation

effect is significant. In the ERP in chapter 3, the Sobel test was used to examine the indirect effect of pain severity and depression through pain catastrophizing. The magnitude of the indirect effect is used to compared the estimated standard error of measurement to derive a t statistic. The relationship between the independent variable and the dependent variable is compared to the relationship between the independent variable and dependent variable including the mediation factor. Formula for t statistic is:

$$t = {}^{(\tau - \tau')}\!/_{SE} \quad \text{OR} \quad t = {}^{(\alpha\beta)}\!/_{SE}$$

Where SE is the pooled standard error term and $SE = \sqrt{(\alpha^2 \sigma^2_\beta + \beta^2\sigma^2_\alpha)}$. σ^2_β is the variance of β and σ^2_α is the variance of α.

PART 3

EMPIRICAL RESEARCH PAPER

Understanding of Pain Severity, Pain Self-efficacy, Pain Catastrophizing and Depression in Older Adults with Chronic Musculoskeletal Pain: a Comparative Study of UK and Hong Kong Samples

R.W.L. Lau[a], S-T. Cheng[b] & K. Laidlaw[a]

[a] University of East Anglia

[b] Hong Kong Education University

Address correspondence to:

Rosanna Lau

Department of Clinical Psychology

Norwich Medical School

University of East Anglia

NR4 7TJ

Rosanna.lau@uea.ac.uk

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Abstract

To clarify the indirect relationship between pain and depression among older people, the current study examines whether pain catastrophizing mediates the relationship between pain severity and depression. It also examines whether pain severity increases the level of depression indirectly through increasing pain catastrophizing when pain self-efficacy is low in the sample of 664 HK Chinese and 29 UK British community-dwelling older people with chronic pain. The study also investigates whether there are mean differences in levels of pain catastrophizing and pain self-efficacy between HK and UK participants.

In the mediation analyses, pain catastrophizing was found to partially mediate the relationship between the effect of pain severity on depression (95% CI [0.09, 0.14], $p < .001$) in HK participants ($n = 664$) and fully mediate the relationship between pain severity and depression (95% CI [0.06, 0.56], $p < .05$) in UK participants ($n = 29$). In the moderated mediation analyses, pain severity had a significant indirect effect on depression through pain catastrophizing when self-efficacy is low in both HK and UK participants. T-tests results indicated that the selected samples of HK participants ($n = 29$) had a statistically significant higher self-efficacy and lower pain catastrophizing (t (56) = 2.32, $p = .02$) than UK participants ($n = 29$).

The current study identified that self-efficacy and pain catastrophizing are important factors for understanding the process that lead to depression with chronic pain patients. There are significant mean differences in pain catastrophizing and pain self-efficacy between UK and HK participants, indicating that catastrophizing and self-efficacy may be culturally sensitive constructs that may be varied across

countries. Further studies are needed to examine the influence of cultural factors on these pain-related variables.

Perspective

This study provided a new perspective to understand the indirect relationship of pain and depression through the interaction of pain catastrophizing and pain self-efficacy, which might shed light on the design of pain intervention by improving self-efficacy and addressing catastrophizing for older people with chronic pain.

Key words

Chronic pain, older adult, catastrophizing, self-efficacy, depression

Introduction

Chronic musculoskeletal pain is a common non-malignant disabling condition in older people which affects muscles, ligaments, tendons, and bones (Hunt, Silman, Benjamin, McBeth, & Macfarlane, 1999; International Association for the Study of Pain [ISAP], 1994). It accounts for half of all chronic disease among adults over 65 years (Walk-bone, 2007) and affects more than half of older people living in the community (Helme & Gibson, 2001). Based on the pain literatures (Bair, Robinson, Katon, & Kroenke, 2003; Hülsebusch, Hasenbring, & Rusu, 2016: Iliffe et al., 2009), depression is one of the most common comorbidities among chronic pain patients, affecting approximately one in four older people with a chronic pain condition (Gleicher, Corxford, Hochman, & Hawker, 2011; Molton, & Terrill, 2014). Chronic pain patients with co-existing depressive symptoms often report more physical and psychosocial disturbance than either condition alone (Gambassi, 2009), such as an increased risk in social isolation, a worsening level of pain in severity and disability (Meyer, Cooper, & Raspe, 2007), increased fall risk (Laura, Brenda, Rich, & Suzanne, 2012), poorer physical functioning (Mossey, & Gallagher, 2004), increased substance abuse and suicidal ideation (Lavin & Park, 2011; Tektonidou, Dasgupta, & Ward, 2011).

In order to reduce the risk of developing depression and to inform precise clinical strategies and treatment recommendations for chronic pain patients, there has been growing research to explain the relationship between pain and depression. Three main hypotheses were postulated to explain the relationship pain and depression. First, some studies proposed the causal direct relationship between pain and depression (Fishbain, Cutler, Rosomoff, & Rosomoff, 1997; Larson, Clark. & Eaton, 2004; Patten, 2001). Second, the bidirectional interaction between pain and

depression was suggested (Kroenke et al., 2011; Talaei-Khoei et al., 2017), explaining that depression can worsen the pain severity as such this would lead to the increased risk of depression. Likewise, as pain severity increases, the level ofdepression would increase and that would affect the level of pain severity. Third, it was proposed to have an indirect relationship between pain and depression through the influence of biopsychosocial factors (Goldenberg, 2009). In line with the cognitive-behavioural mediation model (Kerns & Turk, 1984), pain itself is not sufficient to result in an increased risk for depression (Lumley, Smith, & Longo, 2001). Cognitive factors such as the individual's perception and appraisal towards their pain experience and the ability to control their situation are thought to play central roles in influencing the development of depressive symptoms and severity. To support this model, Rudy et al. (1988) conducted a study examining the relationship between pain, perceived self- control and depression, indicating that the direct link between pain and depression was not significant but the perceived self-control variable significantly mediated the relationship between pain and depression. The results provided an evidence that cognitive factors play important roles in indirectly influencing the relationship between pain and depression.

Pain catastrophizing, which is defined as a tendency to exaggerate and ruminate on painful stimuli (Michael & Burns, 2004; Spanoes, Radtke-Bodorik, & Ferguson, 1979; Sullivan, Bischok, & Pivik, 1995; Sullivan, Rodgers, & Kirsch, 2001), is one of the most common cognitive factors that has been found to indirectly influence the relationship between pain and depression (Hülsebusch et al., 2016; Wood, Nicholas, Blyth, Asghgari, & Gibson, 2013). Based on Beck's Cognitive theory of depression (Beck, 1967), depression is activated by the negative cognitive bias or schemas when individuals are challenged by a stressful event. As such,

depression may be activated by the pain-specific cognitive distortions in context of chronic pain. While pain catastrophizing is characterized as cognitive distortion, individuals with catastrophic thoughts may tend to ruminate on the pain experiences and to negatively evaluate their abilities to deal with painful stimuli (Sullivan et al., 1995). Thus, the catastrophic thinking may increase the risk for developing depression in people with chronic pain. To support this notion, Lee, Chan, and Berven (2007) conducted a structural equation modelling and found that catastrophizing contributed to increased depression among chronic musculoskeletal pain patients. Sullivan and D'Eon (1990) conducted a regression analysis for the prediction of depression in a sample of 125 patients with chronic pain, demonstrating that pain catastrophizing is positively correlated to depression. Therefore, the sense of catastrophizing may be activated by pain, and pain catastrophizing may also predict the level of depression.

Whereas pain catastrophizing predicts the development of depression, pain self-efficacy is a positive coping cognition associated with an inverse relationship with pain catastrophizing (Keefe, Lefebvre, Maixner, Salley, & Caldwall, 1997; Lefebvre et al., 1999; Marks et al., 2005; Vranceanu, Barsky, & Ring, 2009). Pain self-efficacy refers to a belief (Bandura,1987) which is possible to alter the cognition and to influence the individual's confidence in their ability to tolerate pain and to regulate emotional distress (Nicholas, 2007). It can be defined as the confidence of using different coping strategies to regulate own stress and negative moods (Spanos, Radtke-Bodorik, Ferguson, & Jones, 1979). As such, people with high self-efficacy may be less likely to develop the sense of helplessness and rumination. Somers, Wren, and Shelby (2012) reviewed intervention studies that have examined the effect of behavioural and psychosocial interventions to improve self-efficacy for managing

pain and other pain-associated symptoms in patients with arthritis. It was suggested that increasing patients' abilities to manage their pain would reduce the helplessness dimension of catastrophizing. Conversely, a study for osteoarthritis patients (Shelby et al, 2008) found that lower self-efficacy was associated with higher pain catastrophizing. Individuals with a weak sense of self-efficacy are more likely to lose confidence in personal abilities, and focused on personal failings and negative outcomes (Bandura, 1994). Thus, individuals with low self-efficacy may increase the sense to catastrophize their experience. As such, the effect of pain severity on pain catastrophizing might depend on the level of pain self-efficacy.

While pain catastrophizing and pain self-efficacy are efficacy appraisals and have been found to influence an individual's adjustment attempts at managing chronic pain and pain related distress (Geisser, Robinson, & Riley,1999; Rosenstiel & Keefe, 1983), the mechanism of how they may indirectly impact on depression have never been examined. To fill this gap, the current study aims to examine the indirect relationship between pain severity and depression through the interaction of pain self-efficacy and pain catastrophizing. As such, the following model is proposed for investigation (Figure 1) in a sample of community-dwelling older people with chronic pain.

Firstly, a simple mediation model is investigated. Beyond the direct causal effect of pain severity on depression, it is hypothesized that the possible mechanism linking pain severity and depression is through pain catastrophizing. Consistent with previous pain research (Wood et al, 2013), pain catastrophizing is hypothesized to mediate the relationship between pain severity and depression. It is expected that high level of pain severity is expected to increase the level of pain catastrophizing, which in turn leads to a high level of depression.

Secondly, the simple mediation model is extended to a moderated mediation model (Figure 1). It is posited that the effect of pain severity on pain catastrophizing might depend on the level of pain self-efficacy, while pain catastrophizing may also serve as a mediator between pain severity and depression. More specifically, pain severity is hypothesized to have a stronger effect on pain catastrophizing when the level of pain self-efficacy decreases. Thus, pain severity increases the level of depression indirectly through increasing pain catastrophizing when pain self-efficacy is low.

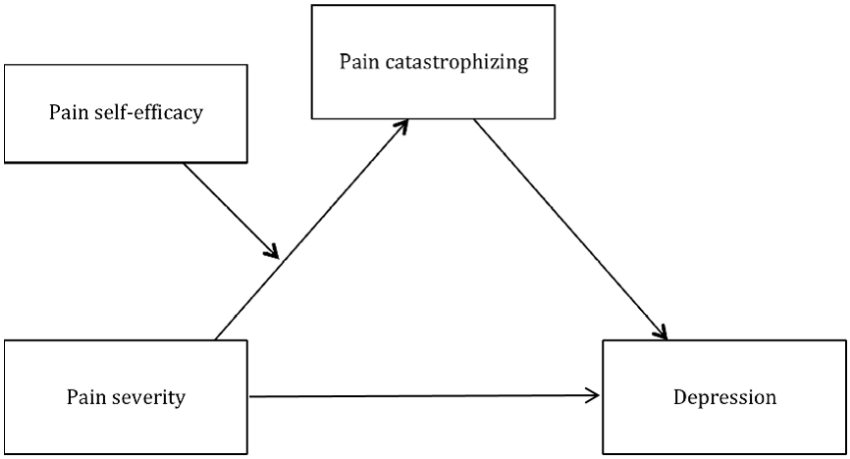


Figure1. Preliminary model of the indirect relationship between pain severity and depression.

In addition, the current study aims to examine the ethnic difference with regard to pain catastrophizing and pain self-efficacy in participants from the Eastern (i.e. Hong Kong) and a Western country (i.e. UK). Research literature with regard to chronic musculoskeletal pain (Campbell & Edwards, 2009; Jensen, Turner, & Romano, 2001; Parker, Vasquez, Chen, & Henderson, 2011) suggests that cognitive coping strategies such as mastery of control and self-efficacy are varied in diverse racial or ethnic groups. A randomised controlled study (Swerissen et al ,2006)

examining the efficacy of a self-management programme suggested that participants in Vietnamese or Chinese backgrounds had a significantly better outcomes on pain symptom management and self-efficacy than participants of Italian and Greek backgrounds. Another study of Lindh, Lurie, and Sanne (1997) examined the efficacy of multidisciplinary pain treatments between Sweden and immigrant groups. The result revealed that the immigrant group has lower confidence to return to work than the Swedish. Therefore, this is possible that people from different ethnic or cultural background may not be benefit in the same way from the same psychological intervention for chronic pain.

In order to inform precise clinical strategies and treatment recommendations for patients with different backgrounds, research that prioritizes investigation into the role of pain related cognitive factors for diverse patient populations may be useful. As such, the current study sets out to compare the level of two cognitive variables, pain catastrophizing and self-efficacy between HK and UK participants. In consistent with previous studies which supported cultural and ethnic differences in pain related cognitions (Campbell & Edwards, 2012; Chan, Malhotra, Do, Malhotra, & Ostbye, 2011; Somers, Wren, & Shelby, 2012), the current study is hypothesized that there would also be a difference in levels of pain self-efficacy and pain catastrophizing between HK and UK participants. The current study is set out for an exploratory nature, therefore no directional hypothesis is posited. In summary, the current study examines three separate hypotheses.

Hypothesis 1: Pain catastrophizing mediates the relationship between pain severity and depression. It is expected that a high level of pain severity contributes to

a high level of pain catastrophizing, which in turn lead to a high level of depression (i.e., mediation).

Hypothesis 2: Pain severity increases the level of depression indirectly through increasing pain catastrophizing when pain self-efficacy is low (i.e., moderated mediation).

Hypothesis 3: There are significant mean differences in levels of pain self-efficacy and pain catastrophizing between HK and UK participants.

Methods

Participants

In total, 664 Chinese and 29 British participants were recruited in HK and the UK respectively. Study inclusion criteria were: 1) community-dwelling older people with the age of 60 years or above. In total, 664 Chinese and 29 British participants were recruited in HK and the UK respectively. Study inclusion criteria were: 1) community-dwelling older people with the age of 60 years or above. The definition of the start of ageing is not solely based on the chronological age, but also depends on how each country makes sense of old age (Glascock, 1980; Gorman, 2000; World Health Organization, 2000). For instance, the socially constructed change and loss of role such as retirement contribute significantly to physical decline and this may also indirectly impact on the pain experiences. (Cornwell & Waite, 2009; Karpansalo, Manninen, Kauhanen, Lakka, & Salonen, 2004). In addition, there is no definite cut-off and agreement on defining the start of ageing, the current study therfore set the cut off at age 60 by considering that this is the age the eligibility for retirement for civil servants, and the eligibility for older-age social programs in Hong Kong and in most Western countries. This decision is also based on the suggestion of United

Nation, which typically has adopted age 60 as the entry age for the start of ageing (United Nations, 2015).

2) Self-report of chronic musculoskeletal pain. 3) Report pain of 3 months duration or longer. 4) Have no communication, neurological or physical conditions that will prevent the completion of the questionnaires. Study exclusion criteria were: 1) Patients with cognitive impairment related to dementia, stroke, Parkinson's disease. 2) Insufficient literacy and language fluency or with hearing or speech impairments or illnesses precluding the feasibility of an interview. Both HK and UK participants completed two separate screening questions to affirm their chronic pain condition. These include 1) ''Are you currently troubled by physical pain, either all the time, or on and off?'' and 2) ''Has this pain persisted for at least three months?" Respondents responding positively to both questions were asked to specify duration of pain experience.

Hong Kong Participants. Six hundred and sixty-four HK Chinese older people ranging in age from 60 to 95 years (M = 74.79, SD = 7.20) participated in this study (Table1a). The majority of the participants were female (79.3%, n = 527), married (55.2%, n = 367) and retired (79.3%, n = 527). Approximately one-third of participants endorsed Buddhist (34.5%, n = 229) and another one-third considered themselves as Christian or Catholic (34.5%, n = 229) in spiritual orientation. The average length of pain duration was 142 months (SD =124.05).

Recruitment occurred in a separate study for older people in HK (Cheng et al., 2017) which evaluating a pain intervention programme at baseline, post-treatment, two and five months follow ups. Participants were recruited from 23 outpatient geriatric clinics or elderly community centers in HK between 2015 and 2016.

Research assistants in HK introduced the study information including participants' rights and potential risks to each participant.

Considering low levels of literacy and minimal education attainment of Chinese HK older populations (Tam, 2012), to ensure informed consent face-to-face interview by trained research assistants were arranged for potential participants in people's homes, pain clinics or elderly community centers. Standardised and validated Chinese language versions of questionnaires were employed with the HK participants with research interviews lasting approximately 30 minutes.

UK Participants. Twenty-nine UK British participants with ages ranging from 60 to 85 years (M = 70.90, SD =7.60) were recruited into the current study (Table 1b). The majority of the participants were female (69%, n = 20), married (65.5%, n = 19) and retired (79.3%, n = 23). Six participants (22 %) were Christian or Catholic and the remaining endorsed no religious beliefs or religious affiliation (24.1%, n =7) with 1 (3.4%) participant reporting other. The average duration of chronic pain experience was 144.31 months (SD = 148.35).

Participants were recruited from outpatient pain management clinics at two hospital trusts, Norfolk and Norwich University NHS Trust and Queen Elizabeth Hospital Kings Lynn in Norfolk and Suffolk in the UK between 2016 and 2017 with the assistance of Clinical Psychologists and Multidisciplinary team members (MDT). Participants were provided with information sheets and they had a minimum of 48 hours to consider their participation in the study. Individuals expressing an interest in taking part in the study were provided a questionnaire pack including consent form (Appendix J) and the study questionnaires (Appendix K) which were distributed by the MDT or the reception of clinics. Participants completed the questionnaires independently based on the instructions stated on the questionnaires at home. They

were given opportunity to ask questions by approaching the research team based on the contact details written on the information sheet. Participants returned the completed questionnaires by post or to the sealed collection box in clinic reception. Completion of questionnaires took place in one session with completion of the questionnaires taking approximately 45 minutes. The study was approved by the Health Research Authority and the local Research and Development Committees (Appendices D, E, F).

Measures

Pain severity. Pain severity was measured by three instruments which included (1) the pain intensity subscale of the Chronic Pain Grade (CPG) questionnaire, (2) the Faces Pain Scale (FPS) and (3) the Visual Analogue Pain scale.

