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REVIEW

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Predictors of treatment outcome in cognitive behavioural therapy for chronic pain: a systematic review

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ABSTRACT

Purpose: The aim of this systematic review was to synthesise the research identifying possible influences on CBT outcomes in chronic pain. Variations in the effectiveness of psychological therapies, such as CBT, in chronic pain have led to research investigating predictors of improved treatment outcomes.

Materials and methods: We identified randomised controlled and cohort studies of CBT for chronic pain, published between 1974 to 2nd August 2023, which identified predictors of CBT outcomes.

Results: Nineteen studies were included in the review. Baseline sociodemographic, physical and emotional factors that influence the outcomes of CBT for chronic pain were identified. The most commonly reported predictors of CBT outcome, with medium to large effect sizes, were anxiety, depression and negative cognitions about pain and coping. Sociodemographic predictors of outcomes demonstrated small effects and lacked replicability.

Conclusions: There was variability across study designs, CBT delivery and outcomes measures. Further research is needed in chronic pain to identify the predictive factors which influence treatment outcomes, and consistency across study designs and outcome variables is needed to reduce heterogeneity.

IMPLICATIONS FOR REHABILITATION

- This review synthesised research identifying factors predicting outcomes of Cognitive Behavioural Therapy for chronic pain.
- The most commonly reported predictors of Cognitive Behavioural Therapy outcome, with medium to large effect sizes, were anxiety, depression, and negative cognitions about pain and coping. sociodemographic predictors of outcomes demonstrated small effects and lacked replicability.
- There is a move towards more individualised treatments in chronic pain.
- Our results suggest that decisions regarding Cognitive Behavioural Therapy for chronic pain should carefully consider baseline levels of anxiety, depression, and negative cognitions about pain.

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Introduction

Chronic pain, classified as pain that persists for three months or more [1] is associated with significant emotional distress and interference with daily functioning [2]. Non-pharmacological management approaches include Cognitive Behavioural Therapy (CBT), an effective psychological treatment for chronic pain, reported to improve quality of life and pain-related distress and disability in people living with chronic pain [3–5]. Alongside Acceptance Commitment Therapy (ACT), CBT is a first-line recommended treatment for chronic pain [6]. Its use was supported by a recent Cochrane review of psychological therapies for chronic pain, which found that CBT had the largest evidence base (59 studies). However, when compared to an active control, it showed only small beneficial effects for pain and distress post-treatment [7].

The latest version of the United Kingdom (UK) National Institute for Health and Care Excellence guidelines on chronic pain made a research recommendation for studies to identify barriers to the successful management of chronic pain to enable stratification of treatment [6]. The evidence reviewed suggested that CBT for pain improves the quality of life for people with chronic primary pain, but consistent benefits were not found for other outcomes. To date, there is insufficient evidence to indicate if specific psychological, biological or social factors predict successful outcomes for pain management [6]. Previous systematic reviews attempted to identify predictors of CBT and ACT outcomes in chronic pain. McCracken and Turk [8] found that differences in sample

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characteristics, treatment features, and assessment methods produced large variability in CBT outcomes, and that patients who are highly distressed and view their pain as an uncontrollable and as a highly negative life event, derive less benefit than other patients. Decreased negative emotional responses to pain, decreased perceptions of disability and increased orientation toward self-management predicted favourable treatment outcomes. Gilpin and colleagues [9] conducted a systematic review of the predictors of ACT outcomes in chronic pain. They reported there was some evidence that baseline emotional functioning predicted treatment response but that the direction of this association varied across studies, and that overall, there was heterogeneity in the treatment delivery.

There is increasing consensus in the literature that improvements in CBT for chronic pain may derive from a better understanding of the patient characteristics which predict, moderate, and mediate key outcomes in chronic pain. It is likely that understanding these factors will help refine and individualise psychological treatments for chronic pain [9–13].

In line with the CBT model for chronic pain, research has attempted to identify factors which not only maintain pain-related distress and disability but also predict outcomes following psychological treatment for pain. Pain-related cognitions such as catastrophising and a sense of helplessness have been linked to CBT treatment outcomes [12,13]. Emotional factors such as depression and fear of movement (or fear avoidance) have been associated with greater pain intensity and disability [14].

Within health research, "prognostic study designs" aim to identify variables, or predictors, associated with health outcomes of interest to help inform clinical decisions and identify targets for new interventions with the aim of modifying the course of a disease or health condition [15]. In the present study the terms predictive variable and prognostic factor have been used interchangeably.

Despite advances in the understanding of pain mechanisms and psychological treatments for chronic pain, the effectiveness of treatment for pain and distress is low [7]. This systematic review therefore aimed to identify predictors of outcome in CBT for chronic pain to help guide the use of treatment resources and support more targeted interventions for those unlikely to benefit from CBT for chronic pain.

Method

Protocol registration

This systematic review was preregistered on the PROSPERO International Prospective Register of Systematic Reviews (PROSPERO-ID CRD42022292504) and conducted in accordance with the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[15].

