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An Evaluation of the Effectiveness of a Cognitive Behavioural Therapy-Based Multidisciplinary Pain Management Programme for Adults Living with Chronic Pain

L. Gemson MSc, [1] Dr. K. Hatton DClinPsy, [1] Dr. S. White DClinPsy, [1] D. Hatch MCSP, [1] Dr. J. Sanderson DClinPsy, [1] & Dr. M. Roy PhD [2]

Abstract

Chronic pain is a complex entity that can lead to individuals experiencing long-term disability. Furthermore, the interaction of physiological, psychological and social factors can intensify the pain experience. Evidence suggests that cognitive behavioural therapy-based pain management programmes (CBT-PMP) are an effective treatment for chronic pain. The aim of this study was to evaluate the effectiveness of the Blackpool Pain Management Service's CBT-PMP, and to explore the association between changes in pain-related disability, pain self-efficacy and depression. This retrospective study was based on pre and post-treatment outcome data for 65 patients (mean age of 50 years; 83% female) who completed the CBT-PMP between the years 2010–2014. Paired sample *t*-tests and Wilcoxon signed-rank tests demonstrated significant improvements over time for all of the outcome measures: pain self-efficacy ($p < .001$, $d = .89$), fear of movement ($p < .001$, $d = .76$), pain catastrophizing ($p < .001$, $d = .78$), depression ($p < .001$, $d = .76$), pain-related disability ($p = .001$, $d = .45$), pain intensity ($p < .001$, $d = .55$) and pain experience - affective ($p < .001$, $d = .55$) and sensory ($p < .001$, $d = .49$), as well as physical measures - 20-metre timed walk ($p < .001$, $r = -.48$) and sit-stand ($p < .001$, $r = -.49$). Hierarchical multiple regression analyses showed that after controlling for baseline pain-related disability ($\Delta R^2 = .11$, $p = .010$) and pre to post-treatment change in pain intensity ($\Delta R^2 = .11$, $p = .007$), changes in pain self-efficacy and depression ($\Delta R^2 = .21$, $p < .001$) significantly predicted change in pain-related disability. These findings indicate that, overall, patients who attended the Blackpool Pain Management Service's CBT-PMP experienced significant improvements in their physical and psychological wellbeing. Furthermore, this study provides convincing evidence that changes in pain self-efficacy and depression are strongly associated with change in pain-related disability.

Keywords

Chronic pain, pain management programme, multidisciplinary rehabilitation, cognitive behavioural therapy, pain self-efficacy, depression, pain intensity, pain disability.

Introduction

British Pain Society (BPS) guidelines for patients suffering from debilitating, persistent pain which causes distress and reduces quality of life recommend referral

[1] Pain Management Service, Blackpool Teaching Hospitals NHS Foundation Trust, Whitegate Health Centre,
[2] School of Psychology, Darwin Building, The University of Central Lancashire, Preston, Lancashire, PR1 2HE, UK.

to a Pain Management Programme (PMP). [1] The PMP should be delivered in a group format, by a multidisciplinary team specialising in cognitive behavioural techniques.[1] In line with BPS guidelines, The Blackpool Pain Management Service developed a cognitive behavioural therapy-based PMP (CBT-PMP) to help increase patients' physical functioning, reduce their dysfunctional pain beliefs and improve their quality of life. This study is an evaluation of the Blackpool Pain Management Service's CBT-PMP.

Chronic Pain

Chronic pain is defined as persistent pain of more than three months duration.[2] Its complex and multifaceted nature is best understood using the Biopsychosocial model.[3] The model proposes that the maintenance and exacerbation of chronic pain conditions is better understood through recognising the interaction of biological, psychological and social factors.[2] The challenge of managing chronic pain reflects its complex and diverse manifestations. Individuals suffering from chronic pain experience a wide range of distressing corollaries, such as psychosocial responses including persistent stress, anxiety, low mood and social isolation.[4–6]As illness duration progresses, such psychosocial factors become progressively more significant in the maintenance of chronic pain.[7] In severe cases, patients living with chronic pain may experience suicidal ideation.[8] As the development and maintenance of chronic pain is a complex process, a multidisciplinary approach to treatment is recommended.[9]

Pain Management Programme (CBT-PMP)

