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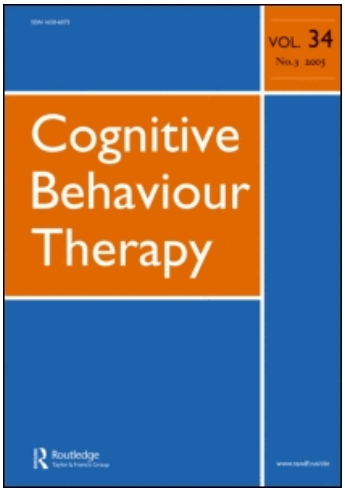
Institutions: Katholieke Universiteit Leuven, University of Regina

Published on: 01 Jan 2010 - Cognitive Behaviour Therapy (Cogn Behav Ther)

Topics: Chronic pain, Acceptance and commitment therapy, Cognitive therapy, Behaviour therapy and Cognitive behavioral therapy



Cognitive Behaviour Therapy
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713926011

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First published on: 20 August 2009

To cite this Article Bailey, Kristen M., Carleton, R. Nicholas, Vlaeyen, Johan W. S. and Asmundson, Gordon J. G.(2010) 'Treatments Addressing Pain-Related Fear and Anxiety in Patients with Chronic Musculoskeletal Pain: A Preliminary Review', Cognitive Behaviour Therapy, 39: 1, 46 — 63, First published on: 20 August 2009 (iFirst)
To link to this Article: DOI: 10.1080/16506070902980711
URL: http://dx.doi.org/10.1080/16506070902980711

Cognitive Behaviour Therapy Vol. 39 No. 1, pp. 46–63, 2010

Treatments Addressing Pain-Related Fear and Anxiety in Patients with Chronic Musculoskeletal Pain: A Preliminary Review

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Abstract. This review covers the current cognitive behavioural treatments available to address fear-avoidance beliefs in patients with chronic musculoskeletal pain (CMP). Four types of treatment protocols were identified for inclusion in the review: (a) graded in vivo exposure (GivE); (b) graded activity (GA); (c) acceptance and commitment therapy (ACT); and (d) mixed cognitive behavioural protocols. Most of the research suggests that GivE and ACT result in the best outcomes for treating fear-avoidance beliefs in patients with CMP. There is also a readily apparent paucity of research from North America; indeed, most of the available studies were conducted in the Netherlands and Scandinavia. This relative absence of North American research raises potentially important questions about the role of compensation status and access to care, which differ between countries, on treatment outcome. Implications and directions for future research are discussed. *Key words: chronic pain; fear; anxiety; cognitive therapy; behaviour therapy; review; treatment.*

Received 14 January, 2009; Accepted 27 March, 2009

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Current theory holds that pain comprises sensory as well as cognitive, affective, behavioral, and social components (Bonica, 1990; Melzack, 1987; Melzack & Wall, 1965). Accordingly, pain can be viewed as both a sensory and an emotional experience. Pain is also ubiquitous, occurring most often as a response to actual or potential tissue damage, and motivates withdrawal from the source of pain in order to facilitate recuperative behaviour. In this context, pain has survival value; however, when it becomes chronic (i.e. persisting $\geq$ 3 months; International Association for the Study of Pain, 1986), it loses its adaptive qualities.

Chronic musculoskeletal pain (CMP) is a potentially debilitating health concern that affects tens of millions of people and accounts for billions of dollars in annual health care costs and lost productivity (Blyth et al., 2001; Gatchel, 2004; Strassels, 2006). Estimates from the United States indicate that 7% of the population has experienced CMP in the past 12 months (McWilliams, Cox, & Enns, 2003) at an annual cost of $100 billion (Weisberg & Vaillancourt, 1999). Many people with CMP make frequent physician visits, sometimes undergo inappropriate medical evaluations, and often miss work and other important activities because of their symptoms (e.g. Spengler et al., 1986). They are also at increased risk for comorbid psychiatric conditions, particularly depression and anxiety

 ISSN 1650-6073
DOI: 10.1080/16506070902980711

disorders (e.g. Asmundson, Coons, Taylor, & Katz, 2002).

Given the impact of CMP, it is not surprising that numerous interventions have been developed in attempts to alleviate unremitting pain and associated emotional suffering. For example, there is now an abundance of research examining the impact of pharmacotherapy (Burns & Ineck, 2006; Chamberlin, Cottle, Neville, & Tan, 2007; Hogg, 2006), surgery (Fritz et al., 2007; Sapkas et al., 2007), and physical therapy (Critchley, Ratcliffe, Noonan, Jones, & Hurley, 2007) on the experience of chronic pain. Overall, this research suggests that chronic pain is a complex problem that must be approached with patient-specific characteristics in mind; moreover, the evidence suggests that multimodal treatment for chronic pain is more effective than monotherapies (Turk, Swanson, & Tunks, 2008).

There have now been several decades of research regarding the relationship between pain and depression (Williams, Jacka, Pasco, Dodd, & Berk, 2006). This research suggests that chronic pain and depression are common comorbidities that may be mutually interactive. Early research also revealed an association between pain and significant degrees of anxiety (Paulett, 1947; Rowbotham, 1947); however, it is only within the last decade that anxiety has come to be viewed as more than a product of intractable pain. Constructs of pain-related anxiety and fear have garnered increasing theoretical, empirical, and practical attention.

Contemporary fear-anxiety-avoidance models of CMP are based primarily on the writings of several groups (Asmundson, Norton, & Norton, 1999; McCracken, Zayfert, & Gross, 1992; Vlaeyen, Kole-Snijders, Boeren, & van Eek, 1995; Waddell, Newton, Henderson, Sommerville, & Main, 1993). Although these groups each provide slightly different conceptualizations of the role of fear and anxiety in perpetuating pain, the main ideas of each are captured in the model proposed by Vlaeyen and Linton (2000; Figure 1). This model focuses on patients with idiopathic (i.e. in the absence of identifiable injury or organic pathology) CMP; however, it has been shown to be applicable to those with other pain conditions,

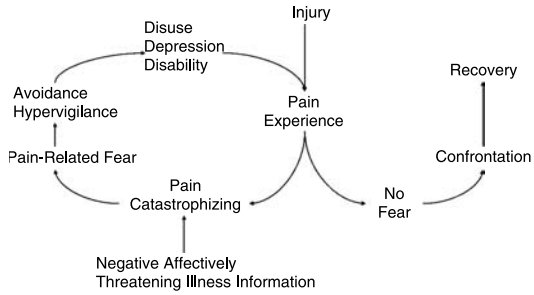

Figure 1. Vlaeyen and Linton's fear-anxiety-avoidance model of chronic musculoskeletal pain. From "Fear-avoidance and its consequences in chronic musculoskeletal pain: A state of the art," by J. W. S. Vlaeyen and S. J. Linton, 2000, *Pain, 85,* p. 329. Copyright 2000. Reprinted with kind permission from the International Association for the Study of Pain, 909 NE 43rd Ave, Suite 306, Seattle, WA.

such as headache (Norton & Asmundson, 2004), fibromyalgia (Goubert et al., 2004), and pain after recovery from severe burns (Sgroi, Willebrand, Ekselius, Gerdin, & Andersson, 2005), and has recently been adapted to account for fear of falling among the elderly (Hadjistavropoulos et al., 2007).