Search strategy

The search strategy was developed with input from clinical psychologists working in chronic pain and a specialist librarian. A systematic literature search was conducted on 24/08/2023 to identify eligible studies published between January 1974 to 24th August 2023 in four relevant electronic databases (Medline, EMBASE, PsychINFO and CINAHL). The search included (1) terms relating to Cognitive Behavioural therapy (2) terms related to chronic pain and (3) free text terms related to various pain conditions. The search strategy covered all types of chronic pain, and had English language limits, human limits and clinical trial limits. In EMBASE and MEDLINE a limit was added for adults aged 18–65. Reference lists for all included studies were scanned for relevant articles. The search was conducted by one reviewer (G.F). For further details see the search strategy section see supplementary materials.

Eligibility criteria

Studies were assessed for their eligibility according to the following inclusion criteria: (1) participants were aged 18 or older and had chronic pain, defined as pain that has persisted for three months or more [1]; (2) the study designs were cohort studies or randomised controlled trials (RCT) comparing CBT to a waitlist control, treatment as usual or active/comparison condition; (3) outcome measurement included one of the following: pain intensity, pain interference, physical function, emotional functioning, quality of life, social functioning, ability to work, sleep and healthcare utilisation; (4) CBT was delivered one-to-one, as a group, part of a multidisciplinary programme or online; and (5) the studies identified predictors of CBT outcomes in chronic pain.

Studies of contextual cognitive behavioural interventions such as ACT, compassion focused therapy, and mindfulness-based interventions were not eligible for inclusion, unless as comparators for CBT intervention. Text-delivered CBT interventions were also excluded. CBT interventions were included in this review if the specific content included a combination of behavioural and cognitive interventions based on Cognitive Behavioural Therapy, delivered by a psychologist, therapist or mental health professionals.

Study selection

Articles which were identified in the initial search strategy were screened by one reviewer (G.F.) on the basis of the title and abstract according to the inclusion criteria. Full text screening was carried out by two reviewers, with one discrepancy resolved following discussions between G.F and P.W. Figure 1 summarises the systematic search and study screening process using a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart.

Data extraction

Data were extracted from the studies on year of publication, study design, sample size, intervention delivery type, content of the intervention, duration of the intervention, outcome measures, and timing of outcome assessments. Significant predictors of outcome were recorded. To aid interpretation, we transformed relevant inferential statistics into correlation coefficients to attain standardisation [16]. See below for characteristics of the included studies and a summary of outcome measurement (Table 1).

Assessment of study quality

Study quality was assessed using the Hayden criteria [34] which are designed to assess the quality of studies of prognosis or prognostic factors. The criteria focuses on six areas of potential

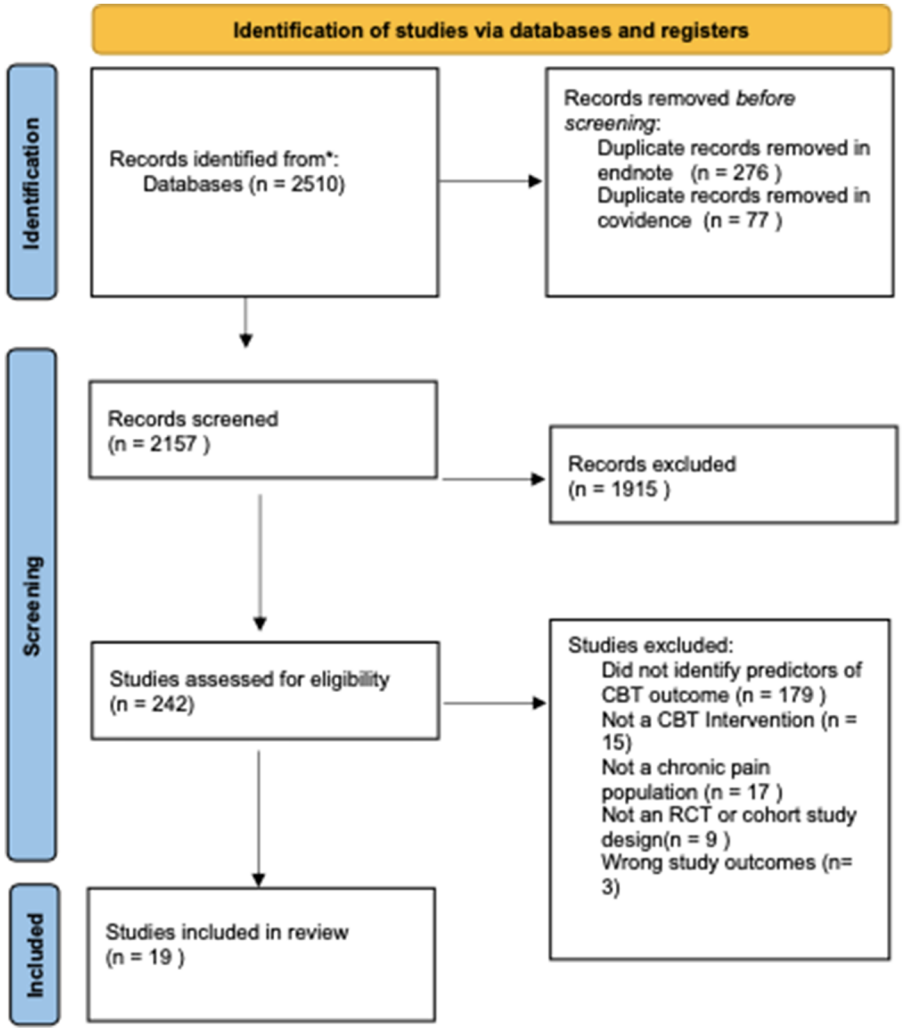

Figure 1. Prisma flow diagram.