The CBT-PMP is based on a biopsychosocial approach.[7] It uses cognitive behavioural principles to teach patients how to self-manage and cope with their pain, and how to challenge negative patterns of thinking in order to prevent further deconditioning, and improve their physical and psychological quality of life.[10,11] The main components that make up a CBT-PMP are education, pacing/functional restoration, pharmacotherapy, CBT and relaxation.[12] Studies show that CBT-PMPs can reduce patients' anxiety and depression levels[13] and reduce pain-related fears (fear of movement and pain catastrophizing).[14] CBT-PMPs have also been shown to increase pain self-efficacy,[15] reduce pain intensity[16] and increase physical functioning.[17]

Predictors of Pain-Related Disability

Growing evidence suggests that psychological factors such as pain self-efficacy, pain catastrophizing, depression and pain-related fear are important predictors of pain-related disability.[18–20] Some authors suggest that pain-related psychological factors may be better predictors of disability than the pain itself.[18,20,21] However, some studies investigating the individual influences of psychological factors on chronic pain highlight that a number of these measures share significant variance with each other, leading to construct redundancy.[22,23] Pain catastrophizing appears to share significant variance with depression and is also highly correlated with pain-related fear.[22] When exploring associations between changes in 20 psychological constructs and pain-related disability, Foster and colleagues found that only changes in illness identity, pain self-efficacy and depression remained significant predictors of change in pain-related disability.[23]

Background of the Blackpool Pain Management Service

The Blackpool Pain Management Service was established in 1997 and is part of the Blackpool Teaching Hospitals NHS Foundation Trust. On average, the service receives 130 referrals a month, of which approximately 75% will require a multidisciplinary-based treatment plan.

The primary aim of this study is to evaluate the effectiveness of the Blackpool Pain Management Service's CBT-PMP, and the secondary aim is to identify whether changes in pain self-efficacy and depression are associated with significant change in pain-related disability. In light of the evidence supporting the efficacy of CBT-PMPs, it is predicted that patients will show a significant improvement in mood, pain, pain-related beliefs, pain-related disability and physical functioning.[13–17] Furthermore, it is anticipated that changes in depression and pain self-efficacy will be significantly associated with change in pain-related disability.[18,23]

Methods

Sample

This study is based on a retrospective analysis of 65 patients (83% female) with a mean age of 50 years (standard deviation 10.8 years) who attended the CBT-PMP at the Blackpool Pain Management Service between 2010 and 2014, and had consented for their data to be used as part of service evaluation. The gender bias in this sample reflects the referrals received to the service as a whole. The patients in this study displayed a range of chronic pain conditions, such as fibromyalgia, nonspecific back pain and arthritis.

Self-Report Measures

Modified Zung Depression Questionnaire (Zung)

This measure contains 23 items that assess the patient's level of depression, such as *"I feel downhearted and sad"* and *"I have crying spells or feel like it"*. Individuals rate on a four-point Likert scale, statements ranging from *"rarely or none of the time"* to *"most of the time"*. The maximum an individual can score is 69, with scores above 33 indicating depressive distress.[24]

Pain Catastrophizing Scale (PCS)

The PCS is a 13-item self-rating scale which can be divided into three subscales: rumination (e.g. *"I anxiously want the pain to go away"*), magnification (e.g. "*I become afraid that the pain will get worse*"), and helplessness (e.g. "*I feel I can't go on*"). The individual rates the items on a five-point Likert scale, ranging from *"not at all"* to *"all the time"*.[25] Total scores range between 0 and 52, and only total scores were used in this study.

Tampa Scale of Kinesiophobia (TSK)

The TSK is a 17-item scale that is scored on a four-point Likert scale, ranging from *"strongly disagree"* to *"strongly agree"*. It assesses self-reported pain-specific fear avoidance, and harm, using statements such as, "*I'm afraid that I might injure myself if I exercise"* and *"pain always means I have injured my body"*. Total scores range between 17 and 68, with higher scores indicating a greater degree of fear avoidance.[26]

Pain Self-Efficacy Questionnaire (PSEQ)

This is a ten-item self-rating scale that uses a seven-point Likert scale, ranging from *"not at all confident"* to *"completely confident"*. The scale assesses the patient's confidence in their ability to undertake various activities despite their pain, using statements such as *"I can cope with my pain in most situations"* and *"I can gradually become more active, despite the pain"*. Total scores range between 0 and 60, with higher scores suggesting greater levels of pain self-efficacy.[27]

The Quebec Pain Disability Scale (QUE)