The contemporary fear-anxiety-avoidance models, although comprising more detailed postulates, can be summarized as follows:

1. When pain is perceived, a judgment of the meaning or purpose of the pain is placed on the experience (pain experience).
2. For most people, pain is judged to be undesirable and unpleasant but not catastrophic or suggestive of a major calamity (no fear). Typically, the person engages in appropriate behavioral restriction followed by graduated increases in activity (confrontation) until healing has occurred (recovery).
3. For a significant minority of people, a catastrophic meaning is placed on the experience of pain (pain catastrophizing). Catastrophizing, influenced by predispositional and current psychological factors, leads to fear of pain (and/or reinjury) and thereafter spirals into a vicious and self-perpetuating cycle that promotes and maintains avoidance, activity limitations, disability, pain, further catastrophizing, and so forth.

The fear-anxiety-avoidance models have garnered considerable empirical support (Asmundson et al., 1999; Asmundson, Vlaeyen, & Crombez, 2004; Leeuw, Goossens, Linton, et al., 2007; Vlaeyen & Linton, 2000) The most recent iterations of the model (e.g. Asmundson et al., 2004), as well as recent findings by Carleton and Asmundson (2009), suggest possible theoretical and clinical distinctions between pain-related fear and pain-related anxiety. Specifically, pain-related fear is suggested to occur during the actual experience of pain, whereas pain-related anxiety is suggested to occur in anticipation of a painful experience. The precedent distinction between present-tense fear and future-tense anxiety has been recognized as important for years (Barlow, 2002); however, in models of chronic pain, the distinction remains somewhat novel. Accordingly, for the purpose of this review, the phrase *fear of pain* is used to refer to both pain-related fear and pain-related anxiety.

Current treatments for pain-related fear and anxiety

New and innovative treatment approaches to CMP have begun to take into account components of the fear-anxiety-avoidance model. Although a relatively new area of inquiry, with the first report on related treatment published in 2001, there is now a sufficient body of research using these new treatment strategies to warrant a comparative review. Accordingly, the current review describes these treatments strategies—graded in vivo exposure (GivE), graded activity (GA), acceptance and commitment therapy (ACT), as well as less standardized techniques comprising various aspects of different therapies (i.e. mixed therapy)—and examines the available research on each treatment strategy.

Graded in vivo exposure and graded activity

GivE is a cognitive behavioural method that was developed by Vlaeyen, de Jong, Sieben, and Crombez (2002). The basic premise of GivE is that fear of pain and disability can be reduced by deliberately exposing patients to movements and tasks that have been avoided because of fear of pain or reinjury. GivE therapy begins with patient psychoeducation regarding the fear-anxiety-avoidance model of CMP followed by a series of interactive therapy sessions involving graded exposure techniques and "behavioral experiments." Patients and therapists collaborate to create an individualized hierarchy of feared activities (e.g. jumping up and down, bending over to pick up an object). In subsequent sessions, patients are gradually exposed to each activity in their hierarchy, providing ratings of fear and pain expectation before and following each activity exposure. Therapists encourage patients to practice the behaviours covered in therapy sessions (i.e. doing the activities in their hierarchy) as homework assignments outside of the therapeutic setting (also see Tang et al., 2007; Vlaeyen, de Jong, Sieben, & Crombez, 2002). It remains to be determined whether therapists need to model behaviours in a biomechanically appropriate fashion. Although this seems a reasonable approach, it has been suggested that focusing on proper biomechanics may be counter-intuitive with patients who fear pain or reinjury (Tang et al., 2007; Vlaeyen, de Jong, Geilen, Heuts, & van Breukelen, 2001); indeed, fearful patients may misinterpret this information to mean that catastrophe will occur if they do not perform activities exactly as demonstrated by their therapist. Accordingly, while additional research on this issue is warranted, it may not be necessary for therapists to demonstrate proper ergonomic movement.

GA, like GivE, is an active therapy used for treating CMP. Healthy behaviours are shaped through positive reinforcement of predefined activity quotas (Fordyce, 1976; Vlaeyen, de Jong, Sieben, & Crombez, 2002). Patients first identify specific functional activities that have been suspended as a result of CMP, and treatment goals are established based on the suspended activities. The client is asked to describe their tolerance level for performing each of the suspended activities. For example, a client might avoid bending at the waist while nonetheless being able to tolerate bending halfway (45 degrees) for a maximum of 10 min. The avoided activities and associated tolerances form a time-contingent treatment schedule, not unlike a fear hierarchy. Patients begin engaging in the activities at 70 to 80% of their baseline tolerance levels (e.g. bending

over to 35 degrees for 8 min) and proceed to gradually increase the activity levels over time.

Despite their similarities, GA and GivE differ in an important way. GA is based on operant conditioning principles, whereas GivE uses the principles from classical conditioning and operant conditioning. More specifically, GA takes advantage of a progressive positive reinforcement schedule to modify behaviours. In contrast, GivE works by first using classical conditioning principles to modify behavior. Although it was previously thought that exposure worked by abolishing pairings between conditioned and unconditioned stimuli, new research has suggested that one of the central components at work during exposure is inhibitory learning (Craske et al., 2008; Crombez et al., 2002). Thus, in GivE, patients are exposed to activities that elicit the fear responses they have learned (e.g. catastrophizing), but through the course of treatment they learn to inhibit those learned responses. Thereafter, positive and negative reinforcement schedules are applied in order to change behavioural activity patterns.

Acceptance and commitment therapy

ACT is based on concepts of mindfulness, acceptance, and values-based action (Hayes, 2004; Hayes & Duckworth, 2006; Hofmann & Asmundson, 2008). This approach has garnered considerable recent attention as a means of treating CMP (Vowles & McCracken, 2008; Wicksell, Melin, & Olsson, 2007). Acceptance occurs when one is willing to experience pain without attempting to control it (i.e. patients are taught to acknowledge their pain, observe it as a sensation, and then accept it as part of present reality without judgment). Values-based action occurs when values are clarified and actions are performed in line with those values in order for one to live their desired life; in other words, patients are encouraged to consciously choose to engage in satisfying, rewarding activities despite their pain. The ACT process facilitates a shift in life focus away from the pain and onto things of greater value. The shift reduces or ameliorates the debilitating, catastrophic cognitions and avoidance behaviours associated with CMP (Vowles, McCracken, & Eccleston, 2008). Some theorists suggest that ACT, as with cognitive behavioural therapy (CBT), focuses on patients' cognitions; however, rather than attempting to change the content of the cognitions, as is done in CBT, ACT attempts to change the function of the cognitions (Hofmann & Asmundson, 2008). Moreover, it is noteworthy that, like GivE and GA, the effects of ACT on fear of pain may result from exposure (e.g. engaging in a pain-provoking experience and working to accept the pain sensation; Dahl, Wilson, & Nilsson, 2004).