Table 1. Risk of bias and study quality.

	Risk of Bias						Study Quality
Study ID	Selection	Attrition	Prognostic Factor	Outcomes	Confounders	Analysis	Overall Rating
Åkerblom et al. [17]	Low	Low	Low	Low	Low	Low	High
Bellomo et al. [18]	High	Moderate	Low	Low	Low	Low	Low
Blanchard et al. [19]	High	High	Low	Low	Low	Low	Low
Brotto et al. [20]	Low	Moderate	Moderate	Low	Low	Moderate	Low
Buchner et al. [21]	Low	Low	Low	Low	Low	Moderate	High
Burns et al. [22]	Low	High	High	Low	Low	Low	Low
Desrochers et al. [23]	Low	Low	Low	Low	Low	Low	High
Flor et al. [24]	Low	High	Low	Low	Low	Low	Low
Jensen et al. [13]	Low	Moderate	Low	Low	Low	High	Low
Jensen et al. [25]	Low	Moderate	Low	Low	Low	Low	High
Lackner et al. [26]	Low	Low	Low	Low	Low	Moderate	High
Lera et al. [27]	Low	Moderate	Low	Low	Low	Low	High
McCracken and Gross [28]	High	Low	Low	Low	Low	Low	Low
Pfingsten et al. [29]	High	Low	Low	Low	Low	Low	Low
Riecke et al. [30]	Low	High	Low	Low	Low	Low	High
Samwel et al. [31]	Low	Moderate	Low	Low	Low	Low	High
Serrat et al. [32]	Low	Low	Low	High	Low	Low	Low
Turner et al. [12]	Low	Moderate	Low	Low	Low	Low	High
Wetherell et al. [33]	Low	Moderate	Low	Low	Low	Low	High

measurement in prognosis studies: study participants, attrition, prognostic factor measurement, measurement of confounding variables, outcome measurement, and analysis. The risk of bias was rated as low, moderate or high. Studies were classified as low quality if one or more areas of bias were rated as high risk, and high quality if the risk of bias ratings or all six areas were low or moderate, in accordance with the protocol described by Hayden [34].

Data synthesis

It was not possible to apply meta-analytic methods for this review due to the lack of replication across predictor and outcome variables in multiple studies. A narrative synthesis of quantitative data was therefore performed [35]. To aid interpretation, relevant inferential statistics were transformed into correlation coefficients to allow for standardisation and enable synthesis.

Primary outcome measures were categorised under four subheadings to group the most prevalent outcome measures used: (1) pain intensity, (2) quality of life, (3) physical functioning, and (4) depression symptoms. A further group of outcomes were categorised as "other" for those studies with outcome measures which did not fall under the four categories and where few other studies had reported the same outcome.

Results

The full characteristics of the 19 studies are presented in Table 2. The majority were randomised controlled trials and seven were cohort studies. Studies were from the Netherlands, Spain, Germany, the USA, Canada and Sweden. Sample sizes ranged from 66 to 405 participants. The samples consisted of adults with a mean age range of 42–55 years old. Four of the studies included women only [18,20,27]. All other studies included more women than men. Most studies used group CBT interventions, with just four studies offering individual CBT. The CBT interventions ranged from three to 15 weeks in duration. Four studies included a mixed sample of chronic pain [17,25,31,33], three specified fibromyalgia [18,27,32]; two focused on irritable bowel syndrome (IBS) [19,26]; two included provoked vestibulodynia (PVD) [20,23], six included back pain [13,21,24,28–30] and one studied musculoskeletal pain [22].

Of the 19 studies included in the review, nine were found to be "low quality" and 10 "high quality" according to the Hayden criteria [34]. Two studies were rated as having a low risk of bias across all areas [17]. The majority of the studies were not primarily designed to identify predictors or moderators of outcome and therefore the quality ratings of the statistical analysis of the studies was, in accordance with the criteria, reduced as a consequence. A rating of "low" quality does not necessarily indicate that the study was of overall low methodological quality but that the methods used were not robust for identifying prognostic factors. See Table 1 for a full summary of the risk of bias ratings and overall study quality rating for the 19 studies included in this review. To check for reliability of the quality ratings, G.F and P.W rated all of the studies ($n = 19$) and were in agreement.

Predictors of CBT for pain outcomes: pain intensity

Nine studies investigated significant predictors of pain intensity outcomes [18,19,21,24,25,28,30,31,33]. The studies identified 11 predictors of pain intensity outcomes for CBT for chronic pain (Table 3). These included: younger age, pain helplessness, pain-related anxiety, lower pain tolerance, passive coping, lower pronounced cognitive distortions, and lower pain self-efficacy. Two of these studies found younger age was linked to better pain intensity outcomes [23,30], however, these effect sizes were small. The majority of psychological predictors had medium effect sizes, indicating that baseline variables such as pain-related cognitions and anxiety are consistent predictors of pain intensity outcomes following CBT for pain, however the quality of these studies is mixed. Four studies were rated as high quality [21,23,25,31] and two were rated as low quality [24,28]. Table 3 shows the results of the studies including sample size, effect size (r), and a rating of the effect size for r.