The subscale of the Chronic Pain Grade (CPG) questionnaire (Von Korff, Dworkin, & Le Resche, 1990) consists of 3 items measuring the intensity ratings for current, worst and average pain within the past 6 months. All items are rated on an 11-point Likert scale, with responses ranging from 0 – 10 where 0 corresponds to 'no pain' and 10 is 'pain as bad as it could be'. Cronbach's alpha for the CPG intensity subscales was .72 in 400 UK adult patients with chronic pain (Salaffi, Stancati, & Grassi, 2006), indicating an acceptable level of internal consistency. The Chinese version of CPG has been adapted in Hong Kong and the underlying structure of the CPG among Chinese was assessed using Exploratory Factor Analyses (Fielding & Wong, 2008). Cronbach's alphas for the CPG intensity subscales was .68 in a pilot study of Hong Kong community dwelling and nursing home older people (Cheng et al., 2017).

The Visual Analogue Pain Scale (VAS) (McCormack, Horne, & Sheather, 1988) is a unidimensional measure of pain severity consisting of a 10-cm line with 0

representing “no pain” at one end” and 10 representing “pain as bad as it could be” at the other end. Respondents are asked to put a “X” on the line to indicate their pain severity over the previous week. The score is determined by measuring the distance (cm) on the 10-cm line from the “ no pain” anchor to the participant’s mark to yield a range of scores from 0-10.

The Faces Pain Scale (FPS) (Herr, Mobily, Kohout, & Wagenaar, 1998; Roberston, 1993) consists of six facial expression illustrating a spectrum of pain severity. Respondents are asked to rate levels of pain in the past week on a scale of 0 (no pain) to 5 (extremely pain). With reference to a previous pain study (Cheng et al. 2017), the scores for the Faces Pain Scale is multiplied by 2 to yield a maximum scores of 10.

In the current study, a composite measure of pain severity is formed by summating total scores of the CPG, FPDS & VAS measures, providing a range of composite measure scores from 0 to 50. Higher scores indicate a high level of pain severity. This way of creating a composite measure is based on Cheng et al (2017) who reported a Cronbach’s alpha of 0.9 for their composite measure in a study of 694 Hong Kong older people.

Pain self-efficacy. The Chronic Pain Self-Efficacy Scale (CPSS) (Anderson, Dowds, Pelletz, & Edwards, 1995) is a 22-item self-report instrument designed to measure perceived self-efficacy in coping with chronic pain. Response item scores were averaged on a 10-point Likert scale anchored on the ends by 10 = very uncertain and 100 = very certain. High scores indicate endorsement of greater self-efficacy. The CPSS consists of three subscales: self-efficacy for pain management (PSE), self-efficacy for physical function (FSE) and self-efficacy for coping with other symptoms (CSE). In a sample of 141 chronic pain patients, Cronbach alpha

coefficient estimates of internal reliability were .86 for PSE, .91 for FSE, and .91 for CSE (Anderson et al., 1995). The instrument is widely used with older community residents (Feng, Gao, Wang, Liu, & Loi, 2013) in chronic pain patients (Arnstein, Caudill, Mandle, Norris, & Beasley, 1999) with good reliability (α = .95).

There is no validated Chinese version of the CPSS thus far, so a translation and back-translation procedure was conducted. A bilingual researcher assistant in Hong Kong has translated the English version of CPSS into a Chinese version. The Chinese version of CPSS has then been back-translated to English by another bilingual research assistant who are blind to the original English version. The back-translated version was compared to the original English version for discrepancies. A critical review and the finalization of the translated Chinese version of the CPSS were performed by a third person. The translated Chinese version of the CPSS hasbeen used in a separate pain study (Cheng et al., 2017). The alpha coefficients α were 0.78, 0.91, and 0.88 for the pain management, physical function and coping with symptoms subscales respectively in a sample of 694 older adults.

Pain catastrophizing. The 13-item Pain Catastrophizing Scale (PCS) (Sullivan et al., 1995) is utilized to assess three core dimensions of pain catastrophizing: rumination, helplessness and magnification. All items are rated on a 5-point likert scale, with responses ranging from 0 – 4 where 0 corresponds to 'not at all' and 10 is 'all the time'. It was administered to a 215 community and 60 pain outpatient samples (Osman et al., 2000) and Cronbach's alpha for the total items of PCS was .92 and .95 respectively, indicating a high internal consistency.

A Chinese version of the PCS has been validated and it was administered in Hong Kong chronic pain populations (Yap et al., 2008). Cronbach's alpha for the item total score of the PCS is .93, indicating a high internal consistency.

Depression. The 10-item Center for Epidemiologic Studies-Depression Scale (CES-D) (Radloff, 1977) consists of 10 self-report questions to reflect various aspect of depression including depressed mood, psychomotor retardation and sleep disturbance. It showed good predictive accuracy when compared to the full-length 20-item version of the CES-D (α = .97, p < .001). The range of scores is 0 to 30, with higher scores representing more depressive symptoms. A cut off score of ten or higher indicates the presence of significant depressive symptoms (Andreson, 1994). It has been shown to possess adequate psychometric properties indicated by good internal consistency (α =.92) in older adults (Irwin, Artin, & Oxman, 1999) and in diverse backgrounds (Husaini, Neff, Harrington, Hughes, & Stone, 1980).

A Chinese version of CES-D was validated (Boey, 1999) with good internal consistency (α =.78) in a large sample of community older adults in Hong Kong (REF). It has been widely used in screening for late-life depression in Hong Kong older adult populations (Chen & Mui, 2014; Cheng & Chan, 2005; Cheng, Chan, & Fung, 2006).

Clinical characteristics, lifestyle, and socio-demographic characteristics. Demographics including age, education, employment, ethnicity and marital status and lifestyle were collected. The socio-demographic characteristics including tobacco use, alcohol consumption, physical activity, health care utilization associated with pain were measured.

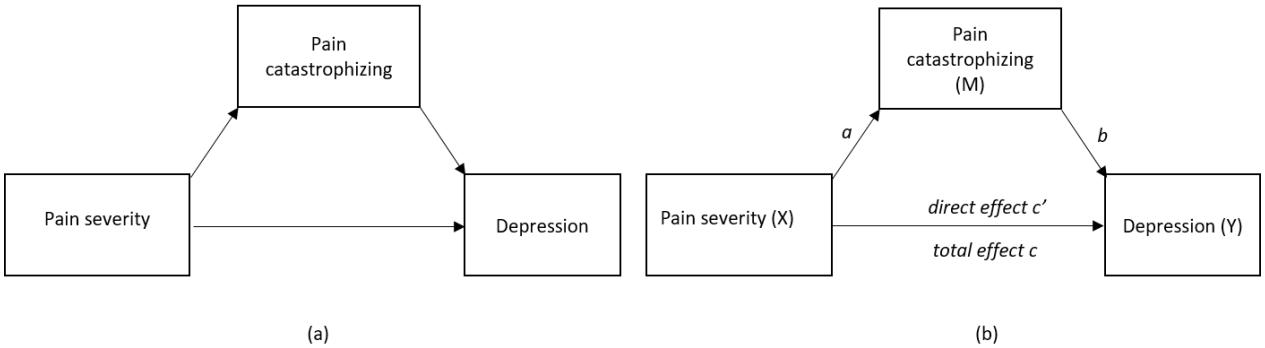
Statistical Analysis

Mediation Analyses

Statistical analyses were performed using SPSS version 23 (IBM Corp, 2015). In order to examine hypothesis 1, that is, whether pain catastrophizing mediates the relationship between pain severity and depression, mediation analyses were

performed by using the PROCESS tool (Hayes, 2013) in the sample of 29 UK participants and 664 HK participants respectively.

A Conceptual and statistical diagram of the mediation model is presented in Figure 2. The mediation analysis provides information about several weights: Weight *a* denotes the pain severity (X) on pain catastrophizing (M) whereas, weight *b* presents the effect of pain catastrophizing (M) on depression (Y) while controlling for pain severity. Weight c represents the total effect of pain severity and depression which is comprised of the direct effect (weight c') of pain severity on depression and the indirect effect (weight ab) of pain severity on depression through pain catastrophizing. A Sobel test (Sobel, 1982) was performed to test the significance of the mediating effect. It is a method to determine whether the relationship between the independent variable and dependent variable is significantly reduced after inclusion of the mediator variable (See the extended methodology). A significant indirect effect via mediators between independent and dependent variables is determined if the 95% CI does not contain zero.

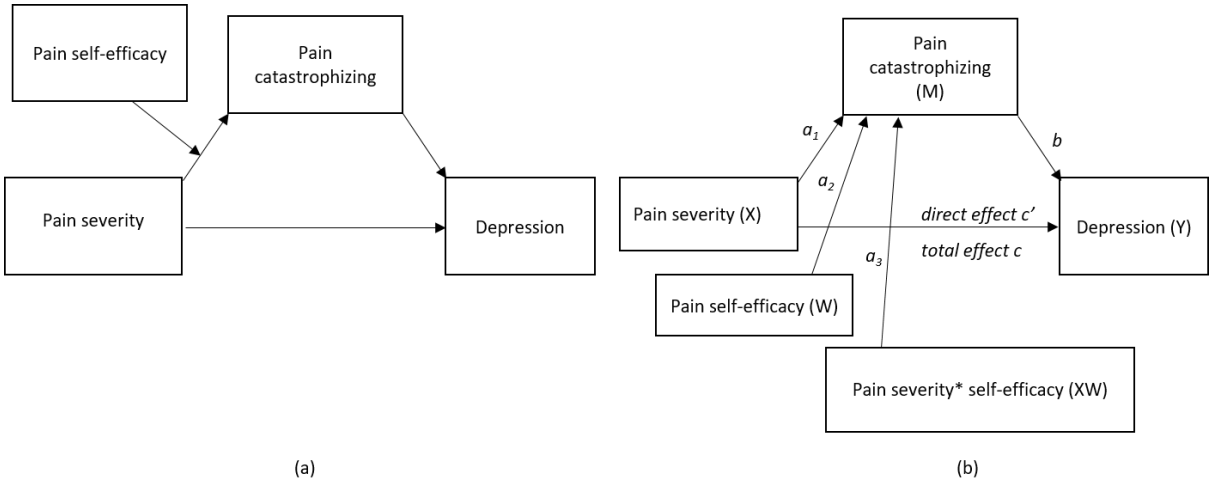


Note. X: Independent variable. Y: Dependent variable. M: Mediator.

Figure 2. Conceptual (a) and statistical (b) diagrams of the mediation model. Indirect effect of X on Y through M = *ab*; Direct effect of X on Y=c'; Total effect c = c' + *ab.*

Moderated Mediation Analyses

To examine hypothesis 2, that is, whether pain severity increases the level of depression indirectly through increasing pain catastrophizing when pain self-efficacy is low, moderated mediation analyses was performed by using the SPSS PROCESS tool (Hayes, 2012). A conceptual and statistical diagram of the moderated mediation model is presented in Figure 3.The moderated mediation analysis provides information about several weights: Weight a_1 denotes the effect of pain severity (X) on pain catastrophizing (M) whereas a_2 denotes the effect of pain self-efficacy (W) on pain catastrophizing (M). Weight a_3 presents the effect of the interaction between pain severity and pain self-efficacy (XW) on pain catastrophizing. Weight *b* presents the effect of pain catastrophizing (M) on depression (Y) while controlling for pain severity. Weight c represents the total effect of pain severity on depression, which is comprised of the direct effect (weight c') of pain severity on depression and the indirect effect ((a_1 + a_3W)b) of pain severity on depression through pain catastrophizing. In order to derive the estimation of conditional indirect effects (Hayes, 2012), biased and corrected bootstrapped CIs were used to determine if the indirect effects of pain severity on depression by way of pain catastrophizing (mediator) differ from zero at specific values (10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles) of pain self-efficacy (moderator).



Note. X: Independent variable. Y: Dependent variable. M: Mediator. W: Moderator.

Figure 3. Conceptual (a) and statistical (b) diagrams of the moderated mediation model. Conditional indirect effect of X on Y through M= $(a_1+a_3W)b$. Direct effect of X on Y=c'. Total effect c= c'+ $(a_1+a_3W)b$.

The bootstrapping resampling procedure (Efron, 1979), a technique to resample the sample data with replacement in order to estimate the population parameters, was performed for both mediation and moderated mediation analyses. Based on the recommendation by Hayes (2012) and the reference from a recent pain study by Mohammadi, Dehghani, Sanderman, and Hagedoorn (2017), a 5000 bootstrap sample with 95% bootstrap confident interval was used in the current study.

Independent Samples T-test Analyses

To address hypothesis 3, that is, whether there are statistically significant mean differences in levels of pain severity, pain catastrophizing and depression between HK and UK participants, independent samples T-test was performed. Given unequal sample sizes between HK and UK participants may affect homogeneity of variance assumption, a portion of 29 HK Chinese participants (mean age =71.45; SD=6.51) were systematically selected from the whole sample of 664 HK Chinese participants in order to compare with the 29 British participants for analysis. The

selection technique was based on stratified random sampling, in which the samples of 664 participants were first divided into strata. The strata were based on the reference of the UK participants by gender, age and pain duration. Thereafter the strata, which in effect the best matches of the key variables of UK participants were chosen and simple random sampling was applied within each stratum by using the randomized generator in SPSS. Based on Cohen's d power table for the between-subject t-test analysis, a sample size of 25 per group has to obtain a large effect size (d= 0.8) in order to achieve a standardized power of .80 (Cohen, 1992).

Tables 1a and 1b presents the descriptive characteristics including frequencies, percentages (%), means (M), and standard deviations (SD) of all demographics and outcome variables of HK participants (n = 664) and UK participants (n = 29). To examine whether there are correlations among the study variables, Pearson's correlations coefficients were used to calculate bivariate correlations between the levels of pain severity, depression, pain catastrophizing and pain self-efficacy.

Table 1a
Demographic and descriptive characteristics of the total HK Chinese participants (n=664).

Measure	HK Chinese (n=664)
Age, M(SD)	74.79 (7.20)
Gender,%	
Female	85.1
Education,%	
No formal education	28.5
Primary school	43.5
Middle school graduate/F1-F3	14.9
High school graduate	8.7
Associate degree	2.8
University degree	1.2
Others	0.2
Unknown	0.3
Marital status, %	
Single	2
Separated/divorced	4.7
Widowed	43.9
Married	49.4
Unknown	0.4
Occupational status,%	
Full time	0.3
Part time	0.8
Retired	77.1
Disabled	0
Unemployed/housewife	21.8
Unknown	0
Pain duration (month), M (SD)	121.14 (126.99)
Religion, %	
No religion	40.7
Christian or Catholic	22.9
Buddhism	35.7
Others	0.6
Unknown	0
CPG-Pain Intensity, M (SD)	15.04 (6.01)
CPG-Pain Disability, M (SD)	10.44 (7.93)
VPS, M (SD)	3.94 (2.28)
FPS, M (SD)	4.61 (2.38)
Composed measures- pain severity	23.60 (9.56)
CPSS, M (SD)	1558.15 (352.53)
CPSS- Pain management	307.11 (96.85)
CPSS- Physical function	686.67 (162.00)
CPSS- Coping with symptoms	564.36 (135.00)

PCS, M (SD)	11.13 (11.40)
PCS- Rumination	4.21 (4.30)
PCS- Magnification	2.75 (3.20)
PCS- Helplessness	4.20 (5.12)
CEDS, M (SD)	8.65 (4.94)

Notes. M: Mean; SD: Standard deviation; CPG: Chronic Graded Scale; VPS: Visual Analogue Pain Scale; FPS: Face Pain Scale; CPSS: Chronic Pain Self-efficacy scale; PCS: Pain Catastrophizing Scale; CESD: Center for Epidemiologic Studies-Depression Scale

Table 1b

Demographic and descriptive characteristics between HK (n=29) and UK participants (n=29).

Measure	UK British (n=29)	HK Chinese (n=29)	*p*-value
Age, M (SD)	70.90 (7.60)	71.45 (6.509)	.77
Gender,%			
Female	69	79.3	
Education,%			.001***
No formal education	0	24.1	
Primary school	0	37.9	
Middle school graduate/F1-F3	20.7	17.2	
High school graduate	3.4	10.3	
Associate degree	37.8	3.4	
University degree	20.7	3.4	
Others	10.3	0	
Unknown	10.4	3.4	
Marital status, %			.23
Single	3.4	0	
Separated/divorced	20.7	10.3	
Widowed	3.4	34.5	
Married	65.5	55.2	
Unknown	6.9	0	
Occupational status,%			
Full time	3.4	0	
Part time	0	6.9	
Retired	79.3	79.3	
Disabled	6.9	0	
Others	3.4	0	
Unknown	6.9	13.8	
Pain duration (month), M (SD)	144.31 (148.35)	141.62 (124.05)	.94
Religion, %			.19
No religion	24.1	31	
Christian or Catholic	62.1	34.5	
Buddhism	0	34.5	
Others	3.4	0	
Unknown	10.3	0	
CPG- pain intensity, M (SD)	22.38 (4.34)	17.38 (6.34)	.001***
CPG-pain disability, M (SD)	20.00 (7.79)	12.07 (8.74)	.001*
VPS, M (SD)	6.95 (1.55)	4.87 (2.51)	.002**
FPS, M (SD)	7.52 (1.98)	5.59 (2.85)	.004*

Composed measures – pain severity	36.85 (7.6)	27.84 (10.34)	.001***
CPSS, M (SD)	1013.79 (453.98)	1481.24 (515.61)	.001***
CPSS- Pain management	208.28 (106.74)	260.69 (102.61)	.062
CPSS- Physical function	423.10 (229.71)	711.58 (312.00)	.001***
CPSS- Coping with symptoms	382.41 (210.25)	508.06 (155.87)	.004*
PCS, M (SD)	25.86 (15.09)	16.45 (13.70)	.024*
PCS- Rumination	9.12(5.45)	6.54 (5.47)	.054
PCS- Magnification	5.10 (3.45)	4.17 (4.05)	.35
PCS- Helplessness	11.60 (6.96)	5.93 (6.97)	.003**
CESD, M (SD)	13.17 (5.01)	10.72 (5.67)	.087

Notes. M: Mean; SD: Standard deviation; *significant at $p<.05$ (2-tailed). **significant at $p<.01$(2-tailed) ***significant at $p<.001$(2-tailed); CPG: Chronic Graded Scale; VPS: Visual Analogue Pain Scale; FPS: Face Pain Scale; CPSS: Chronic Pain Self-efficacy scale; PCS: Pain Catastrophizing Scale; CESD: Center for Epidemiologic Studies-Depression Scale

Results

Descriptive Data and Correlation Analysis

The summary tables of demographic and descriptive characteristics of HK (*n* = 664) and UK participants (*n* = 29) are presented in table 1a and table 1b respectively. The correlation analysis examined the correlation among the variables of pain severity, pain catastrophizing, pain self-efficacy and depression in the sample of HK participants (n = 664) and UK participants (n=29) separately. In order to correct for the multiple comparisons, a standard Bonferroni corrected significance was tested. It divides the significant alpha levels of .05 by the numbers of test performed (i.e. 0.05/6 = 0.008). As this test is considered overly conservative (Perneger, 1988), the significance of cut-off alpha levels was adjusted to .01 in the current study.