Other "mixed" protocols

There are several other protocols that combine a variety of cognitive and behavioural techniques to treat fear-avoidance beliefs associated with CMP (e.g. Linton & Ryberg, 2001; Spinhoven et al., 2004). These alternatives may target the same fear of pain and reinjury beliefs as in GA, GivE, and ACT; however, they utilize relatively less detailed techniques. For example, protocols have included problem-solving, cognitive appraisal, goal-setting, coping skills training, relaxation training, and assertiveness training. Accordingly, it is difficult to adequately compare and contrast these more eclectic protocols with one another or with the three protocols mentioned previously (i.e. GA, GivE, ACT). Nevertheless, because these mixed protocols appear in the fear-anxiety-avoidance literature, they warrant consideration in this review.

Summary

Each of the treatments for fear of pain and reinjury associated with CMP (i.e. GivE, GA, ACT, and the mixed protocols) has received varying levels of empirical support. To date, the results of the available research have not been summarized or critically compared. The purpose of the current study is to provide a comprehensive review of the literature involving protocol that targets treatment of fear of pain and reinjury in a chronic pain population and review the outcomes of those studies.

Method

A search of PsycINFO and PubMed articles published between 1960 and 2008 was conducted using each of the following pain-related search terms: *fear of pain, fear, CMP, low back pain, treatment, cognitive behavioural therapy (CBT), exposure, clinical trial, pain-related fear, avoidance, kinesiophobia,*

acceptance and commitment therapy (ACT). Studies were also identified from bibliographies of retrieved articles and existing reviews on treating CMP (i.e. Asmundson & Carleton, 2008; Lohnberg, 2007; McCracken, Carson, Eccleston, & Keefe, 2004). In addition, major authors in the topic field (i.e. Maaike Leeuw, Johan Vlaeyen, Steven Linton, Katja Boursma, Lance McCracken) were contacted directly via e-mail to elicit information about any studies that they may have recently completed, currently had in press, or submitted to a peer-reviewed journal.

Data were abstracted on the key variables of study design, sample size, types of treatment, type of control group, measurement schedule, definition of improvement, as well as number and duration of treatments. The studies were evaluated based on outcomes for fear of pain, pain-related catastrophizing, avoidance behaviour, kinesiophobia, pain severity, and disability. The outcome variables for each study were assessed as positive (i.e. outcomes for the treatment group were better than the outcomes for the control or comparison treatment group), equivocal (i.e. there was a trend effect that was not statistically significant), or negative (i.e. outcomes for the control or comparison treatment group were better than for the treatment group). Trend effects for comparison or control groups were not taken into consideration when assessing treatment outcomes, because very few studies reported such trends. The diversity of the study designs precluded robust use of a meta-analytic review technique (Sutton, Jones, Abrams, Sheldon, & Song, 2000); accordingly, the current review involved narrative assessment and simple frequency quantification of the available evidence to date.

Results and discussion

Study designs and schedules

The search identified 17 studies, including eight randomized clinical trials (RCTs), eight replicated single-case studies, and one case study, that comprised a total of 1,250 participants (Table 1). The non-RCT studies reported relatively high dropout rates: 126 of the 444 (28.4%) participants did not complete the final outcome measures. The RCTs reported slightly lower dropout rates than the non-RCT studies: 174 of the 806 (21.6%) participants dropped out at various points in the investigations and did not complete the final outcome measures. GivE was used as a treatment in nine of the studies, involving a total of 246 participants, of whom 96 (39%) dropped out. ACT was used as a treatment in four of the studies and involved a total of 375 participants, of whom 107 (28.5%) dropped out. The remaining four studies used the mixed CBT treatment protocols and involved a total of 629 participants, of whom 97 (15%) dropped out. Many of the studies did not cite the reasons for participant attrition; however, two of the GivE studies (Leeuw et al., 2008; Linton et al., 2008) reported the most common reasons for participant attrition as too little motivation and feeling that the treatment was too psychological (i.e. failed to provide a sufficient biomedical explanations of pain). Overall, GivE may be more susceptible to participant dropout. Table 1 provides a comparison of the studies on their treatment and measurement schedules as well as on designs and treatments.

Participant characteristics

The average age of participants was 43.7 years (GivE treatment, 44.2 years; mixed-CBT patients, 40.6 years; ACT patients, 47.6 years; Table 2). Participants in the different treatment groups did not differ significantly in age, $F(2, 14) = 3.52$, $p = .06$. Overall, 59.5% of participants were female (GivE treatments, 54.4%; mixed-CBT studies, 60.8%; ACT studies, 69%). The gender distribution did not differ significantly among any of the treatment types, $F(2, 13) = 1.22$, $p = .33$. The mean duration of pain by participants in all studies was 95.3 months (GivE participants, 98 months; mixed-CBT participants, 83 months; ACT participants, 107 months). Like age and gender distribution, no significant differences existed for the length of pain duration among participants in the different treatment types, $F(2, 8) = 0.32$, $p = .76$. Regarding participants' anatomical pain locations, 14 of the 17 studies identified the back or the low back as the primary area of pain. Of the three remaining studies, two had participants with pain localized in the neck resulting from whiplash disorder (de Jong et al., 2008; Wicksell, Ahlqvist, Bring, Melin,

Table 1. *Measurement and treatment schedules by study, treatment type, and design*

Study	Tx type	Design	*N*	Dropout *n* (%)	Baseline period (weeks)	F-U (mos)	No. Tx sessions	Tx period (weeks)	Total Tx hours
Vlaeyen, de Jong, Sieben, & Crombez (2002)	GivE	Case study	2	0	1	NA	18	6	18
Boersma et al. (2004)	GivE	Multiple baseline	6	0	10	3	0	4	NA
Linton et al. (2008)	GivE	RCT	46	20 (44%)	3	3	14	14	0
Woods & Asmundson (2008)	GivE	RCT	83	39 (47%)	0	1	8	4	6
Leeuw et al. (2008)	GivE	RCT	85	37 (44%)	0	6	21	NA	21
Vlaeyen, de Jong, Geilen, et al. (2002)	GivE	Replicated single Case	6	0	4	12	NA	12	NA
Vlaeyen et al. (2001)	GivE	Replicated single case	4	0	3	NA	NA	3	NA
de Jong et al. (2005)	GivE	Replicated single case	6	0	3	6	NA	7	28
de Jong et al. (2008)	GivE	Replicated single case	8	0	2	6	12	6	12
Spinhoven et al. (2004)	Mixed CBT	RCT	148	46 (31%)	2	12	24	10	132
Linton & Ryberg (2001)	Mixed CBT	RCT	175	13 (7%)	0	12	6	6	12
Smeets et al. (2006)	Mixed CBT	RCT	223	12 (5%)	0	NA	30	10	52.5
Woby et al. (2004)	Mixed CBT	Repeated measures	83	26 (31%)	0	NA	5	8	17.5
Wicksell et al., 2008	ACT	RCT	22	2 (9%)	1	4	10	8	10
Dahl et al. (2004)	ACT	RCT	24	5 (21%)	24	6	4	4	4
McCracken et al. (2005)	ACT	Repeated measures	142	84 (59%)	16	3	15	4	90
Vowles et al. (2008)	ACT	Repeated measures	187	16 (9%)	0	3	15	4	97.5