Depression

Three studies investigated predictors of depression outcomes of CBT for chronic pain (Table 4). Lower pain-related anxiety at baseline was found to have a large effect size on outcomes of depression after CBT for pain in one study [28]. The study quality was low and the sample size relatively small ($n = 79$). Cognitions and coping beliefs predicted depression outcomes with a medium effect size in a study [25] with a larger sample size ($n = 141$) but also of low quality.

Quality of life (QOL)

One study identified multiple predictors of quality of life outcomes (Table 5) [19]. The study focused on patients with irritable bowel syndrome (IBS) and identified that baseline diarrhoea, IBS QOL, race, and anxiety were correlates of QOL post CBT. The effect sizes for all four predictors were large. This study was rated as low quality with a relatively large sample size of 137, however, the study sample was overwhelmingly White (94%), and therefore predictors such as race should be interpreted with caution. These predictors were all in the context of IBS.

Physical functioning

Eight studies identified predictors of physical functioning outcomes of CBT for chronic pain (Table 6) [12,17,21,22,24,25,27,28]. As with pain intensity, younger age was found to be a predictor of outcome but this effect size was small [21]. A number of physical symptoms were found to predict outcomes on physical functioning including fatigue, walking endurance, and number of tender points and pain sites. Two studies found that the number of pain sites correlated with worse outcomes post CBT, however these effects were small [12].

A number of psychological factors were linked to worse physical functioning outcomes post CBT. Higher rates of depression, somatisation (measured using the Somatization Scale of the Symptom Checklist-90), rumination (measured using the Pain Catastrophizing Scale), catastrophising and stress were all found by one study to predict worse physical functioning outcomes post CBT. The sample size in this study was relatively small ($n = 55$) but the quality was rated as high [12]. A medium effect size was found for negative pain cognitions and coping and increased pain related anxiety as predictors of worse outcomes in physical functioning post CBT. The quality for these two studies was low [13,28]. Higher pain flexibility was found to have a small effect size on predicting CBT outcome on physical functioning [17].

Table 2. Table of study characteristics.

Study	Design	Sample	CBT intervention	Outcome	CBT outcomes and predictors
Åkerblom et al. [17]	Cohort Study	Sweden: 232 people with chronic pain 86% females, mean age 41.6 (SD 9.88), 76% born in Sweden, mean pain duration 98 months. Years education not given.	5-week CBT group treatment with 18 active treatment days (5–7 h/d), 2-month "homework" phase on individual goals and 2 further treatment days on progress, difficulties and future goals.	12 months	Pain interference (MPI) was predicted by higher pain inflexibility (PIPS) at baseline (p = .019) Depression (HADS) was predicted by higher pain inflexibility (PIPS) at baseline (p=.047)
Bellomo et al. [18]	RCT secondary analysis, comparing 3 groups: Emotional awareness expression therapy (N = 57), CBT (N = 51), and Pain Education Control (N = 46)	USA: 196 women with Fibromyalgia Mean age 49.7 (SD 11.88), 77% white, mean 15 years education. Pain duration not given.	Eight 90-min weekly group CBT sessions delivered by Clinical Psychologists.	Post-treatment	Improvement in clinical pain severity (Multimodal Automated Sensory Testing (MAST) system) associated with low pain tolerance at baseline (CBT mean [95% CI] = 0.66 [0.24, 1.07] BPI-S (Brief Pain Inventory- Severity) – no predictor identified.
Blanchard et al. [19]	Cohort study	USA: 137 people with IBS 81% females, mean age 49 (SD 13.1), 94% white, mean years education 14.9, mean duration of IBS 18 years.	Ten 90-min weekly group CT sessions delivered by doctoral-level clinicians.	3 months	Improvement in Post-Treatment Discomfort Index was predicted by having fewer baseline Axis I disorders at pre-treatment and lower baseline Daily Stress Inventory Improvement in Post-Treatment QOL was predicted by pre-treatment IBS-QOL score, race, baseline diarrhoea, pre-treatment state anxiety score.(p=.001) Improvement in Post-Treatment Global Severity Index (psychological distress) was predicted by trait anxiety,SF-36, level of education, Dysfunction Attitudes Scale(p = .001), Improvement in Post-Treatment Bowel Regularity Index was predicted by baseline GAD and SF-36 (Physical Functioning subscale)
Brotto et al. [20]	Randomised Study comparing 2 groups: CBT (N = 63) and Mindfulness based cognitive therapy (N = 67)	Canada: 130 women with Provoked Vestibulodynia Mean age 32.35 (±8.21), 66.7% Euro-Canadian, mean duration of PVD 7.95 years	Eight 135-minute weekly group CBT sessions delivered by clinicians with specialist training in group therapy and PVD.	6 months	Sexual Function (Female sexual function index): Women in longer relationships had better outcomes (p = .01) Pain Intensity (NRS): Younger women (p=.01) Pain Catastrophizing (PCS): Primary PVD (p = .01)

(*Continued*)

Table 2. Continued.