HK participants. In the HK Samples (n = 664), the mean score of pain severity was 23.6 (SD=9.56) and the mean score of self-efficacy was 1558.33 (SD=352.10). The mean score of catastrophizing (M =11.16, SD = 11.40) was relatively low when compared to the cutoff score of 30 points (Sullivan, Bishop, & Pivik, 1995). The mean score of depression was 8.63 (*SD* = 4.91). Twenty-seven percent of the samples indicating the presence of significant depressive symptoms as they score above the cutoff score of 10 points.

As can be seen from the Table 2, pain severity is statistically significant and positively correlated to pain catastrophizing (r = 0.45, $p < .01$) and depression (r = 0.48, $p < .01$). Pain severity is statistically significant and negatively correlated with pain self-efficacy (r = -0.55, $p < .01$). Pain self-efficacy was statistically significant and negatively associated with pain catastrophizing (r=-0.48, $p < .01$) and depression

(r = -0.37, $p < .01$). Pain catastrophizing and depression was statistically significant and positively related to each other (r = 0.63, $p < .01$).

Table 2

Mean, SD and the correlation coefficients for the variables in the study with the sample of HK Chinese participants (n=664).

Variable	Mean	*SD*	(1)	(2)	(3)	(4)
(1) Pain severity	23.60	9.56		-.55*	.45*	.48*
(2) PSE	1558.33	352.10			-.48*	-.37*
(3) PC	11.16	11.40				.63*
(4) Depression	8.63	4.91				

Note. *significant at $p < .01$ (2-tailed) after the Bonferonni correction. PSE: Pain self-efficacy. PC: Pain catastrophizing.

UK participants. In the UK participants (n = 29), the mean score of pain severity was 36.85 (SD = 7.60). The participants had relatively low self-efficacy (M =1013.79, SD = 453.98) and high catastrophizing (M = 25.86, SD = 15.09). The mean score of depression was 13.17 (SD = 5.01), with 72 % crossing the threshold presenting significant depressive symptoms.

As can been seen from the Table 3, pain severity was statistically significant and positively correlated with pain catastrophizing (r = 0.57, $p < .01$) and negatively correlated with pain self-efficacy (r = -0.58, $p < .001$). Pain catastrophizing was positively and significantly associated with levels of depression (r = 0.69, $p < .001$). Pain severity was positively correlated with depression (r = 0.41, p = .03) but not statistically significant after performing the Bonferroni correction. Pain self-efficacy was not statistically and significantly correlated with depression (r = - 0.29, p = .18).

Table 3.

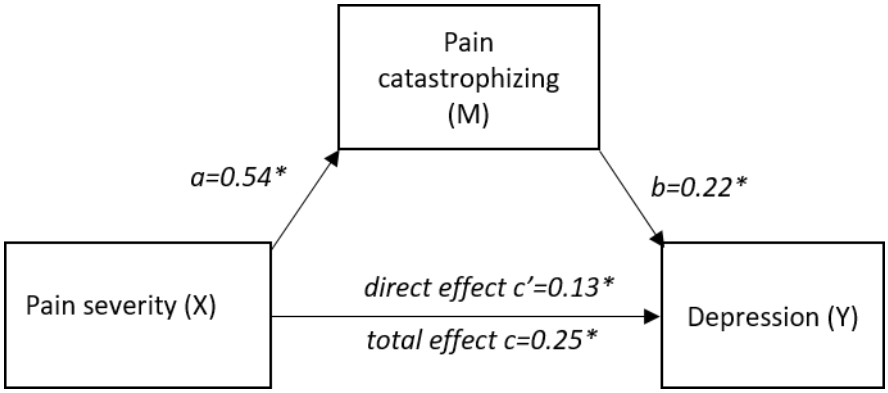
Mean, SD and the correlation coefficients for the variables in the study with the sample of British participants (n=29).

Variable	Mean	*SD*	(1)	(2)	(3)	(4)
(1) Pain severity	36.85	7.6		-.65**	.57**	.41*
(2) PSE	1013.79	453.98			-.58**	-.29
(3) PC	25.86	15.09				.69**
(4) Depression	13.17	5.01				

Note. **significant at p <.01 (2-tailed) after the Bonferroni correction; *p < .05 (2-tailed), non significant after the Bonferroni correction. PSE: Pain self-efficacy. PC: Pain catastrophizing.

Mediation Effect of Pain Severity on Depression through pain catastrophizing

The mediation analyses were performed to examine whether pain catastrophizing mediates the relationship between pain severity and depression in the sample of HK (n = 664) and UK (n = 29) participants separately.



Note. *significant at p < .001 (2-tailed).

Figure 4. Mediation effect of pain severity on depression through pain catastrophizing in HK participants.

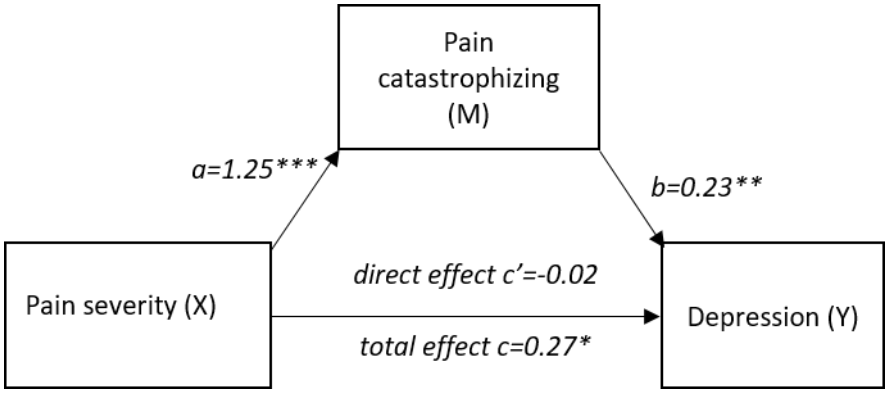
HK participants. As can be seen from the Figure 4, the regression analysis result indicates that pain severity was significantly and positively correlated with pain catastrophizing (B = 0.54, t = 13.13, SE = .04, p < .001). Pain catastrophizing statistically significantly predicts depression (B = 0.22, t =15.8, SE= .01, p <.001).

This positive correlation indicated that high pain severity predicts high pain catastrophizing, and high pain catastrophizing predicts high level of depression.

The direct effects of pain severity on depression was statistically significant (B = 0.13, t =7.51, SE = .017, p < .001) after controlling for pain catastrophizing, indicating that there was a significant direct causal relationship between pain severity and depression.

The Sobel test result revealed that the indirect effect of pain severity on depression through pain catastrophizing was statistically significant (B = 0.12, SE = .012, z =10.1, p < .001). This was evidenced by a 95% bias-corrected bootstrap confidence interval that was above zero (95% CI [0.09, 0.14]). The result indicated that pain severity had a significant indirect effect on depression through pain catastrophizing, and the direct causal relationship between the pain severity and depression has been significantly reduced after inclusion of pain catastrophizing.

The total effect of pain severity on depression (B = 0.25, t =14.08, SE=.018, p < .001) was significant and indicated that the proposed model was significant (F (1,662) =198.17, p < .001, R^2 = 0.23), accounting for 23% of the variance in depression by pain severity and pain catastrophizing. As both direct effect and indirect effect of pain severity on depression were significant, it is concluded that pain catastrophizing partially mediated the effect of pain severity on depression in the sample of HK participants. The result supported our hypothesis that pain severity leads to depression indirectly through pain catastrophizing.



Note. *significant at p < .05 (2-tailed). **significant at *p* < .01 (2-tailed). ***significant at *p* < .001(2-tailed).

Figure 5. Results of the mediation effect of pain severity on depression through pain catastrophizing in UK participants.

UK participants. As can be seen from the Figure 5**,** the analyses revealed that pain severity predicts catastrophizing (*B* =1.25, *SE* = .30, *t* = 4.23, *p* < .001) and pain catastrophizing predicted depression (*B* = 0.23, *SE* = .06, *t* = 3.82, *p* =.01).The positive coefficients indicated that participants report high pain severity predict high level of pain catastrophizing, and high pain catastrophizing leads to high level of depression.

However, the direct effect of pain severity on depression was non-significant after controlling for pain catastrophizing (*B* = -0.02, *SE* =.12, *t* = -0.17, *p* =.87), indicating that pain severity did not directly predict depression. The Sobel tests revealed a significant indirect effect of pain severity on depression through pain catastrophizing (*B* = 0.29, *SE* = .10, *z* = 2.79, *p* = .01). This was evidenced by a 95% bias-corrected bootstrap confidence interval that was above zero (95% CI [0.064, 0.56]).

The total effect of pain severity on depression was significant (*B* = 0.27, *t* = 2.36, *SE* = .11, *p* = .03). This proposed model (Figure 6) was significant (*F* (1, 27) = 5.57, *p* = .03, R^2=0.17), accounting for 17 % of variance in depression. Given that

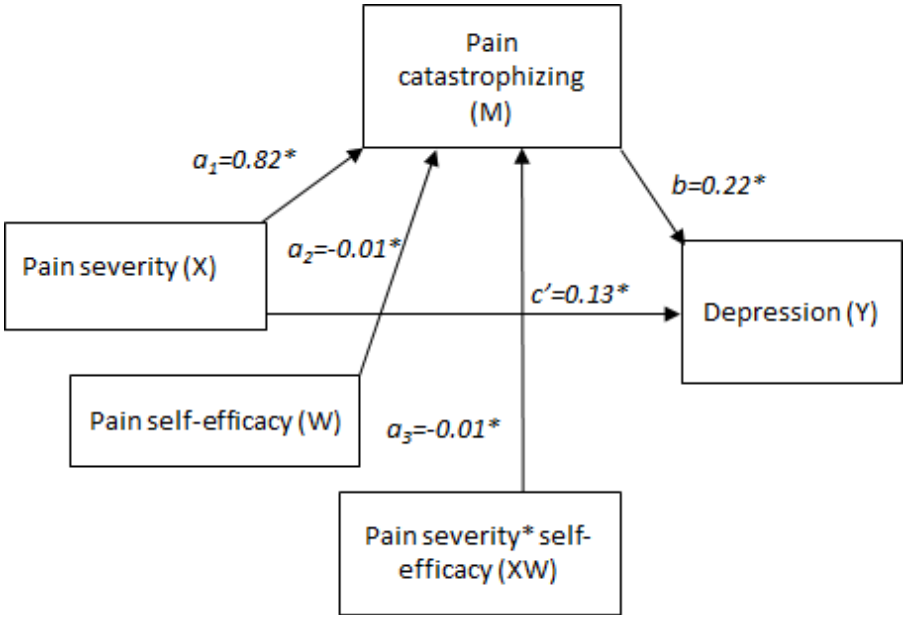
the direct effect of pain severity and depression was non-significant, pain catastrophizing fully mediated the effect of pain severity on depression. The finding supported the hypothesis that pain severity leads to depression indirectly through pain catastrophizing.

In summary, the results from both HK and UK participants supported the first hypothesis, in that pain catastrophizing significantly mediated the effect of pain severity on depression.

Moderated mediation analyses

To assess the hypothesis 2 of whether pain severity increases the level of depression indirectly through increasing pain catastrophizing when pain self-efficacy is low, moderated mediation analyses was performed in the sample of HK (n = 664) and UK (n = 29) participants respectively.

HK participants. As can be seen from the Figure 6, there is a statistically significant interaction between pain severity and pain self-efficacy in the model of pain catastrophizing (B = -0.01, t = -3.26, SE = .01, p < .001). The negative estimate of the interaction effect indicated that the decrease of pain self-efficacy strengthens the effect of pain severity on pain catastrophizing.



Note. *significant at $p < .001$ (2-tailed).

Figure 6. Results of the moderated mediation model of the conditional indirect effect of pain severity on depression in HK participants.

As can be seen from the Table 4, the conditional indirect effects at the 10^{th} , 25^{th}, 50^{th} , 75^{th}, and 90^{th} percentiles of pain self-efficacy were 0.11 (95%CI [0.007, 0.144]), 0.09 (95% CI [0.062, 0.121]), 0.07 (95%CI [0.051, 0.095] , 0.05 [0.034,0.078]) and 0.04 (95% CI [0.013,0.066]) respectively. The results indicated that there was a statistically significant conditional indirect effect of the pain severity on depression through pain catastrophizing at all levels of pain self-efficacy. This was evidenced by the 95% CI that is above zero. The result supported the hypothesis that the strength of indirect effects of pain severity on depression through increasing pain catastrophizing when pain self-efficacy is low.

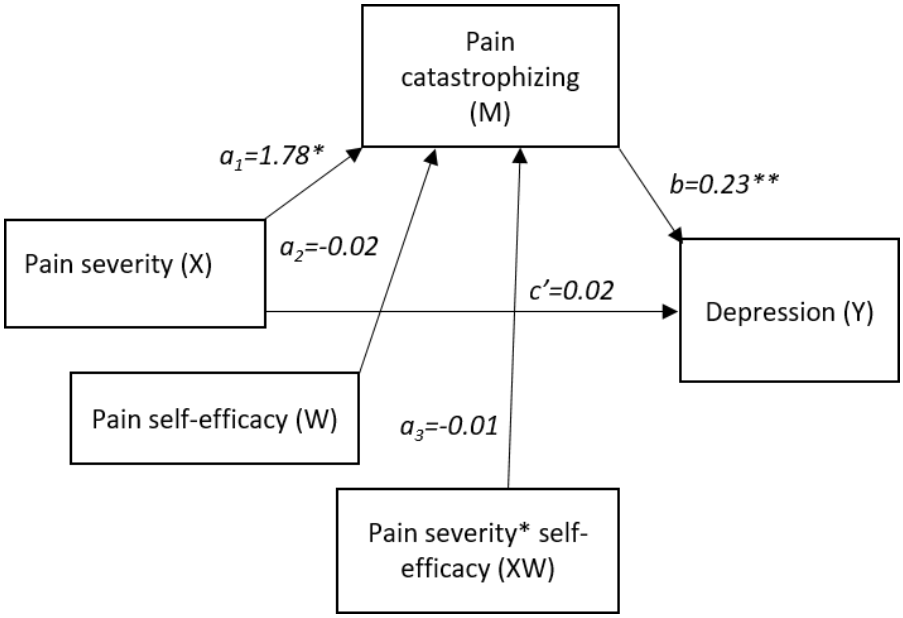
Table 4

Results of the moderated mediation analysis investigating the bootstrapped conditional indirect effects of pain severity on depression via pain catastrophizing at different levels of pain self-efficacy (moderator) with the sample of HK Chinese Participants (n=664).

Mediator: pain catastrophizing						
Pain self-efficacy percentiles	Pain self-efficacy levels	Effect(β)	SE	Boot LLCI	Boot ULCI	Effect size
10th	1110.00	.11	.02	.007	.144	0.46
25th	1320.00	.09	.02	.062	.121	0.41
50th	1560.00	.07	.01	.051	.095	0.35
75th	1820.00	.05	.01	.034	.078	0.28
90th	2040.00	.04	.01	.013	.066	0.24

Note. 5000 bootstrapping resamples. SE: standard error; BootLLCI: lower level of the 95% bootstrap confidence interval; BootULCI: upper level of the 95% bootstrap confidence interval; percentiles: 10th, 25th, 50th, 75th, and 90th percentiles. Effect size: ratio of the indirect effect to the total effect.

UK participants. As can be seen from the Figure 7**, t**he result revealed that there was no significant interaction effect of pain severity and pain self-efficacy on pain catastrophizing (B = -0.01, SE = .01, t = -1.29, p = .21), indicating that that pain severity did not demonstrate significant stronger effect on pain catastrophizing when the level of pain self-efficacy is lower.



Note. *significant at p<.05(2-tailed), **significant at $p < .001$(2-tailed).

Figure 7. Results of the moderated mediation model of the conditional indirect effect of pain severity on depression in UK participants.

However, the conditional indirect effects of pain severity on depression through pain catastrophizing were significant at the 10th (*B* = 0.35; 95%CI [0.11, 0.99]), 25th (*B* = 0.32; 95% CI [0.025, 0.85]), 50th (*B* = 0.24; 95%CI [0.031, 0.58]) and 70th (*B* = 0.20; 95% CI [0.001, 0.46]) percentiles of pain self-efficacy. This was evidenced by the 95% bootstrapped confidence level that is above zero (Table 5). The conditional indirect effect was non-significant when the level of pain self-efficacy was at the 90th percentile (*B* = 0.15, *SE* =.12, 95% CI [-0.02, 0.41]). This was evidenced by the 95% bootstrapped confidence interval that overlapped zero. These results indicated that pain severity increases the level of depression through increasing pain catastrophizing were statistically significant only when the level of self-efficacy was low (i.e. at or below 75th percentiles), but not when self-efficacy was high (i.e. at 90th percentiles).

Table 5

Results of the moderated mediation analysis investigating the bootstrapped conditional indirect effects of pain severity on depression via pain catastrophizing at different levels of pain self-efficacy (moderator) with the sample of UK participants (n=29).

Mediator: pain catastrophizing						
Pain self-efficacy percentile	Pain self-efficacy levels	Effect(β)	SE	Boot LLCI	Boot ULCI	Effect size
10th	320.00	.35	.24	.011	.99	0.94
25th	540.00	.32	.20	.025	.85	0.94
50th	980.00	.24	.14	.031	.58	0.92
75th	1250.00	.20	.12	.001	.46	0.91
90th	1540.00	.15	.12	-.019	.41	0.88

Note. SE: standard error; BootLLCI: lower level of the 95% bootstrap confidence interval; BootULCI: upper level of the 95% bootstrap confidence interval; percentiles: 10th, 25th, 50th, 75th, and 90th percentiles. Effect size: ratio of the indirect effect to the total effect.

In summary, the moderated mediation analysis findings in both HK and UK participants supported the second hypothesis, in that the indirect effect of pain severity on depression through increasing pain catastrophizing when pain self-efficacy is low is statistically significant.

Pain Catastrophizing and Self-efficacy in HK and UK Participants

To examine whether there are significant differences in levels of pain self-efficacy and pain catastrophizing between UK and HK participants, independent samples t-test analyses were conducted. Pain catastrophizing and pain self-efficacy were the dependent variables, with the group (HK Chinese and UK British) as the independent variable. This analysed data was from the selected sample of 29 HK Chinese participants with the mean age of 71.24 years (*SD* = 6.51) and a sample of 29 UK British Participant with the mean age of 70.90 years (*SD* = 7.60).