This scale was developed to measure pain-specific disability on a six-point Likert scale, ranging from "*not difficult at all"* to *"unable to do*". This scale assesses the individual's self-rated disability score across 20 daily activities, such as "*carry two bags of groceries"* and *"turn over in bed"*. The total scores can range between 0 and 100, with higher scores suggesting greater levels of pain-induced disability.[28]

The Short-form McGill Pain Questionnaire (SF-MPQ)

This scale consists of 15 descriptors; 11 sensory (e.g. "*throbbing" and "tender"*), and four affective (e.g. *"sickening"* and *"punishing-cruel"),* which are rated on a three-point Likert scale, ranging from *"none"* to *"severe"*. The sensory score (0–33) gives a total score for the sensation and severity of the individual's pain, and the affective score (0–12) measures the individual's emotional reaction to their pain. The SF-MPQ also includes a pain intensity visual analogue scale (VAS), which measures the individual's current level of pain on a scale of 0–100.[29] However, the SF-MPQ used by the Blackpool Pain Management Service uses a numerical rating scale of 0–10 for pain intensity, instead of the pain intensity VAS.

Physical Measures

20-Metre Walk Test (20-MWT)

The 20-MWT is used to measure gait speed and requires patients to walk 20 metres along a flat corridor as quickly as they can whilst their time is recorded in seconds. The 20-MWT is similar to the 50-foot walk, which has been shown to have excellent test-retest reliability with both chronic pain patients and pain-free participants, as well as differentiating between both populations.[30]

Sit to Stand (Sit-stand)

For this measure, patients are asked to stand from a sitting position and then to sit back down five times, as quickly as possible, whilst the time taken to perform this task is recorded in seconds. This measure has been shown to be a valid measure with acceptable reliability.[30]

Procedure

Following approval by Blackpool Teaching Hospitals, data were collected from 65 patient files across two time points: assessment and end of treatment. All patient names were replaced with an ID number to protect anonymity and their data were entered into SPSS. A series of statistical analyses were then undertaken. However, due to small amounts of missing data, not all of the 65 patients were included in all of the analyses, as cases with missing values were excluded analysis by analysis.

Pain Management Programme

The CBT-PMP sessions were conducted over a six to nine-week period, with some weeks containing two sessions. The groups consisted of approximately six to ten patients. The sessions were designed in line with BPS guidelines and included physiotherapy, exercise, group CBT, relaxation, psychoeducation in the biopsychosocial model, pacing, medication, pain pathways, communication (which included a 'friends and family' day) and relapse prevention.[1] Assignments, relaxation and exercise were also encouraged to be undertaken between sessions.

Statistical Analyses

Retrospective pre and post-treatment data for 65 individuals were used in the analyses. However, cases with missing values were excluded analysis by analysis. Descriptive data were calculated for all variables. Paired sample *t*-tests (Table 1) were then undertaken to explore changes in mood (Zung),[24] pain (SF-MPQ intensity, sensory and affective),[29] pain-related beliefs (PCS,[25] TSK[26] and PSEQ[27]) and pain-related disability (QUE).[28] Wilcoxon signed-rank tests (Table 2) were used for the 20-MWT and sit-stand, as the data were non-parametric. Cohen's *d* was calculated to identify the effect sizes for all of the paired sample *t*-tests and *r* was used to calculate effect sizes for the Wilcoxon signed-rank tests. For Cohen's *d* an effect size of .2 is viewed as a small effect, .5 is considered a moderate effect and .8 is a large effect.[31] For *r*, .1 is interpreted as a small effect, .3 a moderate effect and .5 is a large effect.[32]

Pearson correlations (one-tailed) (Table 3) were calculated to explore the associations between changes (post-treatment minus pre-treatment score) in pain-related disability and fear of movement, pain self-efficacy, depression, pain catastrophizing, pain intensity, affective pain and sensory pain. Hierarchical multiple regression (Table 4) was then undertaken to determine whether, and to what extent, changes in pain self-efficacy and depression were associated with significant change in pain-related disability. Change in pain-related disability was entered as the dependent variable (constant). After controlling for baseline pain-related disability at step 1 and change in pain intensity at step 2, changes in pain self-efficacy and depression were entered into the model at step 3.