Study	Design	Sample	CBT intervention	Outcome	CBT outcomes and predictors
Buchner et al. [21]	Cohort study comparing three age groups; 18–34, 35–50 and 51–65.	Germany: 405 people with chronic lower back pain. 58% females, 18–65 years, sickness leave for <= 6 weeks.	3-week inpatient multidisciplinary therapy programme (8 h /d, 120 h total) providing biopsychosocial therapy including CBT.	6 months	Physical Function (SF-36): 18–34, 35–50 showed significant improvements (p = .029) Pain Intensity (VAS): 18–34, 35–50 showed significant improvements (p = .04) Functional Capacity (FFBH): 18–34, 35–50 showed significant improvements (p = .008
Burns et al. [22]	Cohort study	US: 94 people with musculoskeletal pain	4-week, multidisciplinary program, including physical and occupational therapy, individual and group CBT, biofeedback, education about pain, and treatment by a physician.	6 months	Activity levels (GAS): Increased walking endurance (p = .03) Pain Severity (PSS): Lower pain helplessness (p = .0003)
Desrochers et al. [23]	Randomised Study comparing 2 groups: CBT (N = 46) and Topical application (N = 51)	Canada: 97 women with provoked vestibulodynia aged between 18 and 45.	Ten 90-minute weekly group CBT sessions delivered by PhD level psychotherapists.	6 months	Pain Intensity (VAS): Baseline age of contraceptive use (6% variance), Pain self-efficacy (PSEQ, 9% variance) Pain severity (MPQ-PRI): Pain catastrophising (PCS, 13% variance).
Flor et al. [24]	Randomised Study comparing 3 groups: CBT (N = 26), Electromyographic Biofeedback (N = 26), and Conservative medical treatment (N = 26)	Germany: 78 people with chronic back pain and temporomandibular pain. Average age = 42 years, 60% female, 100% white, 75% married, 66% employed.	Eight 60-min weekly group CBT sessions delivered by Clinical Psychologists.	6 months	Pain severity and interference (MPI): Those with pronounced cognitive distortions (PRSS catastrophising scale) profited least from CBT (p=.01). Chronicity of pain was negatively correlated with outcome (p=.01).
Jensen et al. [13]	Randomised Study, comparing 4 groups: CBT (N = 49), Treatment as usual (N = 48) Behaviour-orientated physical therapy (N = 54) and Behavioural medicine group (N = 63)	Sweden: 214 people on sick leave with chronic non-specific spinal pain, Average age = 43.8 years (SD = 9.6), 54% female, 74% married, 86% employed.	Group intervention comprising of 13–14 h per week aimed to improve subjects ability to manage their pain and resume activity levels.	18 months	QOL (SF-38): Gender, females (p = .004) Taking early retirement: Gender, females sig lower risk 0.1 (0.0 ± 0.8) compared to males 0.6 (0.2 ± 2.1).
Jensen et al. [25]	Cohort study.	USA: 141 people in chronic pain. 51% female, mean age 44.7 (SD 10.7), 90% white and median pain duration 3.2 years (range, 4 months–48 years).	3-week outpatient chronic pain programme aimed at improving pain management skills and physical and psychological functioning.	12 months	Pain intensity (NRS): Changes in passive coping (p = .01) Depression (CES-D): Catastrophising (p = .001) Pain disability (RMDQ): Pain beliefs of medical focus (p = .05) and passive coping (p = .001)
Lackner et al. [26]	RCT secondary analysis comparing 3 groups: 4-session CBT (N = 25), 10-session CBT (N = 23) and a waitlist control (N = 27).	USA: 71 people with irritable bowel syndrome aged 18–70.	CBT was offered as four or ten weekly 1-h sessions.	12 weeks	Decrease in IBSSS score of 50 points of more Higher QOL impairment (IBSQOL, p = .01); Personal control beliefs (IBS-LOC, p = .01)

(*Continued*)

Table 2. Continued.

Study	Design	Sample	CBT intervention	Outcome	CBT outcomes and predictors
Lera et al. [27]	RCT comparing two groups: MDT treatment with CBT ($N=35$) vs without CBT ($N=31$)	Spain: 66 women with fibromyalgia Mean age 50 (SD= 9.3), duration of symptoms 16 years, 4.5 comorbid chronic disorders.	Group CBT, 15 group sessions, 90 min per week led by a clinical psychologist	6 months	Functional status and symptoms (FIQ and SF-36) Fatigue ($r=0.29$); lower number of tender points ($r=0.27$)
McCracken and Gross [28]	Cohort study	USA 79 people with chronic lower back pain.	3 week group pain management programme, 5 d/week, of physical exercise and behavioural interventions.	Post treatment	Decreased depression, pain severity, interference, affective distress and activity: Pain related anxiety ($p = .05$)
Pfingsten et al. [29]	Cohort study	Germany: 90 people with chronic lower back pain, 51% female, mean age 42 (SD= 8.7), average time off work 9 months.	8-week group program of functional restoration and behavioural support.	12 months	Not returning to work was associated with already having applied for a pension ($r=0.95$), a negative outlook about returning to work prior to treatment ($r=0.54$), out of work for > 6 months ($r=0.46$)
Riecke et al. [30]	RCT comparing two groups: CBT ($N=32$) vs exposure *in vivo* therapy CBT ($N=56$)	Germany: 88 people with chronic lower back pain, 55% female, mean age 53, 100% Caucasian.	15 weekly sessions consisting of educational information, cognitive and behavioural graded activity and relaxation.	Long-term follow up (up to 8 years)	Movement related disability (QBPDS) predicted long term follow up movement related disability ($p=.03$)
Samwel et al. [31]	Non- Randomised Study comparing four groups: CBT ($N=21$), Medical treatment ($N=19$), Transcutaneous Electrical Nerve Stimulation ($N=50$), Combined treatment: ($N=20$) vs Control group: ($N=110$)	The Netherlands: 220 people in chronic pain, mean pain duration 63 months, 64% female.	Ten 90-minute weekly sessions of group CBT, focused on reducing disability and depression	Post treatment	Pain intensity (VAS): Acceptance (ICQ, $r=0.20$)
Serrat et al. [32]	RCT comparing two groups: Multicomponent treatment with CBT ($N=135$) and Treatment as usual ($N=137$).	Spain: 272 people with Fibromyalgia mean age 54, mean pain, duration 17 years, 22.4% employed.	Group multicomponent treatment, weekly 2-h sessions for 12 weeks	6 months	Responder group (reduction in FIQR score of 20%): Higher depression score ($p = .01$)
Turner et al. [12]	RCT comparing two groups: CBT ($N=55$) and Educational/attention control group: ($N=50/55$)	USA: 156 people with chronic temporomandibular disorder (TMD), 87% female, 85% White.	Individual bi weekly sessions over 8 weeks by Clinical Psychologists	12 months	Masticatory disability scores: Baseline masticatory scores ($p = .001$) Activity interference: Depression, somatisation, rumination, catastrophising, perceived stress
Wetherell et al. [33]	Randomised study, comparing CBT ($N=57$) and ACT ($N=57$)	USA: 114 people with non-malignant chronic pain conditions. Mean age 55 years, mean pain duration 15 years, 17.5% met criteria for depression.	Eight 90-minute group CBT, 90 sessions	6 months	Treatment response (defined as at least 30% decrease on BPI interference subscale): Younger age (when controlling for depression, p=.01)