The results (Table 1a) revealed that the two groups did not differ by age (t (56) = -.30, p = .77), pain duration (t (56) = -0.006, p = .94), religion (t (56) = 1.34, p = .19) and marital status (t (56) = -1.21, p = .23). However, there was significantly difference in educational level (t (56) =5.66, p < .001). The results indicated a significant difference for pain severity (t (56) = 3.79, p < .05, d = 0.99) between HK and UK participants. Specifically, the UK participants reported significantly higher pain severity (M = 36.85; *SD* = 7.57) than HK Chinese participants (M =2 7.83, *SD* = 10.34). However, there was no statistically significant mean difference in the level of depression between two groups (t (56) = 1.74, p >.05, d = 0.46).

In terms of the pain-related cognitive variables, the mean of pain catastrophizing (t (56) = 2.32, p < .05, d = 0.61) and pain self-efficacy (t (56) = -3.66, p < .05, d = 0.96) were statistically and significantly different between HK and UK participants. Specifically, the UK British participants (M = 25.86, SD = 15.09) reported higher level of pain catastrophizing than HK Chinese participants (M = 16.45, SD = 15.80). UK participants reported lower pain self-efficacy level (M = 1013.79, SD = 453.98) than HK Chinese participants (M = 1481.24, SD = 515.61).

In summary, the results supported the third hypothesis in that there are statistically significant mean differences in levels of pain catastrophizing and pain self-efficacy between HK and UK participants.

Discussion

The primary purpose of the current study was to understand the indirect relationship between pain severity and depression by examining the interaction of pain catastrophizing and self-efficacy. This is currently the first study to consider pain catastrophizing and pain self-efficacy together when attempting to understand

the process that leads to the individual management of psychological disabilities for chronic pain.

The mediation analyses results (Figure 4 & 5) supported the first hypothesis, revealing that pain catastrophizing significantly mediates the relationship between pain severity and depression in both UK and HK participants. When compared to the direct causal relationship between pain severity and depression alone, the current study suggested that pain severity predicts the severity of depressive symptoms to a greater degree through pain catastrophizing. This finding was consistent with the previous study (Wood et al., 2013) which demonstrated that pain catastrophizing mediated the relationship between pain severity and depressed mood in the sample of 669 older adults with chronic pain.

However, the mediating effect of pain severity on depression through pain catastrophizing was different between HK and UK participants. Specifically, a full mediation was found in UK participants while only a partial mediation was found in HK participants. This result demonstrated that pain severity is a valid condition for the development of depression among HK older people, but not for UK older people. The inconsistent mediation results between HK and UK participants might imply that the mediation model work differently across people from different background. One of the possible reasons is that the ethnic or cultural difference may be a moderator that influences the relationship between pain severity and depression. Cross-cultural studies (Forsythe, Thorn, Day, & Shelby, 2011; Potthoff et al., 2016) supported that the cognitive emotion regulation strategies including catastrophizing in response to stressful life events varies by country. However, the underlying mechanism of how cultural factors influence the relationship between pain severity and depression is still unknown. Therefore, further studies are needed to determine

whether there remains a direct effect of pain severity on depression for people with chronic pain when considering ethnic or cultural factor as a moderator.

Further, the results supported the moderated mediation model as reported in figure 6 and 7 for both HK and UK participants. The results suggested that not solely does pain catastrophizing mediate the relationship between pain severity and depression, but pain self-efficacy would influence this mediation pathway. In particular, pain severity increases the level of depression indirectly through increasing pain catastrophizing when pain self-efficacy is low. The current result was supported by other studies of pain (Somers, Kurakula, Criscion-Schreiber, Keefe & Clowse, 2012), revealing that participants who reported low levels of self-efficacy and high levels of pain catastrophizing reported more psychological distress than patients with low levels of pain catastrophizing. In line with the Cognitive Appraisal Theory (Lazarus & Folkman, 1984), the process of cognitive appraisal determines the individuals' coping responses to the challenges of a stressors. In the context of pain, pain catastrophizing and pain self-efficacy are both related to coping appraisals that may possibly alter the negative emotional response of chronic pain. Pain catastrophizing represents a coping response in which individual undermines their ability to cope with pain and develop a sense of helpless in the face of pain (Sullivan et al, 2001). Conversely, self-efficacy was considered as positive cognitive coping strategy which refers to individuals' confidence of their abilities to cope with their pain condition. Increasing pain self-efficacy and reducing pain catastrophizing may therefore serve as cognitive coping strategies against the development of depressive symptoms in the context of chronic pain.

The third hypothesis of the current study examined the levels of pain catastrophizing and pain self- efficacy between UK and HK participants. With the

control of age, pain duration and marital status, the participants in HK showed significant higher levels of self-efficacy than UK participants and significant lower levels of pain catastrophizing in comparison to the UK participants. The differences of the results may be related to that the participants in HK and UK were recruited from different settings. HK participants were recruited from general geriatric clinic who are waiting for a multidisciplinary intervention for pain management while the UK participants were recruited from a specific pain clinic. The differences in recruitment strategies may acount for differences in pain –related outcomes.

Other possible way to understand the difference between HK and UK participants, is to suggest that cognitive coping strategies may be based on the sociocultural model of pain. Given that psychosocial factors are associated with cultural backgrounds promoting different responses to pain (Bates, 1987), it may be possible that older adults from an Asian culture may show more stoicism in their response to pain (Dhingra et al., 2011; Tung, 2015). Stoicism is considered to be a positive trait in Chinese culture (Tung, 2015) and is defined as a mean of exerting emotional control over pain thus promoting a sense of self-dignity (Spiers, 2006). In line with the Communal Coping Model of pain catastrophizing (Sullivan, 1995), the expression of pain catastrophizing may serve as a communication function in order to seek assistance or to elicit empathic responses from others in the social environment (Sullivan, 2012; Sullivan, Martel, Tripp, Savard, & Crombez, 2006). It may be possible that people in Asian society who are more stoic may fear that expressing pain would be viewed as a weakness (Narayan, 2010). This may in turn lead to under-reporting of pain experience. Equally there may be a lower level of willingness to seek empathic responses from others. As such, people in Asian

cultures may report lower pain severity but may be more likely to be self-efficacious in controlling their pain experiences in comparison to UK participants.

The other possible explanation of the difference between two groups might be related to the religion which may influence the way that people respond to pain (Tung & Li, 2015). In this study, over one-third of participants from HK were Buddhists while none of the UK participants were belonged to this religion. Buddhism is a religion that believes in Karma and stresses the importance of accepting the sufferings that happen in life (Anderson, 1999; Sucitto, 2010). As such, people who are Buddhists may be more able to consider their pain as a consequence of their actions in the past and be more able to live with and manage pain, and thus they may tend to report less catastrophizing.

However, the current study finding was in contrary to studies (Forsythe, Thorn, Day, Shelby, 2010; Stewart et al., 2004) revealing that countries in the West reported higher self-efficacy than those in the East. It was suggested the difference in the cognitive coping strategies between the Eastern and Western countries is potentially influenced by the collective or individualistic cultures. Further, the data reported here is contrary to another study that reported Chinese university-aged students having greater pain catastrophizing in a pain experiment when compared to a sample of American undergraduates (Hsieh, Tripp, Ji & Sullivan, 2010). The inconsistent results indicated that the explanations of the difference between pain catastrophizing and self-efficacy are varied. In other words, self efficacy and pain catastrophizing may be the culturally sensitive constructs and that various sociocultural factors may impact the levels of pain catastrophizing and self-efficacy across countries or racial groups differently. Therefore future research examining the

relationship between the influence of cultural factors and pain catastrophizing and pain self-efficacy would be useful.

Clinical implication

In order to alleviate the depressive symptoms related to chronic pain and to improve the quality of life for older people with chronic pain, the current findings suggest that cognitive coping strategies are key factors to adjust the negative affect associated with chronic pain. In particular, pain catastrophizing and pain self-efficacy are two cognitive variables that can be considered in the pain intervention. A pain study (Jensen, Turner, & Romano, 2001) examined multidisciplinary pain treatment for 141 chronic pain adult participants, where data support the suggestion that treatment targets on decreasing pain catastrophizing and the changes in coping responses are associated with a decrease in an individual's pain severity and depression. Nicholas et al (2013) conducted a self-management cognitive and behavioural intervention for older people with chronic pain which targeted on individual's negative cognition and the confidence in cope with pain. The post-intervention result indicated the participants increased self-efficacy, reduction of depression and decreased pain catastrophizing and pain disability. Therefore, the current study result provided support that interventions which targeted on increasing self-efficacy and decreasing pain catastrophizing may be potentially beneficial to reduce the risk of developing depression and other pain-related distress for older people with chronic pain.

In addition, the current study demonstrated that there are differences in pain-related cognitions between HK and UK participants. However, the underlying differences in pain response are multifactorial and complex (Campbell & Edwards, 2012), this study is therefore not possible to conclude whether the intervention

models should be adjusted with the reference of the cultural context. In spite of the inconclusive results, this study help informed healthcare professionals to increase the awareness on the sociocultural context of their patients when understanding their pain experiences, and may also help in designing an appropriate intervention for their patients. In order to have more ideas in which factors should be the main focus on in the psychological intevention, longitudinal studies examining sociocultural factors known to influence the pain experience should be undertaken.

Limitations

There are numbers of limitations in this study. Firstly, different assessment strategies were used when administering the measures. Due to the language proficiency of HK participants, the measures for HK participants were administered by the research assistants whereas the UK participants administered the measure by their own. It is possible that the impact of the presence of the research assistants might have influenced participants' responses, with the possibility of over-reported or under-reported of their pain experiences.

Secondly, lack of diagnostic information is the limitation of this study. In this study, it was not possible to ascertain whether the participants have clinical diagnoses of chronic pain as the self-reported pain participants were also included .While post-diagnosis is an important factor in shaping beliefs about chronic illness conditions and individuals'abilities to cope with the chronic condition in the long term (Anderson, 2005), a clinical diagnosis may have a significant impact on the outcome of catastrophizing. Further research is needed to investigate whether diagnosis of chronic pain would affect individuals's pain cognition.

Thirdly, the participants were community dwelling older people which may not represent all older people populations such as the nursing and residential older

people with chronic pain. Moreover, younger adults populations are not included in this study. To determine whether the indirect relationship between pain severity and depression is influenced by the interaction of self-efficacy and catastrophizing in other populations, the current model should be re-examined by using wider population samples such as younger adults.

Thirdly, despite the current study demonstrated the mean differences in pain-related cognitions (i.e. pain catastrophizing and pain self-efficacy) between HK and UK participants, the result is inconclusive due to not having a population sample. When compared to previous study examining the cultural difference in pain experience (Edwards, Moric, Husfeldt, Buvanendran, & Ivankovich, 2005), the sample size of this study was relatively small. Therefore, the result of this study may be potentially biased and unable to generalize for the whole populations. Although the current study has enough samples to achieve a standardized power of 0.78 with a large effect size for pain severity and pain self-efficacy for the comparison between UK and HK participants, a moderate effect size of 0.64 for pain catastrophizing was obtained which was slightly underpowered. As such, a larger sample size is required in future studies to confirm the differences in levels of pain catastrophizing and pain self-efficacy between HK and UK participants.

In addition, the current study is in an exploratory nature and the standardized cultural measures were not established. Therefore, it remains unclear of what factors contribute to the difference in pain-related cognitions between HK and UK participants. In order to improve our understanding in how the sociocultural factors influence the pain experience across different countries, further research including pain cognition measures and the validated measures for cultural values is recommended.

Conclusion

In summary, the results support the three hypotheses. First, the mediation model is supported in that pain catastrophizing mediates the relationship between pain severity and depression. Second, the moderated mediation model is supported in that the indirect relationship of pain severity and depression are significantly influenced by pain catastrophizing and pain self-efficacy. Third, the levels of pain catastrophizing and pain self-efficacy were significantly difference between UK and HK participants.

The results highlighted the important role of pain catastrophizing and pain self-efficacy in understanding the relationship between pain severity and depression. In order to modify the pain experiences and improve the emotional distress for older people with chronic pain, addressing catastrophizing and enhancing self-efficacy should be considered in the intervention for pain management. The result also indicated that catastrophizing and self-efficacy may be the culturally sensitive constructs that may vary across countries. Further research investigating the underlying mechanism of how the cultural factors influence the pain cognition by including standardized measures for cultural values is recommended.

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Chapter 5: Overall discussion

The ClinPsyD doctoral thesis portfolio submit here consists of a systematic review and meta-analysis (SR/MA) and an empirical research paper (ERP). The portfolio aims to make a significant contribution to the clinical and research literature in pain perception and experiences of chronic pain patients from a psychological perspective. The overall results of SR/MA and EPR provide evidence that is relevant and impactful in understanding pain experiences by examining related cognition and affect. In addition, insight is provided in the design of psychological intervention for improving individuals' pain experiences by considering cognitive factors which previously under-researched such as the roles of pain catastrophizing and pain self-efficacy.

The first part of this portfolio includes a SR/MA to examine the efficacy of structured psychological interventions on the clinical outcomes of pain severity, pain catastrophizing and depression. The second part of this portfolio includes an ERP to examine the interaction of cognitive factors (i.e. pain catastrophizing and pain self-efficacy) between pain severity and depression among the sample of older people.

Considering increasing life expectancies and low medication tolerance (Fine, 2009) ,older people have an increased chance for improvement in pain when the psychological components of pain are treated when compared to conventional pharmacological treatment alone (Rahman, Reed, Underwood, Shipley, & Omar, 2008). A better understanding of factors related to the management of chronic pain in older people from a psychological perspective could help with the precise design and implementation of the psychological intervention for this population.

In addition, older people often perceive pain as a part of normal aging and have been given a lower priority to access the pain intervention programme (Kee,

Middaugh , Redpath, & Hargadon, 1998). As a result, there is a need to apply resources in pain intervention for older people (Arthritis research UK, 2012). However, research regarding the pain management and pain responses in this population remains under-investigated. To move pain research forward, research attention in understanding pain experiences in older people are necessary. While the previous correlation study (Turk et al., 1995) suggested that cognitive factors are less relevant for older populations when looking at the pain perception and responses, the moderated mediation analysis results of the ERP demonstrated that older people with high pain catastrophizing and low self-efficacy contribute to an increased level of depression when compared to those with low catastrophizing and high self-efficacy. This finding provided evidence that cognitive factors are important when examining the interaction between pain severity and depression among the sample of older people. This finding was also consistent with the study of Gibson and Helme (2000), which found that cognitive factors such as catastrophizing are of importance in older chronic pain patients and supported to extend the relevance of cognitive-behavioural models of pain for older people. However, it remains uncertain of whether these results are similar with the adult populations and the question as to whether it is necessary to implement the individualized pain interventions to older people remains unanswered. To confirm this, replicating this study by using the adult populations is recommended in the future research.

Pain catastrophizing

Pain catastrophizing is one of the common cognitive factors included in pain studies (Leung, 2012) and has been examined in the SR/MA and ERP. The SR/MA findings demonstrated that psychological interventions primary efficacy impacts upon pain catastrophizing which was consistent with the systematic review and

meta-analysis result proposed by Schutze et al (2018). The study of Schutze et al (2018) examined the efficacy of experimental interventions on pain catastrophizing and found that CBT, multimodal treatment combining CBT and exercise, and ACT approaches work best in reducing pain catastrophizing. While catastrophizing consists of the dimension of magnification, helpless and rumination, it was proposed that CBT targeting on cognitive restructuring may help to reduce the magnification dimension. Psychoeducation and the paced exercise may help to reduce the sense of helplessness. The ACT approach with mindfulness techniques may help to reduce the rumination dimension. Thus, it is supported that interventions using psychological evidence-based approaches are efficacious in reducing the level of pain catastrophizing for chronic pain patients.

In addition, the second part of this portfolio includes a ERP which was focus on the role of pain catastrophizing. The result confirmed the mediating role of pain catastrophizing on the effect of pain severity on depression, suggesting that addressing pain catastrophizing should be the targeted outcome for psychological intervention. This notion has been supported by numerous correlational studies (Severeijns, Vlaeyen, van den Hout, & Weber, 2001;Turner, Jenson, & Romano, 2000) in that catastrophizing predicts pain intensity and disability and psychological distress of chronic pain patients, therefore it is recommended to address pain catastrophizing in psychological intervention for chronic pain patients.

Pain self-efficacy

Pain self-efficacy, which is considered as a positive coping appraisal, is one of the key elements in the EPR. The World Health Organisation suggested that mental health is defined as a state of wellbeing in which individuals are able to realize their own abilities to cope with the stress. As such, rather than just focusing

upon managing the absence of stress or mental illness in the intervention, it is suggested to improve psychological wellbeing by promoting positive psychological experiences (Fava, Rafanelli, Grandi, Conti, & Belluardo, 1998; Lorenz, 1981), such as identifying positive experiences from daily life, feeling a sense of mastery and purpose in daily life, developing capabilities to cope with daily stress, experiencing positive self-regard and having good relationships with others. The study of Fava et al. (2004) examined the effectiveness of CBT where the CBT was designed to promote psychological well-being and identify positive experience to forty patients with recurrent major depression. The results demonstrated that the group treated with this approach had a significant long term effect with reduced risk of relapse and readmission, indicating that the focus on positive wellbeing is also an important factor in improving negative affect. The concept of promoting positive psychological wellbeing has recently been trialed in patients with chronic pain (Hausmann et al., 2017; Marks, Allegrante, & Lorig, 2005). The study of Hausmann et al. (2017) proposed a positive psychology intervention for patients with arthritis, suggesting that promoting psychosocial wellbeing may be an effective strategy to improve pain severity and physical function. A review (Marks, Allegrante, & Lorig, 2005) concluded that psychological interventions including introducing positive coping strategies or focusing on self-efficacy belief are efficacious in the reduction of pain severity and in the improvement of the quality of life.

Considering the efficacy of promoting positive experiences in the intervention for pain management, the current ERP includes both positive (i.e., pain self-efficacy) and negative (i.e. pain catastrophizing) cognitive appraisals in a model to explain the relationship between pain and depression among older people with chronic pain. The results suggested not solely focus on deficits associated with

chronic pain (i.e., pain severity, pain catastrophizing and depression), the role of the positive psychological factors that impact upon enhanced pain management (i.e. pain self- efficacy) is also important when understanding pain and its comorbid distress. In line with the previous study (McKnight, Afram, Kashdan, Kasle, & Zautra, 2010) which conducted treatments targeting on both self-efficacy and catastrophizing variables, the results have shown a greater impact on improving physical functioning compared to treatments that focus on only one. In summary, the results from this thesis portfolio provided an insight that interventions targeting on both positive cognitive and negative cognitive appraisals may contribute to have greater impact on improving the quality of life and modifying the unpleasant pain experiences for people with chronic pain.