Note. *GivE = graded in vivo exposure; CBT = cognitive behavioural therapy; ACT = acceptance and commitment therapy; RCT = randomized control trial; F-U = follow-up.*

Table 2. *Participant characteristics by study and treatment type*

Study	Tx	Duration of pain (mos)[a]	*N*	Gender	Age[a]	Site of pain
Vlaeyen, de Jong, Sieben, & Crombez (2002)	GivE	NA	2	50% female	47.5 (54)	50% low back, extremities
Boersma et al. (2004)	GivE	123 (95.3)	6	NA	48.2 (11.0)	100% back pain
Linton et al. (2008)	GivE	NA[b]	46	54% female	47.9 (8.2)	76.5% low back
Woods & Asmundson (2008)	GivE	NA	83	49% female	45.2 (10.9)	Low back
Leeuw et al. (2008)	GivE	108 (112.8)	85	48% female	45.3 (9.45)	Back
Vlaeyen, de Jong, Geilen, et al. (2002)	GivE	NA	6	67% female	39.8 (8.6)	Low back
Vlaeyen et al. (2001)	GivE	117 (83.4)	4	75% female	35 (3.7)	75% low back
de Jong et al. (2005)	GivE	NA	6	NA	NA	Low back
de Jong et al. (2008)	GivE	44.4 (NA)	8	38% female	45 (10.3)	Neck
Spinhoven et al. (2004)	Mixed CBT	117.6 (104.4)	148	64% female	39.8 (9.1)	Low back
Linton & Ryberg (2001)	Mixed CBT	NA	175	59% female	40.3 (3.2)	Spinal/back
Smeets et al. (2006)	Mixed CBT	57.5 (73.2)	211*	47% female	41.8 (9.9)	Low back
Woby et al. (2004)	Mixed CBT	75.6 (85.2)	83	45% female	41.1 (10)	Low back
Dahl et al. (2004)	ACT	NA	19*	89% female	40 (13.2)	NA
McCracken et al. (2005)	ACT	132.5 (127.8)	108*	64% female	44 (10.7)	49.5% low back
Vowles et al. (2008)	ACT	NA	187	64% female	47.3 (11.4)	47.5% low back
Wicksell et al. (2008)	ACT	83 (41.7)	22	80% female	51.65 (9.5)	Neck

Note. *GivE = graded in vivo exposure; CBT = mixed cognitive behavioural treatment protocols; ACT = acceptance and commitment therapy; RCT = randomized control trial; NA = not available.*
[a]Values represent mean ± standard deviation. [b]Mean and standard deviation not reported, but it was reported that 83% of participants had pain for more than 12 months. [c]Number of completers of all measures in the study.

& Olsson, 2008) and one did not specify a pain location (Dahl et al., 2004). Participant characteristics (e.g. gender distribution, age, and anatomical location of pain) from each study are presented in Table 2.

Outcome measures

Definitions of significant improvement varied across all of the studies; however, six of the studies explicitly define clinical improvement for the participant (Table 3). The remaining studies used statistically significant improvements based on self-report outcome measures as indicators of improvement. Several different outcome measures were used across the studies. A breakdown of measures and a brief overview of those most commonly used to measure each outcome are presented in Table 3. Specifically, fear of movement was measured using the Tampa Kinesio phobia Scale (TSK; Miller, Kori, & Todd, 1991), perceived harm using the Photographic Series of Daily Activities (PHODA[1]; Kugler, Wijn, Geilen, de Jong, & Vlaeyen, 1999), disability using the Roland Disability Questionnaire (RDQ; Roland & Morris, 1983), pain severity using the McGill Pain Questionnaire–Short Form (MPQ-SF; Melzack, 1987), fear of pain using both the Fear Avoidance Beliefs Questionnaire (Waddell et al., 1993) and the Pain Anxiety Symptoms Scale (PASS-20; McCracken et al., 1992), catastrophizing using the Pain Catastrophizing Scale (PCS; Sullivan, Bishop, & Pivik, 1995), and depression using the Beck Depression Inventory (Beck, Rush, Shaw, & Emery, 1979). Some studies measured catastrophizing and fear of pain daily (e.g. de Jong et al., 2005; Vlaeyen et al., 2001) using an 11-item scale derived from the TSK, PASS-20, and PCS (Vlaeyen et al., 2001).

The aforementioned measures were used most frequently in the studies; however, there were several measures that were used less frequently; for example, the Hospital Anxiety and Depression Index (Snaith & Zigmond, 2000), Orebro Musculoskeletal Pain Screening Questionnaire (Linton & Hallden, 1998), and Chronic Pain Acceptance Questionnaire (Geiser, 1992). Because of the large number of different but less frequently used measures, comprehensive descriptions of each have not been included in this review.

Outcomes and study contexts

The outcomes of all 17 studies are presented in Table 4, sorted first by treatment group and then by comparison group. Only five of the studies explicitly excluded participants on the basis of ongoing litigation or compensation for injury (Dahl et al., 2004; Leeuw et al., 2008; McCracken, Vowles, & Eccleston, 2005; Spinhoven et al., 2004; Woods & Asmundson, 2008); compensation status and participant involvement in litigation were not mentioned in any of the other studies. Given the potential importance of the treatment setting for CMP patients (e.g. provision of secondary vs. tertiary care), the results of the literature review have also been delineated based on the clinical context of the study. The outcomes of all available studies are numerous and complex (see Table 4).

Generally, it appears that GivE and ACT may both be more effective than wait-list or GA in improving disability and reducing fear of pain. GivE was generally more successful than a wait-list GA in reducing fear of pain, fear of movement/reinjury, pain-related catastrophizing, perceived harm, and disability (e.g. Boersma et al., 2004; de Jong et al., 2005, 2008; Vlaeyen, de Jong, Geilen, Heuts, & van Breukelen, 2002). GivE was also marginally more effective for reducing pain severity than wait-list or GA (Boersma et al., 2004; de Jong et al., 2005; Vlaeyen, de Jong, Geilen, et al., 2002; Vlaeyen, de Jong, Sieben, & Crombez, 2002; Woods & Asmundson, 2008). In addition, ACT was proven effective in reducing pain intensity or disability in all (McCracken et al., 2005; Vowles & McCracken, 2008; Wicksell et al., 2008) of the studies reviewed. ACT also proved to be effective in reducing fear of pain in two studies (McCracken et al., 2005; Vowles & McCracken, 2008); however, results from the ACT studies need to be interpreted with caution because only three of the studies used a formal comparison group.