ACT: Acceptance and Commitment Therapy; CBT: Cognitive Behavioural Therapy; RCT: Randomised controlled trial; VAS: Visual Analogue Scale; MPI: Multidimensional Pain Inventory; PIPS: Psychological Inflexibility Pain Scale; IBS: Irritable Bowel Syndrome; NRS: Numerical Rating Scale; QOL: Quality of Life; CES -D: Centre for Epidemiologic Studies Depression Scale; RMDQ: Roland Morris Disability Questionnaire; IBSSS: IBS-Severity Score; IBS-LOC: IBS-Locus of Control; FIQ: Fibromyalgia Impact Questionnaire; SF-36: Short Form 36 Health Survey Questionnaire; VAS: Visual Analogue Scale; ICQ: Illness Cognition Questionnaire; FIQR: FIQ-Revised; MDT: Multidisciplinary Treatment; PSS: Pain Severity Scale; GAS: Goal Attainment Scale; QBPDS: Quebec back pain disability scale.

Predictors of other CBT outcomes

Two studies investigated predictors of work-related outcomes after CBT (Table 7) [13,29]. Females were found to be less likely to take early retirement post CBT [13] and to therefore continue working, however the sample size in the CBT arm of the study was relatively small ($n=49$). Being out of work for six months or more, having already applied for a pension (with the intention to retire) or having a negative outlook on returning to work was found to be correlated with not returning to work post CBT [29]. In a study of provoked vestibulodynia (PVD) the length of relationships, in women, was found to predict sexual function as an outcome of CBT [20]. This effect size was large. Primary

Table 3. Predictors of pain intensity post-treatment.

Category of Predictors of CBT for chronic pain outcomes	Study	*N*	Effect size (r)	Effect size rating (S/M/L)
Demographics				
Age of 1st contraceptive use	Desrochers et al. [23]	46	−0.270	S
Younger Age	Wetherell et al. [33]	57	0.227	S
	Buchner et al. [21]	405	0.087	–
Physical symptoms				
Lower pain tolerance	Bellomo et al. [18]	51	0.316	M
Chronicity of pain (Years)	Flor et al. [24]	26	−0.308	M
Psychological & Mental Health variables				
Pronounced cognitive distortions	Flor et al. [24]	26	−0.480	M
Pain-related anxiety	McCracken and Gross [28]	79	0.440	M
Cognitions and beliefs about coping	Jensen et al. [25]	141	0.39	M
Pain helplessness	Burns et al. [22]	94	0.339	M
Pain self-efficacy	Desrochers et al. [23]	46	−0.310	M
Acceptance	Samwel et al. [31]	21	0.20	S
Pain catastrophising	Desrochers et al. [23]	46	0.260	S

Table 4. Predictors of depression post-treatment.

Category	Predictor Variable	Study	*N*	Effect size (r)	Effect size rating (S/M/L)
Psychological & Mental Health variables					
	Pain-related anxiety	McCracken and Gross [28]	79	0.57	L
	Cognitions and beliefs about coping	Jensen et al. [25]	141	0.41	M
	Higher pain inflexibility	Åkerblom et al. [17]	232	0.16	S

PVD is categorised as women who have experienced pain since first having penetrative sex. Primary PVD was found to be correlated with improvements on pain catastrophising post CBT, compared to secondary PVD. Secondary PVD is categorised as a woman who have experienced pain-free sex prior to the development of PVD.

A number of variables were found to predict physical outcomes in IBS. Disability, bloating, depression and anxiety, and hassles (measured using the Hassles scale) were found to be predictors of worse IBS symptoms outcome post CBT [19]. However, higher IBS QOL and personal control beliefs were linked to better outcomes on IBS symptoms post CBT [26]. Blanchard and colleagues [19] also found large effect sizes for baseline constipation, severity of symptoms, and depression as predictors of worse IBS outcomes following CBT. In summary, worse IBS symptoms at baseline are correlated with poorer CBT outcomes.