Pain severity

The meta-analysis results indicated that psychological interventions for adult chronic pain patients do not show a significant effect on the reduction of pain severity when compared to the control groups. This implied that psychological interventions are not efficacious for pain severity. However, the data from the MA was contrary to several meta-analysis studies examining the efficacy of psychological treatment for Fibromyalgia pain (Glombiewski et al., 2010; Thieme and Gracely, 2009). Glombiewski et al. (2010) suggested that cognitive-behavioral treatment had a significantly moderate effect on Fibromyalgia pain reduction and revealed that higher treatment doses leads to a greater success on pain relief. The result from Thieme and Gracely (2009) demonstrated a high effect size on pain reduction after the CBT and operant behavioural interventions. However, these two studies Glmobiewski, et al., 2010; Thieme and Gracely, 2009) were not compared the intervention groups to non-active control groups. As such, it remains unknown as

to whether intervention is efficacious in pain reduction, given that the usual treatment alone (e.g. pharmacological approach) may also contribute to the success in pain reduction.

In addition, the SR/MA result demonstrated a minimal impact on symptomatic pain relief when compared to control group. This data from the MA was consistent with previous meta-analyses conducted in five years ago (Williams et al., 2012), suggesting that psychological interventions for chronic pain have a minimal impact on symptomatic pain relief when compared to control group. This result may be understood in that individuals may expect a more direct association and link between psychological therapy depression and pain cognition but not for pain severity as this may be considered an 'organic' aspect of pain and therefore not amenable to psychotherapy. Despite challenges in evidencing the improvement of pain severity in psychological intervention (Sturgeon , 2014; Williams et al., 2012), pain severity outcomes cannot be overlooked in psychological interventions. The review by Eccleston et al (2013) highlighted that chronic pain is a complex condition in which there are no promising treatments for chronic pain, whether pharmacological, surgical, physical or rehabilitation. In addition, there is increasing evidence demonstrates that medical interventions by themselves cannot resolve pain completely and even surgical interventions may fail to resolve pain. As such psychological interventions for pain reduction should be a focus alongside distress management.

Depression

The meta-analysis results demonstrated the efficacy of psychological intervention on reduction of depression for adults with chronic pain. The efficacy of interventions on depression has been well-supported by research studies. For

instance, a meta-analytic review examined the efficacy of mindfulness-based practice in 1141 patients with chronic pain (Hofmann, Sawyer, Witt, & Oh, 2010). The results revealed that patient experienced the present moment nonjudgmentally could effectively counter the effects of stressors related to feelings of depression and anxiety. The RCT study of Wicksell et al (2013) examining the efficacy of ACT for fibromyalgia patients suggested that ACT approach increasing psychological flexibility improved the outcome of depression. The CBT approach (Castro, Datlto, Kraychete, & Lopes, 2012) was also found effective which caused improvement in quality of life and depression when compared to the control group for people with musculoskeletal pain. Therefore it was confirmed that depression is a promising targeted component in psychological intervention for the chronic pain patients.

In addition, the EPR in chapter three provides novel findings that pain catastrophizing and self-efficacy are two important cognitive variables that may alter the level of depression. Therefore, when targeting the improvement of depression for people with chronic pain, addressing the levels of catastrophizing and self-efficacy should be considered in the intervention.

Differences between HK and UK participants

The ERP results demonstrated that HK Chinese participants had a lower pain severity, lower pain catastrophizing and higher levels of pain self-efficacy than the UK participants, which provide some insights to inform the direction of further investigation in the field of cultural pain research. However, as discussed, this result was in contrary to previous cultural studies (Forsythe, Thorn, Day, Shelby, 2010; Stewart et al., 2004) that participants with Eastern cultural backgrounds reported higher level of pain catastrophzing and lower level of pain self-efficacy than those from Western background. Some studies (Markus & Kitayama, 1991; Oettingen,

1995) suggested that countries in the East with collective cultures receive the protection and help from the in-group while the countries in the West promote the sense of personal accomplishment and encourage individuals to cope with the situation on their own. Thus, it was suggested that people from countries in the East had a lower level of self-efficacy than those in the West. The inconsistent results between previous cultural studies and current ERP study may be related to various sociocultural factors which have not been examined in this thesis portfolio.

Apart from the impact of sociocultural factors, the recruitment strategies may also account for the differences in the result. For instance, the different contexts of where the UK and HK participants were recruited, and the presence of interviewers may influence participants' report on their pain experiences. Further investigation is needed to clarify the influence of cultural factors and the recruitment strategies on pain catastrophizing and self-efficacy.

Theoretical implication

In general, the two studies reported in the current ClinPsyD thesis improves understanding in pain experience with people with chronic pain from a psychological perspective. The mechanisms between pain and responses and the explanation of the efficacy on psychological interventions were supported by the following theories.

Gate Control Theory of Pain. According to the Gate Control Theory of Pain (Melzack & Wall, 1965), the gating mechanism exists within the dorsal horn of the spinal cord is responsible for allowing or disallowing pain stimuli from the periphery to the brain. The descending transmission (i.e., from the brain to the spinal cord) reflecting affective and cognitive process can interfere with the gating mechanism in the way to modulate or inhibit pain stimuli. In other words, cognition

and emotions are responsible for the underlying peripheral and central processing of pain signal transmission.

In general, the ERP study reported here support the Gate Control Theory of Pain (Melzack & Wall, 1965) by providing evidence that pain experiences are influenced by cognitive and affective perspectives.

Cognitive mediation model of Pain. Cognitive mediation theory (Lazarus, 1982) proposed that the relationship between cognition, emotion and stress are influenced by the appraisal process. Appraisal is defined as the tendency to make automatic and unconscious assessments in interpreting the situations. When applying this theory in explaining the relationship between pain and depression, cognitive process played an important role to influence pain and depression (Rudy, Kerns, & Turk, 1988). The findings are in line with this theory; different levels of catastrophizing and self-efficacy which are related to appraisal process may give rise to a greater or lesser level of depression. The results of the ERP in chapter provided the evidence that cognitive components play an important role in indirectly influence the relationship between pain and depression.

Research implications

The results of SR/MA in chapter two indicated that there is no significant effect of psychological intervention for the reduction of pain severity when compared to control groups. In order to help achieving a greater effect on pain reduction, it was suggested to examine what components of psychological intervention contribute to the effect of pain severity. However, the question with regard to what factors influence the levels of pain severity remained unaddressed in this thesis portfolio. Therefore, further research is needed to explore this aspect in more details.

One of the recommendation is to examine the bidirectional relationship between pain and depression in details (Korenke et al., 2011). In line with the finding in EPR in chapter three demonstrating that individual reported high catastrophizing and low self-efficacy would experience a greater level of depression, this is also possible that there exists a bidirectional effect, that is, individuals report high levels of pain catastrophizing and depression, and low self-efficacy may worsen the pain severity. Therefore, further research examining the bidirectional effect of depression on pain severity through the interaction of catastrophizing and self-efficacy may be potentially helpful to understand the ways that how other cognitive factors influence the level of pain severity.

Limitations

Participants included in the studies. Participants included in the studies have reported having chronic pain for at least 3 months, however, the duration of chronic pain varied among the included participants. Therefore, whether the duration of pain would affect the outcomes have not been examined. It is possible that different duration of pain may contribute to different pain responses (Probst et al., 2016; Gunnarsson, Grahn, & Agerström, 2016). For instance, the study of Probst et al. (2016) demonstrated that depressed mood mediated the effect of pain on disability with longer pain duration (> 120 months) in a sample of 356 chronic pain patients, but the mediating effect was not significant in patients with shorter pain duration. Research focusing on how pain duration relates to the pain responses is needed to explore in the future.

In addition, the other limitation is that the current study did not compare the pain responses from people with specific pain types. The study of Altuğ, Kavlak, Kurtca, ünal, and Cavlak (2015) found that chronic low back pain patients reported

higher level of depression and disability than chronic neck pain patients in the adult samples. As such, participants with different pain types may have difference pain experience and respond to the psychological, however, the current study did not examine this aspect in more details.

Psychological factors included in the studies. The purpose of the EPR in chapter three was to understand pain experiences of older people with different ethnic backgrounds. However, other factors which are sensitive to this specific cohort (e.g. attitude towards ageing, the connectedness with others) were not taken into consideration. Hence, further research including the cohort sensitive factors into the proposed moderating mediation model may be helpful.

Conclusion

In conclusion, the SR/MA findings extended our knowledge in the efficacy of pain intervention on depression and pain catastrophizing in an adult populations. The empirical study demonstrated that pain catastrophizing and pain self-efficacy are two important cognitive factors to understand the indirect link between pain severity and depression. Therefore, interventions addressing pain catastrophizing and pain self-efficacy for people with chronic pain may be helpful to improve their negative experiences and affect related to pain. Given that the results demonstrated a mean differences in level of pain catastrophizing and pain self-efficacy between HK and UK participants, further research examining the influence of cultural factors on the variables of pain catastrophizing and pain self-efficacy is recommended.

Chapter 6: References for overall thesis portfolio

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Appendix A. Author Guidelines for Submission of Journal of Clinical Psychology Review

Article structure

Manuscripts should be prepared according to the guidelines set forth in the Publication Manual of the American Psychological Association (6th ed., 2009). Of note, section headings should not be numbered.

Manuscripts should ordinarily not exceed 50 pages, **including** references and tabular material. Exceptions may be made with prior approval of the Editor in Chief. Manuscript length can often be managed through the judicious use of appendices. In general the References section should be limited to citations actually discussed in the text. References to articles solely included in meta-analyses should be included in an appendix, which will appear in the on line version of the paper but not in the print copy. Similarly, extensive Tables describing study characteristics, containing material published elsewhere, or presenting formulas and other technical material should also be included in an appendix. Authors can direct readers to the appendices in appropriate places in the text.

It is authors' responsibility to ensure their reviews are comprehensive and as up to date as possible (at least through the prior calendar year) so the data are still current at the time of publication. Authors are referred to the PRISMA Guidelines (http://www.prisma-statement.org/statement.htm) for guidance in conducting reviews and preparing manuscripts. Adherence to the Guidelines is not required, but is recommended to enhance quality of submissions and impact of published papers on the field.

Appendices
If there is more than one appendix, they should be identified as A, B, etc. Formulae and equations in appendices should be given separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

Essential title page information

Title. Concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible. **Note: The title page should be the first page of the manuscript document indicating the author's names and affiliations and the corresponding author's complete contact information.**

Author names and affiliations. Where the family name may be ambiguous (e.g., a double name), please indicate this clearly. Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lower-case superscript letter immediately after the author's name and in front of the appropriate address. Provide the full postal address of each affiliation, including the country name, and, if available, the e-mail address of each author within the cover letter.

Corresponding author. Clearly indicate who is willing to handle correspondence at all stages of refereeing and publication, also post-publication. **Ensure that telephone and fax numbers (with country and area code) are provided in addition to the e-mail address and the complete postal address.**

Present/permanent address. If an author has moved since the work described in the article was done, or was visiting at the time, a "Present address"' (or "Permanent address") may be indicated as a footnote to that author's name. The address at which the author actually did the work must be retained as the main, affiliation address. Superscript Arabic numerals are used for such footnotes.

Abstract

A concise and factual abstract is required. This should be typed on a separate page following the title page. The abstract should state briefly the purpose of the research, the principal results and major conclusions. An abstract is often presented separate from the article, so it must be able to stand alone. References should therefore be avoided, but if essential, they must be cited in full, without reference to the reference list.

Highlights
Highlights are mandatory for this journal. They consist of a short collection of bullet points that convey the core findings of the article and should be submitted in a separate editable file in the online submission system. Please use 'Highlights' in the file name and include 3 to 5 bullet points (maximum 85 characters, including spaces, per bullet point). You can view example Highlights on our information site.

Keywords

Immediately after the abstract, provide a maximum of 6 keywords, using American spelling and avoiding general and plural terms and multiple concepts (avoid, for example, 'and', 'of'). Be sparing with abbreviations: only abbreviations firmly established in the field may be eligible. These keywords will be used for indexing purposes.

Abbreviations
Define abbreviations that are not standard in this field in a footnote to be placed on the first page of the article. Such abbreviations that are unavoidable in the abstract must be defined at their first mention there, as well as in the footnote. Ensure consistency of abbreviations throughout the article.

Acknowledgements
Collate acknowledgements in a separate section at the end of the article before the references and do not, therefore, include them on the title page, as a footnote to the title or otherwise. List here those individuals who provided help during the research (e.g., providing language help, writing assistance or proof reading the article, etc.).

Formatting of funding sources
List funding sources in this standard way to facilitate compliance to funder's requirements:

Funding: This work was supported by the National Institutes of Health [grant numbers xxxx, yyyy]; the Bill & Melinda Gates Foundation, Seattle, WA [grant number zzzz]; and the United States Institutes of Peace [grant number aaaa].

It is not necessary to include detailed descriptions on the program or type of grants and awards. When funding is from a block grant or other resources available to a university, college, or other research institution, submit the name of the institute or organization that provided the funding.

If no funding has been provided for the research, please include the following sentence:

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Footnotes

Footnotes should be used sparingly. Number them consecutively throughout the article. Many word processors can build footnotes into the text, and this feature may be used. Otherwise, please indicate the position of footnotes in the text and list the footnotes themselves separately at the end of the article. Do not include footnotes in the Reference list.

Electronic artwork

General points

• Make sure you use uniform lettering and sizing of your original artwork.
• Embed the used fonts if the application provides that option.
• Aim to use the following fonts in your illustrations: Arial, Courier, Times New Roman, Symbol, or use fonts that look similar.
• Number the illustrations according to their sequence in the text.
• Use a logical naming convention for your artwork files.
• Provide captions to illustrations separately.
• Size the illustrations close to the desired dimensions of the published version.
• Submit each illustration as a separate file.

A detailed guide on electronic artwork is available.

You are urged to visit this site; some excerpts from the detailed information are given here.

Formats

If your electronic artwork is created in a Microsoft Office application (Word, PowerPoint, Excel) then please supply 'as is' in the native document format.
Regardless of the application used other than Microsoft Office, when your electronic artwork is finalized, please 'Save as' or convert the images to one of the following formats (note the resolution requirements for line drawings, halftones, and line/halftone combinations given below):

EPS (or PDF): Vector drawings, embed all used fonts.
TIFF (or JPEG): Color or grayscale photographs (halftones), keep to a minimum of 300 dpi.
TIFF (or JPEG): Bitmapped (pure black & white pixels) line drawings, keep to a minimum of 1000 dpi.
TIFF (or JPEG): Combinations bitmapped line/half-tone (color or grayscale), keep to a minimum of 500 dpi.

Please do not:
• Supply files that are optimized for screen use (e.g., GIF, BMP, PICT, WPG); these typically have a low number of pixels and limited set of colors;
• Supply files that are too low in resolution;
• Submit graphics that are disproportionately large for the content.

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Figure captions
Ensure that each illustration has a caption. Supply captions separately, not attached to the figure. A caption should comprise a brief title (**not** on the figure itself) and a description of the illustration. Keep text in the illustrations themselves to a minimum but explain all symbols and abbreviations used.

Tables

Please submit tables as editable text and not as images. Tables can be placed either next to the relevant text in the article, or on separate page(s) at the end. Number tables consecutively in accordance with their appearance in the text and place any table notes below the table body. Be sparing in the use of tables and ensure that the data presented in them do not duplicate results described elsewhere in the article. Please avoid using vertical rules and shading in table cells.

References

Citations in the text should follow the referencing style used by the American Psychological Association. You are referred to the Publication Manual of the American Psychological Association, Sixth Edition, ISBN 1-4338-0559-6, copies of which may be ordered from http://books.apa.org/books.cfm?id=4200067 or APA Order Dept., P.O.B. 2710, Hyattsville, MD 20784, USA or APA, 3 Henrietta Street, London, WC3E 8LU, UK. Details concerning this referencing style can also be found at http://humanities.byu.edu/linguistics/Henrichsen/APA/APA01.html

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Please ensure that every reference cited in the text is also present in the reference list (and vice versa). Any references cited in the abstract must be given in full. Unpublished results and personal communications are not recommended in the reference list, but may be mentioned in the text. If these references are included in the reference list they should follow the standard reference style of the journal and should include a substitution of the publication date with either 'Unpublished results'

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Web references
As a minimum, the full URL should be given and the date when the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading if desired, or can be included in the reference list.

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References should be arranged first alphabetically and then further sorted chronologically if necessary. More than one reference from the same author(s) in the same year must be identified by the letters "a", "b", "c", etc., placed after the year of publication. **References should be formatted with a hanging indent (i.e., the first line of each reference is flush left while the subsequent lines are indented).**

Examples: Reference to a journal publication: Van der Geer, J., Hanraads, J. A. J., & Lupton R. A. (2000). The art of writing a scientific article. **Journal of Scientific Communications,** 163, 51-59.

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Reference to a chapter in an edited book: Mettam, G. R., & Adams, L. B. (1994). How to prepare an electronic version of your article. In B.S. Jones, & R. Z. Smith (Eds.), **Introduction to the electronic age** (pp. 281-304). New York: E-Publishing Inc.

[dataset] Oguro, M., Imahiro, S., Saito, S., Nakashizuka, T. (2015). **Mortality data for Japanese oak wilt disease and surrounding forest compositions.** Mendeley Data, v1. http://dx.doi.org/10.17632/xwj98nb39r.1

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Appendix B. Author Guidelines for Submission of Journal of Pain.

Title page (page 1)
The title should be a concise and informative description of the study and should indicate animal species if the research was conducted on nonhuman animals subjects. Within the title, use nonproprietary names for drugs, and descriptions for devices. Brand name may be mentioned only once within the text (upon first reference), unless essential to the study. The title page should include the authors' names, department(s), institution where the work was done, and institutional affiliations of authors. The corresponding author must be clearly identified and phone/fax/e-mail information must be provided. The corresponding author noted on the manuscript's title page must be the same person designated as corresponding author within the Elsevier Editorial System. The title page should include a short running title (45 characters, excluding spaces).

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This required section must appear on the title page. **Research funding** sources must be acknowledged, including corporate, grant, institutional, or departmental funds. If this does not apply, authors must state that no funding sources were provided. In this section, all authors must disclose any potential **conflicts of interest** and must include a declaration statement if no conflicts exist. Conflicts include honoraria, travel to conferences, consultancies, stock ownership (excluding publicly owned mutual funds), equity interests, and patent-licensing arrangements (particularly if a commercial product is noted in the article).

Formatting of funding sources
List funding sources in this standard way to facilitate compliance to funder's requirements:

Funding: This work was supported by the National Institutes of Health [grant numbers xxxx, yyyy]; the Bill & Melinda Gates Foundation, Seattle, WA [grant number zzzz]; and the United States Institutes of Peace [grant number aaaa].

It is not necessary to include detailed descriptions on the program or type of grants and awards. When funding is from a block grant or other resources available to a university, college, or other research institution, submit the name of the institute or organization that provided the funding.