Both GivE and ACT appear to be effective additions relative to treatment as usual (TAU). Nonetheless, many of the studies reviewed either added the treatment protocol to TAU at an inpatient clinic (e.g. Linton et al., 2008; Vowles & McCracken, 2008; Woby, Watson, Roach, & Urmston, 2004; Woods & Asmundson, 2008) or did not restrict the participants from seeking TAU while the

Table 3. *Most commonly used outcome measures by study*

Study	TSK	RDQ	PHODA	MPQ-SF	FABQ	PASS-20	PCS	BDI	Other
Boersma et al. (2004)	X[1]		X[2]						
Dahl et al. (2004)									
de Jong et al. (2005)	X[2]	X[3]	X[3]						X[4]
de Jong et al. (2008)	X[2]						X		X[6]
Leeuw et al. (2008)			X	X			X		
Linton & Ryberg (2001)	X						X		
Linton et al. (2008)	X		X				X		
McCracken et al. (2005)						X		X	X[7]
Smeets et al. (2006)		X						X	
Spinhoven et al. (2004)				X				X	
Vlaeyen et al. (2001)	X[2]	X[4]	X[3]						X[4]
Vlaeyen, de Jong, Geilen, et al. (2002)	X[2]	X[4]	X						X[4]
Vlaeyen, de Jong, Sieben, & Crombez (2002)	X	X	X						
Vowles et al. (2008)							X		X[7]
Wicksell et al. (2008)	X								X
Woby et al. (2004)					X				
Woods & Asmundson (2008)	X[5]			X	X	X	X		

Note. *Improvement on all measures was defined as a statistically significant difference from pretest to posttest unless otherwise noted by superscript and therein alternatively specified by the researchers:* [1]*Improvement defined as a 30th percentile decrease from pre- to posttest;* [2]*improvement defined as a 50% decrease from pre- to posttest;* [3]*improvement defined as a decrease of 5 from pre- to posttest;* [4]*an 11-item scale was derived from the items in the TSK, PASS, and PCS;* [5]*improvement defined as a posttreatment score that falls 2* SD*s outside the mean;* [6]*A 14-item scale derived from items in the TSK, PASS, and PCS and personal functional goals;* [7]*Physical performance measures of function. TSK = Tampa Scale for Kinesiophobia; RDQ = Roland Disability Questionnaire; PHODA = Photographic Series of Daily Activities; MPQ-SF = McGill Pain Questionnaire–Short Form; FABQ = Fear Avoidance Beliefs Questionnaire; PASS-20 = Pain Anxiety Symptoms Scale; PCS = Pain Catastrophizing Scale; BDI = Beck Depression Inventory.*

Table 4. *Outcomes by study, treatment type, comparison group, and context*

Study	Comparison group	Context	Design	Fear of pain	Catastrophizing	Perceived harm	Fear of movement/ re-injury	Pain level/ intensity	Disability
GivE treatment									
de Jong et al. (2005)	Ed	Outpatient, other	SC	+	+	+	+	+	+
Woods & Asmundson (2008)	GA	Multi-disciplinary Rehab	RCT	+	=	NA	+	=	=
Leeuw et al. (2008)	GA	Outpatient w/o other	RCT	NA	+	+	NA	=	=
Vlaeyen, de Jong, Geilen, et al. (2002)	GA	Outpatient, other	SC	+		+	+	+	+
Vlaeyen et al. (2001)	GA	Outpatient, other	SC	+	+	+	+	NA	+
de Jong et al. (2005)	GA	Outpatient, other	SC	+	+	+	+	+	=
de Jong et al. (2008)	GA	Outpatient, other	SC	+	+	NA	+	+	+
Vlaeyen, de Jong, Sieben, & Crombez (2002)	None	Multi-disciplinary rehab	CS	+	NA	+	+	+	+
Boersma et al. (2004)	WL	Outpatient, other	MB	+	+	+	+	+	+
Linton et al. (2008)	WL	Multi-disciplinary Rehab	RCT	+	=	NA	=	=	+
Woods & Asmundson (2008)	WL	Multi-disciplinary Rehab	RCT	+	+	NA	+	+	=
CBT treatment									
Smeets et al. (2006)	Combined (PT, CBT)	Outpatient w/o other	RCT	NA	=	NA	NA	=	=
Woby et al. (2004)	None	Multi-disciplinary Rehab	SC	NA	+	NA	+	=	+
Smeets et al. (2006)	PT	Outpatient w/o other	RCT	NA	+	NA	NA	+	+
Linton & Ryberg (2001)	TAU	Outpatient, other	RCT	+	=	NA	=	+	NA

Table 4. *Continued*

Study	Comparison group	Context	Design	Fear of pain	Catastrophizing	Perceived harm	Fear of movement/ re-injury	Pain level/ intensity	Disability
Smeets et al. (2006)	WL	Outpatient w/o other	RCT	NA	=	NA	NA	=	=
Spinhoven et al. (2004)	WL	Inpatient							
w/o other	RCT	NA	+	NA	NA	=	NA		
ACT treatment									
Vowles et al. (2008)	None	Multi-disci-plinary Rehab	SC	+	NA	NA	NA	+	+
Wicksell et al. (2008)	TAU	Outpatient w/o other	RCT	NA	NA	NA	+	=	+
Dahl et al. (2004)	TAU	Work site or home	RCT	NA	NA	NA	NA	=	=
McCracken et al. (2005)	WL	Outpatient, other	SC	+	NA	NA	NA	+	+

Note. *MDT = multidisciplinary treatment with amitriptyline; outpatient, other = treatment administered at outpatient clinic and participants not restricted from seeking other treatment simultaneously; outpatient w/o other = treatment administered at outpatient clinic and participants restricted from seeking other treatment simultaneously; multidisciplinary rehab = treatment administered at multidisciplinary rehabilitation centre where participants received treatment as usual (TAU) in addition to the treatment in the study; SC = single-case design; RCT = randomized control trial; CS = case study; MB = multiple baseline design; PT = ; CBT = cognitive behavioural therapy; WL = wait-list; GA = graded activity; Ed = education; NA = not available. A " + " indicates that outcomes for treatment group were superior to those for comparison or control; " = " indicates that there was a trend favoring the treatment group but it was not statistically significant.*

study was underway (e.g. Boersma et al., 2004; de Jong et al., 2005; Linton & Ryberg, 2001; McCracken et al., 2005; Wicksell et al., 2008). This suggests that the independent effectiveness of all protocols remains to be assessed; however, all the protocols and TAU do appear to additively reduce pathology.

The results for the mixed CBT protocols offer less conclusive results; for example, the four mixed-treatment protocol studies reported an equal number of positive (Smeets, Vlaeyen, Kester, & Knottnerus, 2006; Woby et al., 2004) and equivocal (Linton & Ryberg, 2001; Smeets et al., 2006) findings for reducing catastrophizing, fear of movement/reinjury, and disability. Results of these studies suggest that the mixed-treatment protocols are likely not superior to wait-list or to a combination of physical and cognitive therapy in reducing participants' pain intensity.

GivE and ACT appear to be the most effective treatments for fear of pain, disability, and pain intensity, but GivE offers the most promising outcomes for reducing pain-related catastrophizing. There were too few studies to garner statistically significant comparisons between treatment hours needed for GivE (range = 6–28 hr, $M = 17$, $SD = 8.43$) versus ACT (range = 4–98 hr, $M = 50.38$, $SD = 50.24$). The current results are preliminary and suggest that GivE may require fewer treatment sessions than ACT; however, as noted, participant dropout rates may be higher for the GivE treatment protocol.