Results

Pre to Post Changes in Outcome Measures

Paired sample *t*-tests (Table 1) undertaken on the questionnaire data demonstrated that patients experienced significant improvement over time for SF-MPQ pain intensity, SF-MPQ affective, SF-MPQ sensory, Zung, PCS, TSK, PSEQ and QUE. Effect sizes for the outcome measures were small to large. Wilcoxon signed-rank tests (Table 2) also demonstrated significant improvements for both physical measures over time, displaying moderate effect sizes.

Correlations

Correlations between outcome measure change scores (Table 3) demonstrated that change in disability was negatively associated with change in pain self-efficacy ($r = -.53$, $p < .001$) and was positively associated with changes in fear of movement ($r = .48$, $p < .001$), depression ($r = .43$, $p < .001$), pain intensity ($r = .35$, $p < .01$) and pain catastrophizing ($r = .41$, $p < .05$). This suggests that as pain self-efficacy increases, the individual's self-rated level of disability reduces, and as fear of movement, depression, pain catastrophizing and pain intensity reduce, self-rated disability scores also reduce. Changes in SF-MPQ sensory and affective were not associated with change in disability.

Predictors of Change in Pain-Related Disability

The regression analysis with change in pain-related disability (QUE) as the dependent variable (Table 4) was highly significant ($r^2 = .42$, $F = 10.29$, $p < .001$). Baseline pain-related disability was entered into the model at step 1 (F (1, 60) = 7.02, $p = .010$), explaining 11% of the variance of change in disability. At step 2, change in pain intensity was entered (F (1, 59) = 7.94, $p = .007$) and significantly explained a further 11%. Finally, at step 3, change in pain self-efficacy and change in depression were entered into the model (F (2, 57) = 10.23, $p < .001$) and significantly explained

an additional 21% of the variance. From the model it can be seen that a higher level of baseline disability predicted a greater reduction in disability between assessment and end of treatment. In addition, a greater reduction in pain intensity between pre and post-treatment was associated with a larger reduction in pain-related disability at end of treatment. After controlling for baseline disability and change in pain intensity, a greater reduction in disability was predicted by a greater increase in pain self-efficacy and a greater reduction in depression scores.

Table 1. Displays mean pre-treatment and post-treatment scores for various self-report measures

Outcome Measures	*n*	Mean (SD)		*t*	*p*	*d*
		Pre	Post			
SF-MPQ Pain Intensity	62	7.37 (1.43)	6.2 (1.93)	4.37	p < .001	.55
SF-MPQ Affective	64	6.73 (3.66)	4.86 (3.39)	4.40	p < .001	.55
SF-MPQ Sensory	64	18.56 (6.99)	15.27 (8.02)	3.89	p < .001	.49
Zung	65	39.40 (8.33)	34.40 (9.18)	6.09	p < .001	.76
PCS	65	29.58 (11.40)	20.89 (11.12)	6.28	p < .001	.78
TSK	64	36.89 (7.69)	30.58 (7.84)	6.08	p < .001	.76
PSEQ	65	20.52 (8.84)	29.92 (10.59)	−7.17	p < .001	.89
QUE	65	61.18 (15.59)	55.69 (16.39)	3.64	P = .001	.45

Table 2. Displays mean pre-treatment and post-treatment times for two physical measures

Outcome Measures	*n*	Mean (SD)		*z*	*p*	*r*
		Pre	Post			
20-MWT	62	31.27 (25.21)	23.88 (8.40)	−5.34	p < .001	−.48
Sit-stand	62	38.30 (30.69)	24.23 (9.37)	−5.52	p < .001	−.49

Table 3. Correlations between changes in outcome measures and change in pain-related disability

Measures	*n*	Change in Pain-Related Disability (QUE)
Change in pain self-efficacy (PSEQ)	65	−.53***
Change in fear of movement (TSK)	64	.48***
Change in depression (Zung)	65	.43***
Change in pain intensity (SF-MPQ)	62	.35**
Change in pain catastrophizing (PCS)	64	.41*
Change in McGill affective (SF-MPQ)	64	.20
Change in McGill sensory (SF-MPQ)	64	.19

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

Table 4. Regression analysis predicting change in disability following the CBT-PMP ($n = 62$)

Outcome Measures	Change in Disability (QUE)	
	Δ R^2	β
Step 1	.11*	
Baseline disability (QUE)		−.32*
Step 2:	.11**	
Change in pain intensity (SF-MPQ)		.33**
Step 3:	.21***	
Change in pain self-efficacy (PSEQ)		−.33**
Change in depression (Zung)		.28*
Total R^2	.42***	

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

Discussion

The aim of this study was to evaluate patients' responses to the Blackpool Pain Management Service's CBT-PMP, and to test whether pre to post-treatment changes in pain self-efficacy and depression were significantly associated with change in pain-related disability. Based on previous studies, it was predicted that patients would experience significant improvements in mood, pain, pain-related beliefs (pain self-efficacy, fear of movement and pain catastrophizing), pain-related disability and physical functioning (walking 20 metres and sit-stand), and that changes in pain self-efficacy and depression would be strongly associated with change in disability.