If no funding has been provided for the research, please include the following sentence:

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Abstract (page 2)
An abstract should describe concisely the purpose of the study, the main findings, and conclusions, all in one paragraph without subheadings. References may not be included in the abstract.

Trial registration
The Journal will only consider for publication randomized clinical trials that were registered with an appropriate registration agency (such as clinicaltrials.gov) before the first subject was recruited. Registration information must be included at the end of the Abstract.

These guidelines apply to studies that involve both pharmacological and non-pharmacological interventions. The online registry information should appear at the end of the abstract.

Perspective
This item, limited to 50 words, should appear at the end of the abstract. The perspective presents a synopsis of the work to facilitate understanding of its significance. Authors of basic science reports should highlight the potential clinical relevance of their results for the benefit of clinical readers. Authors of clinical science reports should highlight the underlying mechanisms for the results, for the benefit of clinical scientists and basic scientists. Example: "Perspective: This article presents the psychometric properties of a new measure of spouse responses to patient chronic pain and well behavior. This measure could potentially help clinicians who seek to assess how spouse responses may contribute to patient pain and disability." References should not be included in the Perspective.

Key words
Five key words should be provided following the Perspective.

Text
Text headings should be as follows:

Introduction: State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.
Methods: Provide sufficient detail to allow the work to be reproduced. Methods already published should be indicated by a reference; only relevant modifcations should be described.
Results: Results should be clear and concise.
Discussion: This should explore the significance of the results of the work, not repeat them. Avoid extensive citations and discussion of published literature.

Footnotes are not permitted in the text. Information must be cited parenthetically, or within the **References** section.

Essential title page information

• ***Title.*** Concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.
• ***Author names and affiliations.*** Please clearly indicate the given name(s) and family name(s) of each author and check that all names are accurately spelled. You can add your name between parentheses in your own script behind the English transliteration. Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lower-case superscript letter immediately after the author's name and in front of the appropriate address. Provide

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Acknowledgments

Collate acknowledgments in a separate section at the end of the article before the references; do not include them on the title page, as a footnote to the title, or otherwise. List here those individuals who provided help during the research (eg, providing language help, writing assistance, or proofreading the article). The Acknowledgments section is optional.

Footnotes
Footnotes should be used sparingly. Number them consecutively throughout the article. Many word processors build footnotes into the text, and this feature may be used. Should this not be the case, indicate the position of footnotes in the text and present the footnotes themselves separately at the end of the article.

Artwork

All figures must be cited in the text; figures must be cited in consecutive order (this

also applies to individual panels within figures). Computer-generated figures should use solid fills or cross-hatching, not tonal shading. Color figures may be accepted but any cost related to print production is the responsibility of the author. However, authors who are members of the American Pain Society may qualify for complimentary production of essential color figures. Also, color figures may be published in the electronic version of **The Journal** at no cost to the authors. Within figures, patients' eyes must be masked unless authors receive patient permission. For a consent form, contact the Editorial Office at jpain@jpain.us.

TIFF and EPS are the preferred formats for artwork. All type fonts used in studio-created artwork must be either "embedded" in the file or supplied separately. All graphic files supplied as bitmap format (not vector format) in TIFF, JPEG, or GIF must be submitted in sufficiently high resolution (240-300 dpi for grayscale or color images and 600-1000 dpi for line art) to allow for printing. See Elseviers website for guidelines for preparing electronic artwork:
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Electronic artwork

General points

• Make sure you use uniform lettering and sizing of your original artwork.
• Preferred fonts: Arial (or Helvetica), Times New Roman (or Times), Symbol, Courier.
• Number the illustrations according to their sequence in the text.
• Use a logical naming convention for your artwork files.
• Indicate per figure if it is a single, 1.5 or 2-column fitting image.
• For Word submissions only, you may still provide figures and their captions, and tables within a single file at the revision stage.
• Please note that individual figure files larger than 10 MB must be provided in separate source files.

A detailed guide on electronic artwork is available.

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Formats

Regardless of the application used, when your electronic artwork is finalized, please 'save as' or convert the images to one of the following formats (note the resolution requirements for line drawings, halftones, and line/halftone combinations given below):

EPS (or PDF): Vector drawings. Embed the font or save the text as 'graphics'.
TIFF (or JPG): Color or grayscale photographs (halftones): always use a minimum of 300 dpi.
TIFF (or JPG): Bitmapped line drawings: use a minimum of 1000 dpi.
TIFF (or JPG): Combinations bitmapped line/half-tone (color or grayscale): a minimum of 500 dpi is required.

Please do not:

• Supply files that are optimized for screen use (e.g., GIF, BMP, PICT, WPG); the resolution is too low.
• Supply files that are too low in resolution.
• Submit graphics that are disproportionately large for the content.

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A legend must be provided for each figure. Figure legends should be brief and not repetitive of description in the text. Legends should be placed in numerical order after the list of references.

Tables

All tables must be cited in the text in consecutive order. Tables should be comprehensive without reference to the text and should not be repetitive of descriptions in the text. Every table should consist of two or more columns; tables with only one column will be treated as lists and incorporated into the text. Each column must have a column heading. Explanatory matter and source notations for borrowed or adapted tables should be placed in a table footnote, not in the title or table body.

References

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There are no strict requirements on reference formatting at submission. References can be in any style or format as long as the style is consistent. Where applicable, author(s) name(s), journal title/book title, chapter title/article title, year of publication, volume number/book chapter and the pagination must be present. Use of DOI is highly encouraged. The reference style used by the journal will be applied to the accepted article by Elsevier at the proof stage. Note that missing data will be highlighted at proof stage for the author to correct. If you do wish to format the references yourself they should be arranged according to the following examples:

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Books
Koltzenberg M, McMahon S (eds): Wall and Melzack's Textbook of Pain, 5th ed. Philadelphia, Elsevier, 2006

Chapter/article in book
Begg C: Publication bias. In: Cooper H, Hedges L (eds): Handbook of Research Synthesis. New York, Russell Sage Foundation, 1994, pp 399-409

Software
SAS Institute. SAS/STAT software: Changes and enhancements through release 6.12. Cary, NC: SAS Institute, 1996

Supplement
Dworkin RH, Gnann JW, Oaklander AL, Raja SN, Schmader KE, Whitley RJ: Diagnosis and Assessment of Pain Associated with Herpes Zoster and Postherpetic Neuralgia. J Pain 9(Suppl 1):37-55, 2008

Epub Ahead of Print
Nielsen CS, Staud R, Price DD: Individual differences in pain sensitivity: Measurement, causation, and consequences. J Pain 2009 Feb 8; [Epub ahead of print]

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The American Academy of Pain Medicine: The use of opioids for the treatment of chronic Pain: A Consensus Statement. Available at: http://www.painmed.org. Accessed March 9, 2006

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Web references

As a minimum, the full URL should be given and the date when the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading if desired, or can be included in the reference list.

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The Journal of Pain will publish appropriate images on the journal's cover. Selected figures may accompany a submitted manuscript (authors should make a note in the covering letter), or images may be submitted individually. Authors are encouraged to submit art for consideration; materials may be uploaded to http://ees.elsevier.com/jpain.

Proprietary Information

Use nonproprietary names for drugs, and descriptions for devices. Brand name may be mentioned only once within the text (upon first reference), unless essential to the study. For presentation of brand or trade names, include manufacturer's name, city, state and country within parentheses. Upon subsequent reference, use generic drug names or device descriptions only.

Appendix C. UEA Sponsorship Authorisaton

University of East Anglia

Research & Enterprise Services
West Office (Science Building)
University of East Anglia
Norwich Research Park
Norwich, NR4 7TJ

Telephone: +44 (0)1603 591482
Email: t.moulton@uea.ac.uk

Web: www.uea.ac.uk/researchandenterprise

TO WHOM IT MAY CONCERN

09 August 2016

Dear Sirs,

Study: *Pain experience in older adults with chronic musculoskeletal pain*

Chief Investigator: *Rosanna Lau*

This is to confirm that the University of East Anglia shall act as sponsor for the above study.

Further the University of East Anglia and Subsidiary Companies have arranged insurance cover as detailed on the attached Company Public Liability and Professional Negligence Insurance certificates.

The cover is subject to the terms and conditions of the policy. If you require further details, please contact the undersigned.

It is fully expected that UEA shall renew its insurance policies with at least the equivalent cover going forward.

Yours faithfully

T. Moulton

Tracy Moulton
Research Contracts Manager
Research and Enterprise Services
University of East Anglia
Norwich NR4 7TJ

Tel: 01603 591482
Email: t.moulton@uea.ac.uk

Appendix D. Health Research Authority Approval

NHS
Health Research Authority

Miss Rosanna Wing Lam Lau
Trainee Clinical Psychologist
Department of Clinical Psychology, Norwich Medical School,
Faculty of Medicine and Health Sciences,
University of East Anglia, Norwich Research Park,
Norwich. UK
NR47TJ

Email: hra.approval@nhs.net

04 November 2016

Dear Miss Lau

Letter of HRA Approval

Study title:	**Pain Severity, Pain Self-efficacy and Pain Catastrophizing in Older Adults with Chronic Musculoskeletal Pain: a Comparative Study of UK and Hong Kong Residents**
IRAS project ID:	**183258**
REC reference:	**16/LO/1608**
Sponsor	**University of East Anglia**

I am pleased to confirm that **HRA Approval** has been given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications noted in this letter.

Participation of NHS Organisations in England

The sponsor should now provide a copy of this letter to all participating NHS organisations in England.

Appendix B provides important information for sponsors and participating NHS organisations in England for arranging and confirming capacity and capability. **Please read *Appendix B* carefully**, in particular the following sections:

- *Participating NHS organisations in England* – this clarifies the types of participating organisations in the study and whether or not all organisations will be undertaking the same activities
- *Confirmation of capacity and capability* - this confirms whether or not each type of participating NHS organisation in England is expected to give formal confirmation of capacity and capability. Where formal confirmation is not expected, the section also provides details on the time limit given to participating organisations to opt out of the study, or request additional time, before their participation is assumed.
- *Allocation of responsibilities and rights are agreed and documented (4.1 of HRA assessment criteria)* - this provides detail on the form of agreement to be used in the study to confirm capacity and capability, where applicable.

Further information on funding, HR processes, and compliance with HRA criteria and standards is also provided.

IRAS project ID	183258

It is critical that you involve both the research management function (e.g. R&D office) supporting each organisation and the local research team (where there is one) in setting up your study. Contact details and further information about working with the research management function for each organisation can be accessed from www.hra.nhs.uk/hra-approval.

Appendices

The HRA Approval letter contains the following appendices:

- A – List of documents reviewed during HRA assessment
- B – Summary of HRA assessment

After HRA Approval

The document *"After Ethical Review – guidance for sponsors and investigators"*, issued with your REC favourable opinion, gives detailed guidance on reporting expectations for studies, including:

- Registration of research
- Notifying amendments
- Notifying the end of the study

The HRA website also provides guidance on these topics, and is updated in the light of changes in reporting expectations or procedures.

In addition to the guidance in the above, please note the following:

- HRA Approval applies for the duration of your REC favourable opinion, unless otherwise notified in writing by the HRA.
- Substantial amendments should be submitted directly to the Research Ethics Committee, as detailed in the *After Ethical Review* document. Non-substantial amendments should be submitted for review by the HRA using the form provided on the HRA website, and emailed to hra.amendments@nhs.net.
- The HRA will categorise amendments (substantial and non-substantial) and issue confirmation of continued HRA Approval. Further details can be found on the HRA website.

Scope

HRA Approval provides an approval for research involving patients or staff in NHS organisations in England.

If your study involves NHS organisations in other countries in the UK, please contact the relevant national coordinating functions for support and advice. Further information can be found at http://www.hra.nhs.uk/resources/applying-for-reviews/nhs-hsc-rd-review/.

If there are participating non-NHS organisations, local agreement should be obtained in accordance with the procedures of the local participating non-NHS organisation.

IRAS project ID	183258

User Feedback

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received and the application procedure. If you wish to make your views known please email the HRA at hra.approval@nhs.net. Additionally, one of our staff would be happy to call and discuss your experience of HRA Approval.

HRA Training

We are pleased to welcome researchers and research management staff at our training days – see details at http://www.hra.nhs.uk/hra-training/

Your IRAS project ID is **183258**. Please quote this on all correspondence.

Yours sincerely

Michael Pate
Assessor

Email: hra.approval@nhs.net

Copy to: *Ms Yvonne Kirkham – University of East Anglia – Sponsor's contact*
Lisa Chalkley - Norfolk and Norwich University Hospital NHS Trust – Lead NHS R&D contact.

IRAS project ID	183258

Appendix A - List of Documents

The final document set assessed and approved by HRA Approval is listed below.

Document	*Version*	*Date*
Copies of advertisement materials for research participants [Flyers]	2	01 May 2016
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [evidence of sponsor insurance or indemnity]		09 August 2016
IRAS Application Form [IRAS_Form_12082016]		12 August 2016
Letter from sponsor [UEA sponsorship authorisation]		08 August 2016
Other [HRA statement of activities]		20 October 2016
Other [HRA Schedule events template]	1	20 October 2016
Participant consent form [Participant consent form]	4	02 November 2016
Participant information sheet (PIS) [Participant information sheet]	3	01 November 2016
Participant information sheet (PIS) [Information sheet for clinician]	2	01 November 2016
Referee's report or other scientific critique report [Critique report from UEA]	1	31 August 2015
Research protocol or project proposal [Thesis Protocol]	2	01 March 2016
Summary CV for Chief Investigator (CI) [CV for CI]	1	01 March 2016
Summary CV for supervisor (student research) [CV_Prof. Sheung tak Cheng]		13 August 2016
Summary CV for supervisor (student research) [summary CV for supervisor]	1	01 June 2016
Validated questionnaire [validated questionnaire]	2	01 May 2016

IRAS project ID	183258

Appendix B - Summary of HRA Assessment

This appendix provides assurance to you, the sponsor and the NHS in England that the study, as reviewed for HRA Approval, is compliant with relevant standards. It also provides information and clarification, where appropriate, to participating NHS organisations in England to assist in assessing and arranging capacity and capability.

For information on how the sponsor should be working with participating NHS organisations in England, please refer to the, *participating NHS organisations, capacity and capability* and *Allocation of responsibilities and rights are agreed and documented (4.1 of HRA assessment criteria)* sections in this appendix.

The following person is the sponsor contact for the purpose of addressing participating organisation questions relating to the study:

Name: Ms Yvonne Kirkham
Tel: 01603591386
Email: Y.Kirkham@uea.ac.uk

HRA assessment criteria

Section	HRA Assessment Criteria	Compliant with Standards	Comments
1.1	IRAS application completed correctly	Yes	No comments
2.1	Participant information/consent documents and consent process	Yes	The "consent to share contact details" form will not be used. Clinicians will be asked to obtain verbal consent from potential participants, for their details to be shared with the research team. Following REC favourable opinion, the information sheets and consent form were updated to bring them in line with HRA standards.
3.1	Protocol assessment	Yes	No comments
4.1	Allocation of responsibilities and rights are agreed and documented	Yes	A Statement of Activities will form the agreement between the Sponsor and participating sites.

IRAS project ID	183258

Section	HRA Assessment Criteria	Compliant with Standards	Comments
4.2	Insurance/indemnity arrangements assessed	Yes	Where applicable, independent contractors (e.g. General Practitioners) should ensure that the professional indemnity provided by their medical defence organisation covers the activities expected of them for this research study
4.3	Financial arrangements assessed	Yes	No funding will be offered to participating sites.
5.1	Compliance with the Data Protection Act and data security issues assessed	Yes	No comments
5.2	CTIMPS – Arrangements for compliance with the Clinical Trials Regulations assessed	Not Applicable	No comments
5.3	Compliance with any applicable laws or regulations	Yes	No comments
6.1	NHS Research Ethics Committee favourable opinion received for applicable studies	Yes	No comments
6.2	CTIMPS – Clinical Trials Authorisation (CTA) letter received	Not Applicable	No comments
6.3	Devices – MHRA notice of no objection received	Not Applicable	No comments
6.4	Other regulatory approvals and authorisations received	Not Applicable	No comments

IRAS project ID	183258

Participating NHS Organisations in England

This provides detail on the types of participating NHS organisations in the study and a statement as to whether the activities at all organisations are the same or different.
All participating sites will be conducting the same activities, as per the protocol; therefore, one site type. The Chief Investigator or sponsor should share relevant study documents with participating NHS organisations in England in order to put arrangements in place to deliver the study. The documents should be sent to both the local study team, where applicable, and the office providing the research management function at the participating organisation. For NIHR CRN Portfolio studies, the Local LCRN contact should also be copied into this correspondence. For further guidance on working with participating NHS organisations please see the HRA website. If chief investigators, sponsors or principal investigators are asked to complete site level forms for participating NHS organisations in England which are not provided in IRAS or on the HRA website, the chief investigator, sponsor or principal investigator should notify the HRA immediately at hra.approval@nhs.net. The HRA will work with these organisations to achieve a consistent approach to information provision.

Confirmation of Capacity and Capability

This describes whether formal confirmation of capacity and capability is expected from participating NHS organisations in England.
Participating NHS organisations in England **will be expected to formally confirm their capacity and capability to host this research**. • Following issue of this letter, participating NHS organisations in England may now confirm to the sponsor their capacity and capability to host this research, when ready to do so. How capacity and capacity will be confirmed is detailed in the *Allocation of responsibilities and rights are agreed and documented (4.1 of HRA assessment criteria)* section of this appendix. • The Assessing, Arranging, and Confirming document on the HRA website provides further information for the sponsor and NHS organisations on assessing, arranging and confirming capacity and capability.

IRAS project ID	183258

Principal Investigator Suitability

This confirms whether the sponsor position on whether a PI, LC or neither should be in place is correct for each type of participating NHS organisation in England and the minimum expectations for education, training and experience that PIs should meet (where applicable).
A local collaborator should be in place at participating sites. It has been confirmed that these have already been identified. GCP training is not a generic training expectation, in line with the HRA statement on training expectations.

HR Good Practice Resource Pack Expectations

This confirms the HR Good Practice Resource Pack expectations for the study and the pre-engagement checks that should and should not be undertaken
The external researcher will present the study at MDT meetings, therefore will have direct staff contact. She will have indirect patient contact through discussing the study with potential participants over the telephone. She will also require access to the sites to collect questionnaires from clinical areas. A letter of access will be required but no evidence of DBS or occupational health clearance would be expected.

Other Information to Aid Study Set-up

This details any other information that may be helpful to sponsors and participating NHS organisations in England to aid study set-up.
• The applicant has indicated that they do not intend to apply for inclusion on the NIHR CRN Portfolio.

Appendix E. NNUH Trust R&D Approval.