The equivocal results reported by researchers using either GivE or ACT protocols produce questions about how different cognitive changes serve to derail the underlying mechanisms maintaining CMP. ACT and GivE are both, at least according to some theorists (e.g. Hofmann & Asmundson, 2008), based on cognitive behavioural principles, but they function to change behaviour in different ways. For example, GivE identifies fear and avoidance beliefs regarding pain and activity and then actively challenges those beliefs so they can be disconfirmed. In contrast, ACT identifies negative cognitions and encourages the client to foster an accepting posture toward them. Both protocols encourage repeated exposure to previously feared painful activities, and it may be this exposure that is responsible for comparable outcomes; however, dismantling studies are needed to confirm this speculation. Practitioners treating people with CMP should recognize the potential benefits and drawbacks of both GivE and ACT. For example, GivE may at times be less appropriate because the exposure exercises might affirm painful expectations; some exposure exercises may cause the patient pain, which may be taken as evidence to justify their fear and avoidance of the movement. In contrast, ACT may, at times, be less appropriate because it may serve to affirm the inevitability of the pain. In any case, despite their differences, both of these approaches have evidence of efficacy for reducing the fear and avoidance as well as disability associated with CMP.

Limitations

Limitations of this review warrant consideration. First, the review is limited to published studies written in English. Second, it is possible that some completed studies were not indexed in either PsycINFO or PubMed or identified by contacting experts in the field. Third, a robust meta-analysis was not possible given the considerable inconsistency in protocols, dependent measures, and independent measures across all of the available studies to date (Sutton et al., 2000). The inability to perform a robust meta-analysis restricted the review to frequency data. Finally, the current review was limited to adult treatment studies. The two published treatment studies investigating fear of pain in adolescents (Wicksell et al., 2007; Wicksell, Melin, Lekander, & Olsson, 2009) were purposely excluded because of potential differences between adult and child/adolescent pain. Future research should expand the available data and further explore differences based on age.

There are also broad limitations within the contexts of the current extant literature that span most of the studies reviewed. These limitations involve study design and sample selection. Regarding study design, there have been few RCTs conducted to date; in particular, only Wicksell et al. (2008), Woods and Asmundson (2008), Leeuw et al. (2008), Linton and colleagues (2001, 2008), Smeets et al. (2006), Spinhoven et al. (2004), and Dahl et al. (2004) have used an RCT design. Many of the studies have utilized replicated single-case experimental designs, possibly in an effort

to accommodate the time-consuming and costly treatment that participants were administered. The single-case experimental design is useful in generalizing results to comparable clinical settings and paving the way for larger-scale trials (Onghena & Edgington, 2005); however, problems associated with internal validity (e.g. differential carryover) can make it difficult or impossible to compare results with other studies, such as RCTs. Additional RCTs are clearly warranted, not only within each of the treatments protocols but between them.

Regarding sample size, there is an apparent geo-cultural selection bias for specific countries researching treatment options for fear of pain in patients with CMP. Most of the available research was conducted in the Netherlands, Sweden, and the United Kingdom. Indeed, among the GivE articles, most research has been conducted in one of two clinics located in the Netherlands and Sweden; only one study was conducted in North America. Placing aside questions regarding the general paucity of research from other countries, most of which have comparable epidemiological reports of CMP (Breivik, Collett, Ventafridda, Cohen, & Gallacher, 2006; Hadjistavropoulos & Craig, 2004), there may be issues of cultural differences that need to be addressed. For example, most of the countries conducting research on treatment options for fear of pain in patients with CMP have comprehensive health care systems that include coverage for CBT protocols where applicable (e.g. Netherlands, Sweden). In such countries, patients from all socioeconomic backgrounds can readily access care that includes psychotherapeutic protocols. Potentially more important is that these same countries do not rely on insurance models for psychology-augmented multidisciplinary health care. Accordingly, concerns about litigation and secondary gain are simply not applicable. In contrast, citizens of Canada and of the United States must pay or rely on insurance agencies for such comprehensive treatment. These substantial differences in government policy underscore the need for additional research throughout North America. Notwithstanding, it is encouraging that the outcomes of the GivE RCTs conducted in the Netherlands, Sweden, and Canada are comparable.

Future directions

The growing research into treatments protocols for fear of pain and reinjury in CMP (i.e. several single-case experimental designs and two well-designed RCTs) now provides sufficient evidence to warrant funding of larger and increasingly diverse RCT studies. These subsequent studies should support an increasingly comprehensive evidence base for the utility of treatment protocols for fear of pain and reinjury in CMP. Such studies will also help to resolve questions about the comparative and independent benefits of GivE and ACT, relative to TAU, in a variety of socioeconomic settings. In particular, differences between cultures with and without comprehensive health care coverage can be elucidated and made available for policy-makers internationally. Although both GivE and ACT may be beneficial treatments, whether one of these treatments is more effective than the other, and what aspects are more effective, remains to be determined. RCTs directly comparing GivE and ACT are needed to determine whether one treatment is superior to the other, and dismantling treatment studies for fear of pain and reinjury in CMP (e.g. Resick et al., 2008) may help determine what aspects of GivE and ACT are most effective. Results of such investigations will ultimately help clinicians to design more efficient and effective treatment protocols.

New technologies can also be used to provide a multiple-measurement domain perspective for patients with fear of pain and reinjury who have CMP. For example, functional magnetic resonance imaging and Medoc thermal sensory analyzers (TSAs) have been used to test pain thresholds and compare subjective pain intensities across different groups (Defrin et al., 2008; Geuze et al., 2007); however, there is a paucity of basic research exploring the neural pathways involved in the fear of pain. Use of technologies like the ones offered by Medoc's TSAs may allow pain researchers to study fear of pain in the laboratory with increasingly sophisticated and controlled designs.

Subsequent comprehensive studies should also consider clearly stating definitions of improvement for participants. Ideally, the measures will include a set of standard

self-report measures for fear of pain as well as a generally comparable measure of functional physical deficit (e.g. see Carleton, Kachur, Abrams, & Asmundson, 2008). Lists of commonly used self-report measures assessing fear of pain and related constructs are available (e.g. Asmundson & Carleton, 2008; Leeuw, Goossens, Linton, et al., 2007; McNeil & Vowles, 2004) and may serve as a starting point for pain researchers to come to a consensus on a set of standardized measures. At a minimum, a comprehensive battery might include the PASS-20, the Anxiety Sensitivity Index (ASI), the TSK, and the MPQ-SF. Injury-specific disability measures (e.g. the RDQ) might also be included and, where possible, a standardized measure of functional deficit (Carleton, Kachur, Abrams, & Asmundson, 2009). Recent research has provided normative data on many of these common self-report measures (e.g. Nicholas, Asghari, & Blyth, 2008). Ideally, future research efforts may target empirical identification of the measures that provide maximal information with minimal overlap.