The results of this study demonstrated that patients experienced significant improvements (small to large effect sizes) in their pain (SF-MPQ pain intensity), pain experience (SF-MPQ sensory and affective), mood (Zung), pain-related beliefs (PCS, PSEQ and TSK), pain-related disability (QUE) and physical functioning (20-MWT

and sit-stand). Overall, these findings are consistent with previous studies that have evaluated the effectiveness of CBT-PMPs for managing chronic pain.[13–17] However, Norrbrink Budh et al,[13] Woby et al[14] and Fedoroff et al[17] differed slightly, as they reported no significant change in pain intensity following their pain programmes. This is not an unusual finding; few studies identify any significant change in pain intensity, and studies that do often only find small effects.[17] This may be because the main focus of a pain management programme is to support patients to self-manage their pain rather than to eliminate it.[13] Patients attending the CBT-PMP in this study were offered a pain medication review as part of the programme, which differs from Norrbrink Budh et al,[13] Woby et al[14] and Fedoroff et al,[17] and may explain why a moderate effect size was observed rather than a small effect. It is important to note at this stage that some degree of caution should be taken when interpreting our findings in comparison to other studies, as our evaluation included patients with a wide range of pain diagnoses, and our programme content and duration may also differ from other studies.

The results of the regression analysis demonstrated that pain-related disability at baseline significantly predicted change in pain-related disability, explaining 11% of the variance. This suggests that patients who experience higher levels of disability at baseline may experience greater reductions in pain-related disability following the CBT-PMP than patients with lower levels at baseline. When change in pain intensity was added to the model, it significantly explained a further 11% of the variance. This suggests that as pain levels improve, pain-related disability reduces. After controlling for baseline disability and changes in pain intensity, pain self-efficacy and depression were added to the model and were identified as significant predictors of change in pain-related disability, explaining a further 21% of the total explained variance. This suggests that changes in pain self-efficacy and depression levels are strongly associated with change in pain-related disability, and may play an important role in reducing pain-related disability.[18, 19] This study also supports the findings of Foster and colleagues, who found changes in pain self-efficacy and depression to be significantly associated with change in disability. [23]

This study has a number of limitations. The patient sample who volunteered for their data to be used in this study were diagnosed with a range of chronic pain problems and therefore may differ from chronic pain patients taking part in other studies. Only 17% of the patient sample were male, and so the results may be limited in their generalizability. The predictors for the multiple regression were purposefully chosen based on previous research, and predictors such as pain catastrophizing and fear of movement were not considered based on the variance that they share with depression and pain self-efficacy. Furthermore, the final regression model was limited in scope due to the sample size; variables that were not considered may also predict change in pain-related disability. This study did not include a comparison group and therefore no inferences can be made of actual treatment effects.

The main strengths of this study were the respectable sample size for pre and post-treatment analysis, which reflects the chronic pain patients who attend the Blackpool Pain Management Service. A further strength of this study was the use of an extensive range of outcome measures.

Summary

In summary, this study has shown that, overall, patients who took part in the Blackpool Pain Management Service's CBT-PMP experienced significant improvements in their pain levels, mood, pain-related beliefs, disability and physical functioning. Furthermore, multiple regression analysis demonstrated that

changes in pain self-efficacy and depression significantly predicted change in pain-related disability. These findings add further support to the evidence that changes in pain self-efficacy and depression are strongly associated with change in pain-related disability.

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Conflict of interest disclosures

We declare that we have no conflict of interest.
Disclaimers and conflict of interest policies are found at: http://bit.ly/1wqiOcl

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Contacts/correspondence

Lloyd Gemson, Pain Management Service, Blackpool Teaching Hospitals NHS Foundation Trust, Whitegate Health Centre, Whitegate Drive, Blackpool, FY3 9ES, UK.
E-mail: Lloyd.Gemson@bfwhospitals.nhs.uk

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