In fibromyalgia patients, higher depression scores were correlated with worse outcomes on fibromyalgia impact scale, with a medium effect size [32].

Table 5. Predictors of quality of life post-treatment.

Category	Predictor Variable	Study	*N*	Effect size (r)	Effect size rating (S/M/L)
Demographics					
	Race (Caucasian)	Blanchard et al. [19]	137	0.55	L
Physical Symptoms					
	Baseline Diarrhoea (IBS)	Blanchard et al. [19]	137	0.51	L
Psychological & Mental Health variables					
	IBS QOL	Blanchard et al. [19]	137	0.68	L
	State anxiety	Blanchard et al. [19]	137	0.59	L

Table 6. Predictors of physical functioning at post-treatment.

Category	Predictor variable	Study	*N*	Effect size (r)	Effect size rating (S/M/L)
Demographics					
	Younger age	Buchner et al. [21]	405	−0.09	–
Physical Symptoms					
	Fatigue	Lera et al. [27]	35	0.29	S
	Tender points	Lera et al. [27]	35	−0.27	S
	Walking endurance	Burns et al. [22]	94	0.26	S
	Number of pain sites	Turner et al. [12]	55	0.21 0.31	S M
	Movement related disability	Riecke et al. [30]	64		
Psychological & MH variables					
	Cognitions and coping	Jensen et al. [25]	141	0.47	M
	Pain related anxiety	McCracken and Gross [28]	79	0.37	M
	Depression	Turner et al. [12]	55	0.31	M
	Somatization	Turner et al. [12]	55	0.31	M
	Rumination	Turner et al. [12]	55	0.31	M
	Catastrophising	Turner et al. [12]	55	0.31	M
	Perceived stress	Turner et al. [12]	55	0.31	M
	Higher pain flexibility	Åkerblom et al. [17]	232	0.20	S

Discussion

CBT is an effective psychological therapy for people with chronic pain, but not all people benefit. Studies have investigated a diverse range of variables that may influence outcomes of CBT

Table 7. Predictors of "other outcomes" post-treatment.

Category	Predictor Variable	Study	*N*	Effect size (r)	Effect size rating (S/M/L)
Demographics					
Not taking early retirement	Females	Jensen et al. [13]	49	9% Females 18% Males	
Not returning to work after CBT	1. Being out of work for 6 months	Pfingsten et al. [29]	90	0.95	1. L
	2. Already applied for a pension,			0.54	2. L
	3. Negative outlook about returning to work			0.46	3. M
Sexual function (sexual function index)	Length of relationship	Brotto et al. [20]	63	0.69	L
Physical Symptoms					
Improvement in GI symptoms	4. Disability severity inventory	Blanchard et al. [19]	137	0.39	M
	5. Baseline bloating GI diary			0.33	M
	6. DAS (Depression and anxiety)			0.33	M
	7. Hassles frequency			0.28	S
Irritable Bowel Syndrome Severity Score (IBSSS)	8. Personal control beliefs (IBS-LOC)	Lackner et al. [26]	71	0.30	M
	9. IBS QOL			0.28	S
Revised fibromyalgia impact questionnaire	Higher Depression scores (HADS)	Serrat et al. [32]	135	0.45	M
Psychological & MH variables					
Pain catastrophizing	PVD Type (Primary)	Brotto et al. [20]	63	0.69	L
Global severity index	10. Baseline constipation GI diary	Blanchard et al. [19]	137	0.54	L
	11. Global severity scale			0.69	L
	12. BDI			0.66	L

in chronic pain. This review has identified a number of baseline cognitive, emotional, demographic, and physical factors that correlate with outcomes of CBT for chronic pain.

Patient demographic factors identified as potential predictors of improved outcomes in CBT were gender (females), younger age, later age of first contraceptive use (in PVD), race (being White), being in a longer relationship (in PVD), being out of work for less than six months, not having applied for a pension, or having a more positive outlook about returning to work. Demographic variables such as age and gender as predictors of CBT outcome should be interpreted with caution, as the study samples in this review were predominantly White and had high proportions of females, and the prevalence of chronic pain is widely accepted as being more prevalent in females [36].

Many samples included in this review are not representative of ethnic diversity in the UK and not representative of disparities of chronic pain prevalence and increased intensity across some ethnic groups. Several studies have reported greater pain intensity in Black American participants [37,38]. The Versus Arthritis chronic pain report [39] suggested that Black communities in the UK are more likely to have chronic pain than people of other ethnicities and people who describe themselves as Asian are more likely to report chronic pain than people of other ethnic groups.

A large effect was found for the length of relationship and outcomes for sexual function in PVD. This reflects the literature in other pain conditions such as fibromyalgia where partnered patients reported less pain-related physical disability, which is mediated by more adaptive affective and cognitive responses (such a less pain catastrophising) to pain, than found in unpartnered patients [40]. Teasing apart the predictive or causal nature of relationship status and chronic pain is unclear. However, it is well established that psychosocial factors play a significant role in pain, for example episodes of loneliness have been associated with increased pain and negative social relations [41–43].