A final consideration for future research involves the outcome of interest in CMP treatment research based on a fear-anxiety-avoidance model. Many of the studies reviewed conceptualized and identified a primary dependent variable but then focused treatment on reducing or improving a different variable. For example, pain severity and disability were often cited as the primary dependent variable in GivE treatments, whereas fear-avoidance beliefs and pain catastrophizing were targeted in treatment. Similarly, quality of life was often cited as the primary dependent variable in ACT treatments, whereas fear of pain and acceptance of pain were targeted in treatment. Based on the successful reductions in disability, the discrepancy between the target dependent variables and treatment targets appears to be relatively unimportant. Accordingly, the treatment goals appear to be functional (i.e. reducing disability) rather than symptomatic (i.e. reducing pain), and these goals can be achieved by targeting the process variables involved in the experience of pain (i.e. catastrophizing, acceptance of pain). Longitudinal research is required to determine why function recovery follows a reduction in fear of pain. Moreover, researchers need to determine whether pain experienced after functional gains have been made is experienced comparably at all levels of the hierarchy or only at maximal levels; that is, after the hierarchy is completed, does the first step cause the same amount of pain as the last step? A participant in the GivE study by de Jong et al. (2005) reported that he had learned his fears of reinjury were irrational and that his avoidance of certain activities in the past were unfounded, yet he still found himself automatically choosing to avoid activities. As with most psychological schemas, changing pain-related attitudes and beliefs is a complex process, and the speed at which an attitude changes does not necessarily correspond to the speed at which behaviour change occurs (de Jong et al., 2005).

Conclusion

The present study is the first to review treatment outcome investigations targeting fear of pain and reinjury in people with CMP. The review suggests that GivE and ACT are promising interventions for reducing fear of pain, catastrophizing, and fear of movement as well as improving pain severity and disability. Additional RCTs are necessary to evaluate fear of pain and reinjury and treatment outcomes across more generalizable samples. In particular, future research should explore a variety of cultural contexts to determine the impact that different health care systems may have on treatment outcomes. Given global health care resource constraints, it will also be prudent to determine the most poignant and palatable treatment protocols and components. Replication and extension of existing epidemiological and clinical studies are warranted and will likely provide important contributions to this emerging area of research.

Acknowledgments

This work was supported by Canadian Institutes of Health Research Grants FRN 63186 and 80455 and by NWO Social Sciences Research Council of the Netherlands Innovational Grant 453-04-003.

Note

1. An online version of the PHODA can be downloaded at http://www.psychology.unimaas.nl/phoda-sev/ (Leeuw, Goossens, van Breukelen, Boersma, & Vlaeyen, 2007).

References

Asmundson, G. J. G., & Carleton, R. N. (2008). Fear of pain. In M. M. Antony & M. B. Stein (Eds.), *Handbook of anxiety and the anxiety disorders* (pp. 551–561). New York: Oxford University Press.

Asmundson, G. J. G., Coons, M. J., Taylor, S., & Katz, J. (2002). PTSD and the experience of pain: Research and clinical implications of shared vulnerability and mutual maintenance models. *Canadian Journal of Psychiatry*, *47*, 930–937.

Asmundson, G. J. G., Norton, P. J., & Norton, G. R. (1999). Beyond pain: The role of fear and avoidance in chronicity. *Clinical Psychology Review*, *19*, 97–119.

Asmundson, G. J. G., Vlaeyen, J. W. S., & Crombez, G. (Eds.). (2004). *Understanding and treating fear of pain*. Oxford, UK: Oxford University Press.

Barlow, D. H. (2002). *Anxiety and its disorders* (2nd ed.). New York: Guilford Press.

Beck, A. T., Rush, A. J., Shaw, B. F., & Emery, G. (1979). *Cognitive therapy of depression*. New York: Guilford Press.

Blyth, F. M., March, L. M., Brnabic, A. J. M., Jorm, L. R., Williamson, M., & Cousins, M. J. (2001). Chronic pain in Australia: A prevalence study. *Pain*, *89*, 127–134.

Boersma, K., Linton, S., Overmeer, T., Jansson, M., Vlaeyen, J., & de Jong, J. (2004). Lowering fear-avoidance and enhancing function through exposure in vivo: A multiple baseline study across six patients with back pain. *Pain*, *108*, 8–16.

Bonica, J. J. (1990). Evolution and current status of pain programs. *Journal of Pain and Symptom Management*, *5*, 368–374.

Breivik, H., Collett, B., Ventafridda, V., Cohen, R., & Gallacher, D. (2006). Survey of chronic pain in Europe: Prevalence, impact on daily life, and treatment. *European Journal of Pain*, *10*, 287–333.

Burns, T. L., & Ineck, J. R. (2006). Cannabinoid analgesia as a potential new therapeutic option in the treatment of chronic pain. *Pain Management*, *40*, 251–260.

Carleton, R. N., Abrams, M. P., Kachur, S. S., & Asmundson, G. J. G. (in press). Waddell's symptoms as correlates of vulnerabilities associated with fear-anxiety-avoidance models of pain: Pain-related anxiety, catastrophic thinking, perceived disability, and treatment outcome. *Journal of Occupational Rehabilitation*.

Carleton, R. N., & Asmundson, G. J. G. (2009). The multidimensionality of fear: Construct independence for the Fear of Pain Questionnaire–Short Form and the Pain Anxiety Symptoms Scale-20. *Journal of Pain*, *10*, 29–37.

Carleton, R. N., Kachur, S. S., Abrams, M. P., & Asmundson, G. J. G. (2009). Waddell's symptoms as indicators of psychological distress, perceived disability, and treatment outcome. *Journal of Occupational Rehabilitation*, *19*, 41–48.

Chamberlin, K. W., Cottle, M., Neville, R., & Tan, J. (2007). Oral oxymorphone for pain management. *Annals of Pharmacotherapy*, *41*, 1144–1152.

Craske, M. G., Kircanski, K., Zelikowsky, M., Mystkowski, J., Chowdhury, N., & Baker, A. (2008). Optimizing inhibitory learning during exposure therapy. *Behaviour Research and Therapy*, *46*, 5–27.

Critchley, D. J., Ratcliffe, J., Noonan, S., Jones, R. H., & Hurley, M. V. (2007). Effectiveness and cost-effectiveness of three types of physiotherapy used to reduce chronic low back pain disability. *Spine*, *32*, 1474–1481.

Crombez, G., Eccleston, C., Vlaeyen, J. W., Vansteenwegen, D., Lysens, R., & Eelen, P. (2002). Exposure to physical movements in low back pain patients: Restricted effects of generalization. *Health Psychology*, *21*, 573–578.

Dahl, J., Wilson, K. G., & Nilsson, A. (2004). Acceptance and commitment therapy and the treatment of persons at risk for long-term disability resulting from stress and pain symptoms: A preliminary randomized trial. *Behavior Therapy*, *35*, 785–801.

de Jong, J. R., Vangronsveld, K., Peters, M. L., Goossens, M. E. J. B., Onghena, P., Bulte, I., & Vlaeyen, J. W. S. (2008). Reduction of pain-related fear and disability in post-traumatic neck pain: A replicated single-case experimental study of exposure in vivo. *Journal of Pain*, *9*, 1123–1134.

de Jong, J. R., Vlaeyen, J. W. S., Onghena, P., Goossens, M. E. J. B., Geilen, M., & Mulder, H. (2005). Fear of movement/(re)injury in chronic low back pain: Education or exposure in vivo as mediator to fear reduction? *Clinical Journal of Pain*, *21*, 9–17.