Our Vision
To provide every patient with the care we want for those we love the most

Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust

Please reply to: Research and Development Department
Level 3, East Block, Room 032
Norfolk & Norwich University Hospitals NHS Foundation Trust
Colney Lane
Norwich
Norfolk
NR4 7UY
Direct Dial: 01603 289808
Internal: 5808

e-mail: rdoffice@nnuh.nhs.uk
Website: www.nnuh.nhs.uk

Yvonne Kirkham
Research & Enterprise Services West Office
University of East Anglia
Norwich
NR4 7TJ

27/01/2017

Dear Yvonne,

Confirmation of Capacity and Capability

RE: 183258 (205-11-16).

Study Title: Pain severity, pain self-efficacy and pain catastrophizing in older adults with chronic musculoskeletal pain. A comparative study of UK and Hong Kong Residents.

This letter confirms that **Norfolk and Norwich University Hospitals NHS Foundation Trust** has the capacity and capability to deliver the above referenced study. Please find attached our agreed Statement of Activities as confirmation.

We agree to start this study on a date to be agreed when you as sponsor give the green light to begin.

If you wish to discuss further, please do not hesitate to contact me.

Kind regards

Professor Alastair Forbes
Chief of Research and Innovation

Cc. Rosanna Lau, Prof Cheng Sheung-Tak, Professor Kenneth Laidlaw, Katherine Dyer

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To provide every patient with the care we want for those we love the most

Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust

Miss Rosanna Lau
University of East Anglia
Faculty of Medicine & Health
Norwich Medical School
Norwich
NR4 7TJ

Research & Development Office
Level 3 East
Norfolk & Norwich University Hospitals NHS Foundation Trust
Colney Lane
Norwich
NR4 7UY

direct dial: 01603 289808
Ext:: 5808
e-mail: rdoffice@nnuh.nhs.uk
website: www.nnuh.nhs.uk

27/01/2017

Dear Miss Lau

Reference Number:

R&D Reference Number: 183258 (205-11-16)
Title: Pain severity, pain self-efficacy and pain catastrophizing in older adults with chronic musculoskeletal pain. A comparative study of UK and Hong Kong Residents.

I am pleased to inform you that the Norfolk & Norwich University Hospitals NHS Foundation Trust has confirmed to the sponsor that we have the capacity and capability to take part in the above study.

Please note you cannot begin this study until you have received confirmation to do so from the study sponsor.

The agreed total local recruitment target for your study is 50 participants.

To support requirements of the National Institute of Health Research (NIHR) we will be monitoring and publishing outcomes of recruitment into your study. This includes benchmarking against a 70 day period from the time of receipt of a valid local document set to the time of recruitment of the first patient for your study.

The date of receipt of a valid local document set for this study is 22/11/2016 and the benchmark of 70 days to recruit the first patient is 31/01/2017.

Please notify the R&D department when the first patient is enrolled/consented into the study. Wherever the duration exceeds 70 days of the Trust receiving a valid local document set, the Investigator will be expected to explain the reason for the delay in writing.

If you have any queries regarding this or any other project please contact **Laura Harper**, Research Study and Recruitment Facilitator, at the above address. Please note, the reference number for this study is **183258 (205-11-16)** and this should be quoted on all correspondence.

Yours sincerely

Laura Harper
Research Facilitator

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Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust

Screening of Patient Notes for Research Purposes – Guidance Notes for NNUH

Note – Work is ongoing nationally to address the issue of screening notes for research purposes – this guidance will be updated once this national guidance becomes available.

Access to patient-identifiable information should be on a strict need-to-know basis: Only those individuals who need access to patient identifiable information should have access to it, and they should only have access to the information items that they need to see.

Caldicott Principles, laid down by the NHS Executive

Clinical staff providing care may use their patients' clinical data to identify eligible patients in order to contact them about participation in research. They do not have to ask for separate consent before identifying and contacting the patients as data protection legislation permits patient data to be processed for research purposes providing there is no breach in confidentiality. This also covers clinical staff that both provide routine care and undertake research, provided they are only using data about patients treated by their clinical care team.

Research support staff i.e. staff that are employed to support research activities and that are not involved in providing care to the patient, are not part of the clinical care team.

National Information Governance Board (NIGB), Frequently Asked Questions

The guidance provided for research is clear. **No-one outside of the primary healthcare team can have access to patient identifiable notes prior to consent of the patient** for any research project unless approved under Section 251 of the National Health Service Act 2006. Honorary research contracts do not provide a mechanism to access confidential patient information without consent.

It is clear therefore that any screening of patient notes prior to consent must be done by the healthcare team. Due to workload issues however, it is not often practical for the primary healthcare team to do all the screening themselves; therefore we advise that although researchers *cannot access notes* prior to consent, researchers can assist with the following activities:

Advise on search criteria for database searches
Prepare information packs for sending to patients and mail shots.

These activities *must* be conducted on Trust premises.

The initial approach to patients must be via their primary healthcare team, all invitation letters must be sent from the Trust and on Trust headed paper. Postage costs should be covered by the research team.

Full details of patient screening activities must be given in the application for research governance and ethics approval. This will be considered by both committees prior to approval being given.

All researchers who will have access to confidential information (including names and addresses) for research purposes will need to be issued an Honorary Contract or Letter of Access by the Trust. This will be arranged through the Research & Development Office at NNUH. Letters of Access and Honorary Contracts are subject to completion of Information Governance Training. Further information is available from the Research & Development Office.

Funding should also be provided to cover the workload involved in screening patients and access to Health Records. For NIHR portfolio studies this will be through NHS support funding, for non-portfolio studies the researcher should consider how this can be funded. Funding issues can be discussed with the Research & Development Office.

Section 251 of the NHS Act 2006
Section 251 of the NHS Act 2006 provides a power to ensure that patient identifiable information needed to support essential NHS activity can be used to support medical purposes. These activities must be in the interest of patients or to the wider public and *only where consent is not a practicable alternative and where anonymised information will not suffice*. Those wishing to complete activities with Section 251 support must first apply to the National Information Governance Board (NIGB) http://www.nigb.nhs.uk/s251/howtoapply with all the necessary information. The NIGB will then review the application and decide whether to provide support under Section 251.

Further Reading:

Research in the NHS – HR Good Practice Resource Pack Version 2.0, February 2010
http://www.nihr.ac.uk/systems/Pages/systems_research_passports.aspx

National Information Governance Board (NIGB)
http://www.nigb.nhs.uk/advice/indentfags/

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Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust

Roles and Responsibilities of the Researcher

The Chief Investigator[i] has

Primary responsibility for the design, management, conduct, analyses and reporting of the study to the standards set out in the Research Governance Framework[ii], or manages those with delegated authority for these aspects

Responsibility for co-ordinating the investigators who take the lead at each site involved in the study.

Responsibility for ensuring that research is conducted to an agreed protocol (or proposal); accountability for this is to the chief investigator's employer and through them, to the sponsor of the research.

Chief and Principal Investigators[iii] must ensure that research is carried out in accordance with the Research Governance Framework and ICH GCP guidelines this includes:

Study approvals

The study complies with legal and ethical requirements.

Application is made to a NHS research ethics committee for ethical approval and the Trust R&D office for Trust approval. The research does not commence before a favourable opinion is received, from both Ethics and R&D and the research team acts on any conditions attached to the approvals.

The R&D office is informed that the study is planned and their permission is obtained before the research starts. This is done via the Central Systems for permission for NIHR registered studies (CSP) and via R&D office systems for other studies.

Changes to the protocol or proposal are reported to the R&D Office and the appropriate Research Ethics Committee (REC) for review. Approval is obtained before any changes other than urgent safety measures are implemented.

Conduct of the study

The research is conducted to high ethical standards, following independent external review wherever possible

The study is conducted according to a written protocol. The investigator will be fully conversant with the details of the study protocol and the drugs, devices and procedures used in the study, and are satisfied that the objectives of the study are appropriate and the methods used are valid.

The study is conducted according to the relevant standard operating procedures (SOPs). For Trust sponsored studies these will be the relevant Trust SOPs, for externally sponsored SOPs these will be determined by the Sponsor. Details of current Trust SOPs are available via the R&D Website (http://www.nnuh.nhs.uk/Dept.asp?ID=681) . The CI/PI is responsible for ensuring that the study team is appropriately trained in the applicable SOPs

Each member of the research team, including those on collaborating sites, is qualified by education, training and experience and is able to produce evidence of Good Clinical Practice (GCP) training

Delegation of duties and responsibilities is formally recorded and reported.

Each investigator in a clinical trial involving medicine is aware of their duties in respect of the EU Directive on Clinical Trials[iv] and is appropriately trained in the principles of Good Clinical Practice[v]

Student and new researchers have adequate supervision, support and training.

Controlled trials are registered, and for clinical trials involving medicinal products (CTIMPs), the research follows any conditions imposed by the appropriate licensing authority.

Arrangements are made for the management of financial and other resources provided for the study, including for the management of any intellectual property arising. For NNUH studies these aspects are managed via the R&D Department.

All data and documentation associated with the study are available at the request of the internal or external inspectors or auditors.

Participant's involvement

Participant dignity, rights, safety and well-being are given priority at all times.

When the study involves participants under the care of a doctor, nurse or social worker for the condition to which the study relates, those care professionals are informed that their patients or users are being invited to participate, and agree to retain overall responsibility for their care.

When the research involves a social care service user or carer or child, looked after or receiving services under the auspices of the local authority, the agency director or her deputy agrees to the person (and/or their carer) being invited to participate, and is fully aware of the arrangements for dealing with any disclosures or other relevant information.

Unless participants or the relevant research ethics committee specify otherwise, participants' care professionals are given information specifically relevant to their care that arises in the research.

Data collection, analysis and publication

Procedures are in place to ensure collection of high quality, accurate data and the integrity and confidentiality of data during processing and storage. Arrangements are made for the appropriate archiving of data when the research has finished.

Reports on the progress and outcomes of the work required by sponsors, funders, R&D Departments and Ethics committees are produced to time and to an acceptable standard.

Where studies are National Institute of Health Research portfolio adopted any information required by the NIHR research networks is submitted to the appropriate authority

Findings from the work, once critically reviewed through accepted channels, should be disseminated promptly and fed back as appropriate to participants

The investigator plays a key role in detecting and preventing scientific misconduct by adopting the role of guarantor on published outputs

[i] The Chief investigator is the authorised health care professional, whether or not he is an investigator at any particular site, who takes primary responsibility for the conduct, design, and reporting of the trial at a single site or at more than one site. There is only one CI per study.
[2] Department of Health (2005) Research Governance Framework for Health and Social Care. Department of Health: London. Second edition, 2005
[iii] Principle investigator is responsible for the study at a site. There is only one PI per site.
[iv] The EU Directive on GCP in Clinical Trials (2001/20/EC)
[v] ICH Guideline for Good Clinical practice (E6)

Appendix F. QEHKL Trust R& D approval.

The Queen Elizabeth Hospital NHS
King's Lynn
NHS Foundation Trust
The Queen Elizabeth Hospital
Gayton Road
Kings Lynn
Norfolk
PE30 4ET
www.qehkl.nhs.uk

Research and Development

Research&development@qehkl.nhs.uk

Tel: 01553 214571/214574

Miss Rosanna Wing Lam Lau
Trainee Clinical Psychologist
Department of Clinical Psychology, Norwich Medical School, Faculty of Medicine and Health Sciences,
University of East Anglia, Norwich Research Park,
Norwich
Norfolk
NR47TJ

Tuesday 13 December 2016

Dear Miss Lau

Title: Pain Severity, Pain Self-efficacy and Pain Catastrophizing in Older Adults with Chronic Musculoskeletal Pain: a Comparative Study of UK and Hong Kong Residents
IRAS ID: 183258
REC ID: 16/LO/1608

I am writing to confirm that our site QEHKL has the capacity and capability to participate in the above study.

Approval is subject to compliance with the Trust Policy and Procedures on Research Governance.

Documents reviewed;
Protocol - Submission Date: 7th July 2015
Information sheet for clinician version 2 dated 27 Oct 2016
Participant information sheet version 3 dated 27 Oct 2016
Consent form version 4 dated 2 Nov 2016
Questionnaire version 2 dated May 2016
Flyer version 2 dated May 2016

Thank you for using QEHKL to deliver your study, and we look forward to working with you on future studies.

If our department can be of any further assistance please do not hesitate to contact me.

Yours sincerely –

Dr Antonia Hardcastle, Research & Development Manager
Tilney Ground Floor Offices
The Queen Elizabeth Hospital Kings Lynn NHS Foundation Trust
Gayton Road Kings Lynn Norfolk, PE30 4ET

Appendix G. Information Sheet for Clinicians

Faculty of Medicines and Health Science
Doctoral Programme in Clinical Psychology
University of East Anglia

Information Sheet

Study Title: Pain severity, pain self-efficacy and pain catastrophizing in older adults with chronic musculoskeletal pain: a comparative study in UK and Hong Kong residents.

Study aim: 1) To examine the mechanism of how pain severity, pain catastrophizing and pain self-efficacy may impact and moderate depression scores on psychometric mood measures.
2) To have a better understanding of factors related to the management of chronic musculoskeletal pain and we hope to shed light on improving cognitive treatment for chronic musculoskeletal pain patients in older populations.

Number of participants: 80

Inclusion Criteria:

1) 60 or above years of age
2) Having Musculoskeletal Pain* for over 3 months
   - *Musculoskeletal pain can be attributed to a wide range of pathologies. It can be caused by disorders of bones, joints, muscles, tendons, ligaments or a combination.
   - *Common examples include soft issues syndromes (e.g. Back pain and neck pain) 2) Generalized soft issue syndromes (e.g. Fibromyalgia) 3) Osteroarthritis 4) Osteroporosis 5) Inflammatory arthritis or 6) Generalized inflammatory conditions (e.g. Polymyalgia rheumatic or connective tissue diseases).

Exclusion Criteria:

1) Patients with cognitive impairment related to dementia
2) Insufficient literacy precluding the feasibility of completing the questionnaires.

Procedure:

- We would like you to help to identify the participants and provide patients with participant information sheet. Individuals have a minimum of 48 hours to consider their participation in the study. Potential individuals expressing an interest in taking part in the study will receive a questionnaire pack including consent form, the study questionnaires from the MDT or from the reception of clinic sites.

- Participants can fill in the questionnaires independently based on the instructions stated on the questionnaires at home. This is a one-time point study and completion of the questionnaires will take approximately 45 minutes.
- Participants can return the completed questionnaires to the collection box in clinic reception or by post (stamped- addressed envelopes will be provided).

Referring to the study: We would like you to give information sheets about the research to anyone attending your services who meet the inclusion criteria. If individuals are interested in taking part or have concerns regarding the consent form or the study, they can approach the research team based on the contact details written on the information sheet. Alternatively, if individuals wish they can provide contact details for the research team to contact them at their convenience, we will ask you to obtain verbal consent from them to pass on their contact details.

Timescale: Recruitment of participants will begin in November 2016 and continue until February 2017.

Contacts: Please feel free to get in touch if you have any queries on the following email: **rosanna.lau@uea.ac.uk** or contact: 07456151891

Thank you very much

Researcher (Rosanna Lau, Trainee Clinical Psychologist, University of East Anglia)
Supervisor (Prof. Ken Laidlaw, University of East Anglia)

Appendix H. Information Sheet for Participants

Faculty of Medicines and Health Science
Doctoral Programme in Clinical Psychology
University of East Anglia

Participant Information Sheet

Study Title: Pain severity, pain self-efficacy and pain catastrophizing in older adults with chronic musculoskeletal pain: a comparative study in UK and Hong Kong residents.

I would like to invite you to participate in this project, which is concerned with your experience and perception of chronic pain. This sheet provides you with more information about the study. It is important that you read this information as it will help you decide whether you would like to take part. Please take as much time as you would like to read the following information. If you have any questions regarding the research please get in touch with a member of the research team using the contact details at the end of this sheet.

Why is this research being done?

The project is part of my thesis for my doctoral programme in clinical psychology at University of East Anglia. As chronic pain in older adults tends to be under-treated

and less well understood, it is hoped that the project can provide useful information that can guide future intervention.

Why have I been invited to take part?

We are inviting people who aged over 60 years with chronic musculoskeletal pain to take part in this questionnaire study. If you would like to take part we will ask you some questionnaires regarding your pain experience and cognitions and see whether the project is right for you.

Do I have to take part?

It is entirely up to you if you would like to take part. If you wish to take part you will be asked to sign a consent form and you can withdraw from the study at any time without providing a reason.

What does the study involve if I decide to take part?

A series of questionnaires will be given to you in this pack and we would like you to complete the questionnaires. After you have finished, you can return the questionnaires in the collection box at reception or by post (stamped-addressed envelope will be provided).

How much of your time will participation involve?

The questionnaires are likely to take a maximum of 45 minutes.

What are the possible benefits of taking part?

Whilst the study is unlikely to be of any direct benefit to you personally the results of the study could help us to have a better understanding of pain experience in a psychological way.

What are the possible risks of taking part?

Thinking about your pain may cause you some distress and or discomfort. If this were to happen you are welcome to take a break or stop at any point. Your

participation in this project is entirely voluntary and you are free to withdraw at any time during the process. Data already collected with consent would be retained and used in the study. No further data would be collected or any other research procedures carried out on or in relation to you.

We have included some leaflets from the pain management services that might be of interest to you. It is possible that you would like to approach your G.P or other health professionals for advice appear to experience distress when discussing the thoughts in your pain experience. In this case, it may be helpful for the GP/health professional to be aware of your involvement in this study. You will be asked for consent to inform your G.P or any other healthcare professionals responsible for your care that you are taking part in the study.

Will your participation in the project remain confidential?

Your GP/ any other healthcare professionals responsible for your care may be aware of your involvement in this study. However, your responses to the questions will be used for the purpose of this project only. If you agree to take part, your name will not be recorded on the questionnaires and the information will not be disclosed to other parties.

What happens if something goes wrong?

If you are harmed by taking part in the project there are no special compensation arrangements. However, if you would like to make a complaint about any area of the research you can contact Professor Ken Laidlaw. Tel: 01603 593600 Email: K.Laidlaw@uea.ac.uk

What will happen to the results of the research?

The result of the study will be disseminated to research teams and the results of the study may also be published in psychology journals. All information relating to your answers will remain entirely anonymous throughout this process.

Will my information be kept confidential?

The research team at UEA will have access to your personal data but we will not share your personal information with anyone outside the research team. All information relating to the study will be confidential and anonymous. You will be given a code called a participant number so that we know which information is yours but no-one else would be able to tell. All information will be stored in a locked filing cupboard or encrypted computer drive which is only accessible by the research team. All your personal data will not be kept at the end of the study and all data will be destroyed 10 years after the study has ended in line with NHS research policy.