Unsurprisingly this review identified predictors of returning to work such as chronicity of absence from work and negative beliefs about returning to work. This is in line with a study of sick leave more broadly, which found that those on short sick leave were more satisfied when returning to work than those who were on longer sick leave [44]. This fits with the literature and cognitive models of pain in that negative pain experience and beliefs can lead to increased disability over time [45].

This review identified several physical symptoms which predicted outcomes of CBT in chronic pain. These included the number of pain sites, walking endurance, fatigue, IBS symptoms, chronicity of chronic pain, and pain tolerance. The severity of symptoms prior to receiving CBT was found to impact on outcomes post-CBT. Two studies identified that an increased number of pain sites were correlated with worse outcomes but these effects were small. These findings add to a larger literature which has failed to find consistent evidence that this variable predicts outcomes of treatment in chronic pain [8,9,17].

The most common category of predictors identified overall were psychological variables, which was expected as CBT is a psychological intervention. Anxiety was the most prevalent predictor of poorer outcomes identified in four studies in this review with effect sizes in the medium to large range. Two studies identified a medium effect size for depression in predicting poorer outcomes after CBT. Higher levels of psychological distress such as anxiety and depression at baseline have been associated with poorer outcome in CBT for chronic pain [46] and can be understood by the fear avoidance model of pain as a maintaining or exacerbating factor in chronic pain [43]. Anxiety and depression in pain are also associated with increased negative beliefs around coping, pain catastrophising, and rumination which are all features of depression and anxiety in chronic pain. Three studies identified that higher levels of pain catastrophising at baseline predicted worse CBT outcomes, however, the effect sizes varied from small to large.

In this review, higher pain flexibility was found to have a small effect on positive outcomes in CBT. This has been well studied as a predictor of positive outcome in ACT therapies for chronic pain [9] but less so in CBT and warrants further investigation.

Limitations

Of the 178 studies identified that investigated treatment outcomes for CBT in chronic pain, only 19 studies identified significant predictors of treatment outcome. In the studies included

in this review, there were a number of methodological weaknesses. Most studies were primarily designed to assess the effectiveness of an intervention and not to identify prognostic factors. There was variability in the design of studies between randomised controlled trials and cohort designs, between follow-up time points, the outcomes measured and the delivery of the CBT intervention. These inconsistencies make it difficult to draw comparisons across studies. As previous research has highlighted, there is a need for outcomes in pain research to be consistently measured in a standardised way [9,47,48]. There was also variability in the types of chronic pain studied, some studies focused on all forms of chronic pain and others focused on specific types of chronic pain, such as IBS or PVD, which in turn linked to specific outcome measures such as IBS symptoms or sexual function. The samples included in this study are largely White and predominantly, if not completely, female, potentially limiting the generalisability of the findings. There is also a risk of publication bias as only published studies were included in the review, it is also a limitation that only studies in the English language were included in the search.

In terms of the delivery of CBT interventions. there were differences between methods of delivery (e.g., group or individual sessions) and the number of sessions offered. In many studies, the CBT intervention was delivered as part of a multi-package of several other components such as physical therapy, sleep education and nutrition. It is likely that these differences in treatment delivery impact on the differences in outcome found across the studies in this review. This highlights the methodological inconsistencies and the difficulty of synthesizing results across studies in CBT for chronic pain.

A key limitation of this review was the focus only on predictors and not moderators or mediators of CBT outcome in chronic pain. Understanding the role of mediators and moderators in CBT outcome may help create a more comprehensive picture of the variables that affect outcomes. A recent review of predictors of outcome in ACT proposed that a focus on a theoretically driven approach to identifying predictors or moderators of outcome is needed [9]. Arguably predictors of CBT for pain outcomes have largely fitted with the CBT fear avoidance theory of pain, in that they can be categorised into pain cognitions, pain experience and physical disability. However, some studies in the review were less theory-driven in terms of identifying predictors of CBT outcome. This could explain why some variables such as demographic features are less likely to be replicated across studies. Gilpin and colleagues [9] proposed that a fundamental difficulty in finding meaningful predictors of outcome in chronic pain may be the lack of theoretical grounding in the selection of potential predictors, or moderators, of treatment outcome. A theory driven approach to identifying predictors of outcome in chronic pain will help to reduce heterogeneity across studies and enable more consistent findings to emerge.

A recent article by McCracken [49] highlighted the need to move towards more individualised treatments in chronic pain, and that individualised treatments should be tailored around the predominant symptom the individual is presenting with. Hofmann and Hayes [50] also suggest a move towards personalised treatments based on functional analysis and targeting evidence-based processes of change, opposed to following manualised treatments based on a particular therapeutic approach such as CBT or ACT. A systematic review [51] found, however, that most multidisciplinary treatments for chronic pain show low levels of tailoring interventions (80%), and few were highly tailored (8%). Therefore, future research focused on symptom targeted interventions in chronic pain may provide useful insights.

A number of demographic, and baseline physical and emotional factors were identified which impact on the effectiveness of CBT. The most prevalent predictors of CBT for pain outcomes involved forms of emotional distress (anxiety and depression) and cognitions about pain and coping. Demographic predictors of outcomes demonstrated small effects and lacked replicability. There was heterogeneity across study designs, CBT interventions and importantly outcomes measures used. Further research is needed in chronic pain to identify the prognostic factors which influence treatment outcomes and consistency across study designs and outcome variables is needed to reduce heterogeneity, and enable robust meta-analyses of the data.

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