Who has approved the research?

This study has been approved by Health Research Authority. This type of research cannot take place without seeking approval from ethics committees who check studies for any risks and ensure that enough information is provided to allow you to make a decision as to whether you would like to take part.

What happens now?

If you are interested in taking part, you can sign the consent form and complete the questionnaires included in this pack. Once complete you can return them to me in the pre-paid envelope provided or to the reception.

Where can I get further information?

If you have any queries in the process, you could contact **Rosanna Lau at 07456151891 or email at rosanna.lau@uea.ac.uk or Professor Ken Laidlaw (the study research Supervisor) at k.laidlaw@uea.ac.uk.**

Researcher
Rosanna Lau, Trainee Clinical Psychologist, University of East Anglia

Supervisor
Prof Ken Laidlaw, University of East Anglia
Prof Sheung-Tak Cheng, Hong Kong Institute of Education

Appendix I. Poster

Pain questionnaire study in older adults

Invitation to take part in a research

Chronic pain in older adults tends to be under-treated and less well understood. We are conducting a study to try to find out more about pain experiences, beliefs and mood in older adults

What does the study involve?

- Filling in some questionnaires and answering some questions related to your pain experience and belief.

-The study will take approximately 45 minutes in total

How do I get involved?

If you are aged above 60 and are having chronic musculoskeletal pain* for over 3 months and are interested in taking part or would like some further information, please feel free to get in touch on the number or email address below.

* Musculoskeletal pain can be attributed to a wide range of pathologies. It includes soft issues syndromes (eg. Back pain and neck pain); Generalized soft issue syndromes (e.g. Fibromyalgia); Osteroarthisits; Osteoporosis; inflammatory arthistis or generalized inflammatory conditions (e.g. Polymyalgia rheumatic, connective tissue diseases).

Appendix J. Consent Form

IRAS ID: 183258 Centre Number: Participant Number:

Doctoral Programme in Clinical Psychology
Faculty of Medicines and Health Science
University of East Anglia

CONSENT FORM

Title of project: Pain Severity, Pain Self-efficacy and Pain Catastrophizing in Older Adults with Chronic Musculoskeletal Pain: a Comparative Study of UK and Hong Kong Participants. (**IRAS ID:** 183258)

Name of Researcher: Rosanna Lau (Trainee Clinical Psychologist, University of East Anglia)

Please ✓ initial box

1. I confirm that I have read the information sheet dated..... (version 4) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected. ☐
3. I understand that all information collected as part of the study will be treated as completely confidential and that relevant sections of data collected during the study (including personal data) may only be looked at by individuals (the research team at UEA) from the University of East Anglia. I give permission to these individuals to have access to my data. ☐
4. I understand that the data collected from me will be fully anonymised and will be used to compare with a dataset collected in Hong Kong. ☐
5. I understand that the information collected about me will be used to support other research in the future, and may be shared anonymously with other researchers. ☐
6. I agree to my General Practitioner or any other healthcare professionals responsible for your care being informed of my participation in the study. ☐
7. I agree to take part in the above study. ☐

Name of **Participant**:_____

Signature: _____ Date: _____

Name of **Researcher**: _____

Signature: _____ Date:_____

1 for participant, 1 for site files

Version 4, 2Nov 2016

Appendix K. Questionnaire pack

Pain questionnaire study in older adults

Pain Severity, Pain Self-efficacy and Pain Catastrophizing in Older Adults with Chronic Musculoskeletal Pain: a Comparative Study of UK and Hong Kong Residents

Screening questions:

1) Are you aged 60 or above? (Circle) **Yes / No**

2) Are you currently troubled by physical pain, either all the time, or on and off? (Please Circle) **Yes / No**

3) Has this pain persisted for at least three months? (Please Circle) **Yes / No**

4) Please specify the duration of pain : _____years ____ months

Note:

1) If you have any queries in the process, you could contact **Rosanna Lau (researcher)** at **07456151891** or email at **rosanna.lau@uea.ac.uk**

2) After you have finished, you can return the questionnaires (**with the signed consent form)** into the collection box at reception or by post .

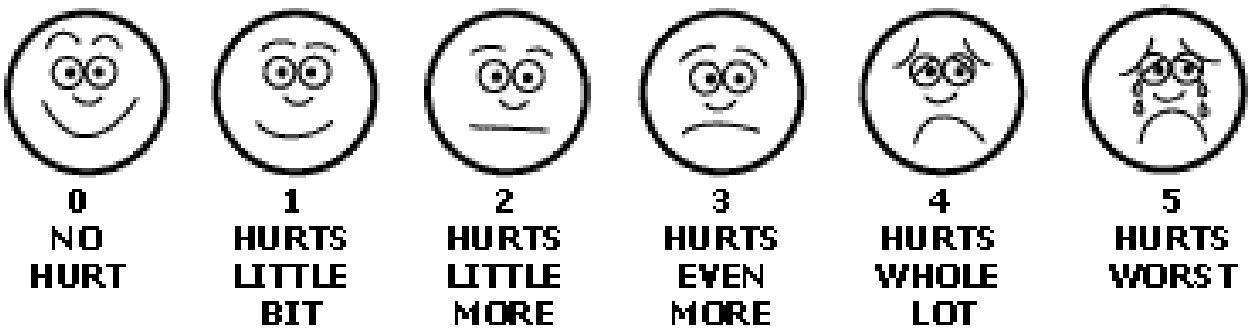
Part 1: Pain Severity

To indicate your answer **circle** one of the numbers on the scale under each item

1	How would you rate your pain on a 0-10 scale at the present time, that is right now, where **0 is ' no pain'** and **10 is 'pain as bad as could be'**? **0 1 2 3 4 5 6 7 8 9 10**
2	In the past 6 months, how intense was your worst pain rated on a 0-10 scale where **0 is ' no pain' and 10 is 'pain as bad as could be'**? **0 1 2 3 4 5 6 7 8 9 10**
3	In the past 6 months, on the average, how intense was your pain rated on a 0- 10 scale where **0 is ' no pain' and 10 is 'pain as bad as could be'**? (That is, your usual pain at times your were experiencing pain.) **0 1 2 3 4 5 6 7 8 9 10**
4	About how many days in the last 6 months have you been kept from your usual activities (work, school or housework) because of pain? _____Days
5	In the past 6 months, how much has pain interfered with your daily activities rated on a 10-scale **where 0 is 'no interference' and 10 is 'unable to carry on any activities'**? **0 1 2 3 4 5 6 7 8 9 10**
6	In the last 6 months, how much has your pain changed your ability to take part in recreational, social and family activities where **0 is ' no change' and 10 is 'extreme change'**? **0 1 2 3 4 5 6 7 8 9 10**
7	In the past 6 months, how much has pain changed your ability to work (including housework) where **0 is 'no change' and 10 is 'extreme change**' **0 1 2 3 4 5 6 7 8 9 10**

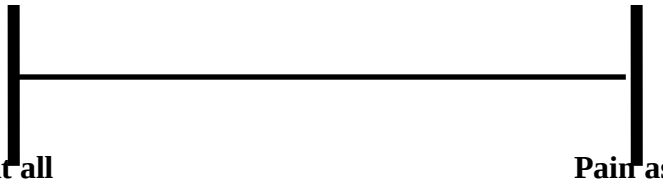
1.2 Face Pain Scale

"Each of these faces is of a person who has no pain, or some, or a lot of pain. The first face does not have any pain at all. The next face has just a little bit of pain. Each of the next faces has a little more pain until you get to this last face, which has the worst pain you can imagine." **Please circle.**



1.3, **Visual analogue Pain Scale**

Please put a "X" on the line to indicate your pain intensity.



No pain at all **Pain as bad as it could be**

Part 2: Pain self-efficacy

2.1 Chronic pain self-efficacy Scale

Please rate how confident you are that you can do the following things at present, despite the pain. To indicate your answer **circle** one of the numbers on the scale under each item, where 1=not very certain to 10 = very certain.

1	How certain are you that you can decrease your pain quite a bit?									
	1 very uncertain	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10** very certain
2	How certain are you that you can continue most of your daily activities?									
	1 very uncertain	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10** very certain
3	How certain are you that you can keep your pain from interfering with your sleep?									

	1 **2** **3** **4** **7** **8** **9** **10** very uncertain very certain
4	How certain are you that you can make a small-to-moderate reduction in your pain by using methods other than taking extra medications? **1** **2** **3** **4** **5** **6** **8** **9** **10** very uncertain very certain
5	How certain are you that you can make a large reduction in your pain by using methods other than taking extra medications? **1** **2** **3** **4** **5** **6** **7** **8** **9** **10** very uncertain very certain
6	How certain are you that you can walk 1/2 mile on flat ground? **1** **2** **3** **4** **5** **6** **7** **8** **9** **10** very uncertain very certain
7	How certain are you that you can lift a 10 pound box? **1** **2** **3** **4** **5** **6** **7** **8** **9** **10** very uncertain very certain
8	How certain are you that you can perform a daily home exercise program? **1** **2** **3** **4** **5** **6** **7** **8** **9** **10** very uncertain very certain
9	How certain are you that you can perform your household chores? **1** **2** **3** **4** **5** **6** **7** **8** **9** **10** very uncertain very certain
10	How certain are you that you can shop for groceries or clothes? **1** **2** **3** **4** **5** **6** **7** **8** **9** **10** very uncertain very certain
11	How certain are you that you can engage in social activities? **1** **2** **3** **4** **5** **6** **7** **8** **9** **10** very uncertain very certain
12	How certain are you that you can engage in hobbies or recreational activities? **1** **2** **3** **4** **5** **6** **7** **8** **9** **10**

	very uncertain									very certain
13	How certain are you that you can engage in family activities?									
	1	**2**	**3**			**6**	**7**		**9**	**10**
	very uncertain									very certain
14	How certain are you that you can perform the work duties you had prior to the onset of chronic pain? (For homemakers, please consider your household activities as your work duties.)									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	very uncertain									very certain
15	How certain are you that you can control your fatigue?									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	very uncertain									very certain
16	How certain are you that you can regulate your activity so as to be active without aggravating your physical symptoms (e.g. fatigue, pain)?									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	very uncertain									very certain
17	How certain are you that you can do something to help yourself feel better if you are feeling blue?									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	very uncertain									very certain
18	As compared to other people with chronic medical problems like yours, how certain are you that you can manage your pain during your daily activities?									
	1		**3**	**4**	**5**	**6**	**7**		**9**	**10**
	very uncertain									very certain
19	How certain are you that you can manage your physical symptoms so that you can do the things you enjoy doing?									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	very uncertain									very certain
20	How certain are you that you can deal with the frustration of chronic medical problems?									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	very									very

	uncertain certain
21	How certain are you that you can cope with mild to moderate pain? **1 2 3 4 5 6 7 8 9 10** very very uncertain certain
22	How certain are you that you can cope with severe pain? **1 2 3 4 5 6 7 8 9 10** very very uncertain certain

Part 3: Pain Catastrophizing

3.1 Pain Catastrophizing Scale

We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, **please <u>circle</u> the degree to which you have these thoughts and feelings when you are experiencing pain.**

0 Not at all	**1** To a slightly degree	**2** To a moderate degree	**3** To a great degree	**4** All the time

When I'm in pain…

1	I worry all the time whether the pain will end. 0 1 2 3 4 not at all all the time
2	I feel I can't go on. 0 1 2 3 4 not at all all the time
3	It's terrible and I think it's never going to be better. 0 1 2 3 4 not at all all the time
4	It's awful and I feel it overwhelms me. 0 1 2 3 4 not at all all the time
5	I feel I can't stand it anymore. 0 1 2 3 4 not at all all the time
6	I become afraid that the pain will get worse. 0 1 2 3 4 not at all all the time

7	keep thinking of other painful events.				
	0 not at all	1	2	3	4 all the time
8	I anxiously want the pain to go away.				
	0 not at all	1	2	3	4 all the time
9	I can't seem to keep it out of mind.				
	0 not at all	1	2	3	4 all the time
10	I keep thinking about how much it hurts.				
	0 not at all	1	2	3	4 all the time
11	I keep thinking about how badly I want the pain to stop.				
	0 not at all	1	2	3	4 all the time
12	There's nothing I can do to reduce the intensity of the pain.				
	0 not at all	1	2	3	4 all the time
13	I wonder whether something serious may happen.				
	0 not at all	1	2	3	4 all the time

Part 4: Depression

4.1 The Center for Epidemiologic Studies-Depression Scale

Below is a list of ways you might have felt or behaved. Please **Circle** how often you have felt this way **DURING THE LAST WEEK.**

0	**1**	**2**	**3**
Rarely or none of the time **(less than 1 day)**	Some or a little of the time **(1-2 days)**	Occasionally or a moderate amount of the time **(3-4 days)**	Most or all of the time **(5-7 days)**

1.	I was bothered by things that don't usually bother me.			
	0 Rarely of the time	1	2	3 Most of the time
2.	I had trouble keeping my mind on what I was doing.			
	0 Rarely of the time	1	2	3 Most of the time
3.	I felt depressed.			
	0 Rarely of the	1	2	3 Most of the

time			time
4. I felt everything I did was an effort.			
0 Rarely of the time	1	2	3 Most of the time
5. I felt hopeful about the future.			
0 Rarely of the time	1	2	3 Most of the time
6. I felt fearful.			
0 Rarely of the time	1	2	3 Most of the time
7. My sleep was restless.			
0 Rarely of the time	1	2	3 Most of the time
8. I was happy.			
0 Rarely of the time	1	2	3 Most of the time
9. I felt lonely.			
0 Rarely of the time	1	2	3 Most of the time
10. I felt terrific.			
0 Rarely of the time	1	2	3 Most of the time

Part 5: Healthcare utilization pattern associated with pain problems

1a. <u>During the past three months,</u> have you ever had any of the following? Please check.

1.1 ☐ Back pain 1.2 ☐ Knee Pain
1.3 ☐ Neck pain 1.4 ☐ Shoulder pain
1.5 ☐ Muscle pain (Myalgia) 1.6 ☐ Joint pain (arthralgia)
1.7 ☐ Joint inflammation (Arthritis) 1.8 ☐ Fibromyalgia
1.9 ☐ Inflammatory arthritis (e.g. Rheumatoid Arthritis)
1.10 ☐ Osteoarthritis 1.11 ☐ Infectious arthritis
1.12 ☐ Osteoporosis 1.13 ☐ Osteonecrosis

1.14 ☐ Gout and related disorders 1.15 ☐ Facial Pain
1.15 ☐ Autoimmune and vasculitic disorders (e.g. systemic lupus erythematosus and Henoch-Schönlein purpura)

1b. Is there any type of pain not listed above that you have or have had? If so, please list. _____

2. During the past three months, have you ever had any of the following pain treatment ? Please check.

2.1 ☐ Drug/ Medication Therapy 2.2 ☐ Physical /Occupational therapy
2.3 ☐ Therapeutic massage 2.4 ☐ Injections /Nerve Block
2.5 ☐ TENS 2.6 ☐ Acupuncture/Acupressure
2.7 ☐ Chiropractic Adjustment 2.8☐ Relaxation/ Biofeedback techniques
2.9 ☐ Surgery 2.10☐ Psychological Intervention
2.11 ☐ Exercise that includes muscle strengthening and stretching
2.12 ☐ Others: _____

Part 6: Clinical characteristics and medications

Present Medical History

1a. Do you have or have you ever had any of the following? If yes, please check.
1.1 ☐ Cardiovascular disorder.(e.g. Heart diseases) Please list _____
1.2 ☐ Gastrointestinal disease. Please list _____
1.3 ☐ Neurological disorder (e.g. Stroke, Dementia). Please list _____
1.4 ☐ Metabolic diseases (e.g. Diabetes). Please list _____
1.5 ☐ Respiratory diseases. Please list _____
1.6 ☐ Urinary disorder. Please list _____
1.7 ☐ Immune Disorder. _____
1.8 ☐ Mental illness (e.g. Depression , Anxiety). Please list _____

1b. Are there any medical conditions or diseases not listed above that you have or have had? If yes, please list.
❑ Yes_____
❑ No ❑ Not sure/ Maybe ❑ would rather not say

2. Are you taking any prescription medications, non-prescription drugs or herbal supplements of any kind? If yes, please list.
❑ Yes _____
❑ No ❑ Not sure/ Maybe ❑ would rather not say

Demographics

1. Gender: ❑ Male ❑ Female ❑ would rather not say

2. Age : _____ ❑ would rather not say

3. Religion :
❑ No religion ❑ Christian (including Church of England, Catholic, Protestant and all other Christian denominations) ❑ Buddhist ❑ Hindu ❑ Jewish
❑ Muslim ❑ Sikh ❑ Any other religion: _____
❑ would rather not say

4. Marital Status :
❑ Single ❑ Married ❑ Divorced ❑ Separated ❑ Widowed ❑ Life Partner
❑ Other:_____ ❑ would rather not say

5. Occupational Status:
❑ Full time ❑ Part time ❑ Retired ❑ Disabled ❑ Other:_____
❑ would rather not say

6. Living Status:
❑ Living alone ❑ With Spouse ❑ With Other Family ❑ With Friends
❑ Skilled Nursing ❑ Other: _____ ❑ would rather not say

7. What is the highest level of education you have completed?

❑ Grammer school
❑ Middle school graduate
❑ High school graduate or equivalent
❑ Vocational /technical school/ vocational work-based qualification
❑ Some college
❑ University degree
❑ Postgraduate degree
❑ Other _____
❑ Would rather not say

8. What is your ethnic group?

A White ❑ English/Welsh/Scottish/Northern
❑ Irish/British Irish
❑ Gypsy or Irish Traveller
❑ Any other White background, write in
B ❑ Mixed/multiple ethnic groups
C ❑ Asian/ Asian British
D ❑ Black/African/Caribbean/Black British
E ❑ Other Ethnic group
F ❑ Would rather not say

Thank you for completing this questionnaire.

Appendix L. The permission of the use of PCS

Michael Sullivan, Dr. <michael.sullivan@mcgill.ca>

Reply

Mon 7/6/2015, 4:40 PM

Rosanna Lau (MED) <Rosanna.Lau@uea.ac.uk>

Greetings,
Please feel free to use the PCS in your work. If you go to the url below my signature block and click on 'PCS', you can download electronic copies of the PCS in various languages as well as the User Manual.
good luck with your research,,,,

Michael Sullivan, PhD
Departments of Psychology, Medicine and Neurology
Canada Research Chair in Behavioural Health
McGill University
1205 Docteur Penfield
Montreal (Quebec)
H3A 1B1

Tel; 514 398 5677
Fax: 514 398 4896

http://sullivan-painresearch.mcgill.ca

Administrative Assistant:
Ms. Chantale Bousquet
Room W8/10
514 398 6127
Chantale.Bousquet@mcgill.ca