Defrin, R., Ginzburg, K., Solomon, Z., Polad, E., Bloch, M., Govezensky, M., & Schreiber, S. (2008). Quantitative testing of pain perception in subjects with PTSD: Implications for the mechanism of the coexistence between PTSD and chronic pain. *Pain*, *138*, 450–459.

Fordyce, W. E. (1976). *Behavioral methods for chronic pain and illness*. St. Louis, MO: Mosby.

Fritz, J., Niemeyer, T., Clasen, S., Wiskirchen, J., Tepe, G., Kastler, B., et al. (2007). Management of chronic low back pain: Rationales, principles, and targets of imaging-guided spinal injections. *RadioGraphics*, *27*, 1751–1771.

Gatchel, R. J. (2004). Comorbidity of chronic pain and mental health: The biopsychosocial perspective. *American Psychologist*, *59*, 792–794.

Geiser, D. S. (1992). *A comparison of acceptance-focused and control-focused psychological treatments in a chronic pain treatment center*.

Unpublished doctoral dissertation, University of Nevada, Reno.

Geuze, E., Westenberg, H. G. M., Jochims, A., de Kloet, C., Bohus, M., Vermetten, E., & Schmahl, C. (2007). Altered pain processing in veterans with posttraumatic stress disorder. *Archives of General Psychiatry*, *64*, 76–85.

Goubert, L., Crombez, G., Van Damme, S., Vlaeyen, J. W. S., Bijttebier, P., & Roelofs, J. (2004). Confirmatory factor analysis of the Tampa Scale for Kinesiophobia: Invariant two-factor model across low back pain patients and fibromyalgia patients. *Clinical Journal of Pain*, *20*, 103–110.

Hadjistavropoulos, T., & Craig, K. D. (Eds.). (2004). *Pain: Psychological perspectives*. Mahwah, NJ: Erlbaum.

Hadjistavropoulos, T., Martin, R. R., Sharpe, D., Lints, A. C., McCreary, D. R., & Asmundson, G. J. G. (2007). A longitudinal investigation of fear of falling, fear of pain, and activity avoidance in community-dwelling older adults. *Journal of Aging and Health*, *19*, 965–984.

Hayes, S. C. (2004). Acceptance and commitment therapy, relational frame theory and the third wave of behavioural and cognitive therapies. *Behaviour Therapy*, *35*, 639–665.

Hayes, S. C., & Duckworth, M. P. (2006). Acceptance and commitment therapy and traditional cognitive behavioral therapy approaches to pain. *Cognitive and Behavioral Practice*, *13*, 185–187.

Hofmann, S. J., & Asmundson, G. J. G. (2008). Acceptance and commitment therapy: Old wave or new hat? *Clinical Psychology Review*, *28*, 1–16.

Hogg, R. C. (2006). Novel approaches to pain relief using venom-derived peptides. *Current Medicinal Chemistry*, *13*, 3191–3201.

International Association for the Study of Pain. (1986). Classification of chronic pain: Descriptions of chronic pain syndromes and definitions of pain terms. *Pain*, *3*(Suppl.), S1–S226.

Kugler, K., Wijn, J., Geilen, M., de Jong, J., & Vlaeyen, J. W. S. (1999). *The Photograph Series of Daily Activities (PHODA)*. The Netherlands: Heerlen.

Leeuw, M., Goossens, M. E. J. B., Linton, S. J., Crombez, G., Boersma, K., & Vlaeyen, J. W. S. (2007). The fear-avoidance model of musculoskeletal pain: Current state of scientific evidence. *Journal of Behavioral Medicine*, *30*, 77–94.

Leeuw, M., Goossens, M. E., van Breukelen, G. J., Boersma, K., & Vlaeyen, J. W. S. (2007). Measuring perceived harmfulness of physical activities in patients with chronic low back pain: The Photograph Series of Daily Activities–short electronic version. *Journal of Pain*, *8*, 840–849.

Leeuw, M., Goossens, M. E. J. B., van Breukelen, G. J. P., de Jong, J. R., Heuts, P. H. T. G., Smeets, R. J. E. M., et al. (2008). Exposure in vivo versus operant graded activity in chronic low back pain patients: Results of a randomized controlled trial. *Pain*, *138*, 192–207.

Linton, S. J., Boersma, K., Jansson, M., Overmeer, T., Lindblom, K., & Vlaeyen, J. W. S. (2008). A randomized controlled trial of exposure in vivo for patients with spinal pain reporting fear of work-related activities. *European Journal of Pain*, *12*, 722–730.

Linton, S. J., & Hallden, K. (1998). Can we screen for problematic back pain? A screening questionnaire for predicting outcome in acute and subacute back pain. *Clinical Journal of Pain*, *14*, 209–215.

Linton, S. J., & Ryberg, M. (2001). A cognitive-behavioral group intervention as prevention for persistent neck and back pain in a non-patient population: A randomized controlled trial. *Pain*, *90*, 83–90.

Lohnberg, J. A. (2007). A review of outcome studies on cognitive behavioral therapy for reducing fear avoidance beliefs among individuals with chronic pain. *Journal of Clinical Psychology in Medical Settings*, *14*, 113–122.

McCracken, L. M., Carson, J. W., Eccleston, C., & Keefe, F. J. (2004). Acceptance and change in the context of chronic pain. *Pain*, *109*, 4–7.

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

McCracken, L. M., Zayfert, C., & Gross, R. T. (1992). The Pain Anxiety Symptom Scale: Development and validation of a scale to measure fear of pain. *Pain*, *50*, 67–73.

McNeil, D. W., & Vowles, K. E. (2004). Assessment of fear and anxiety associated with pain: Conceptualization, methods, and measures. In G. J. G. Asmundson, J. W. S. Vlaeyen, & G. Crombez (Eds.), *Understanding and treating fear of pain* (pp. 198–211). Oxford, UK: Oxford University Press.

McWilliams, L. A., Cox, B. J., & Enns, M. W. (2003). Mood and anxiety disorders associated with chronic pain: An examination in a nationally representative sample. *Pain*, *106*, 127–133.

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

Melzack, R., & Wall, P. D. (1965). Pain mechanisms: A new theory. *Science*, *150*, 971–979.

Miller, R. P., Kori, S. H., & Todd, D. D. (1991). *The Tampa Scale*. Unpublished manuscript.

Nicholas, M. K., Asghari, A., & Blyth, F. M. (2008). What do the numbers mean? Normative data in chronic pain measures. *Pain*, *134*, 158–173.

Norton, P. J., & Asmundson, G. J. G. (2004). Anxiety sensitivity, fear, and avoidance behavior in headache pain. *Pain*, *111*, 218–223.

Onghena, P., & Edgington, E. S. (2005). Customization of pain treatments: Single-case design and analysis. *Clinical Journal of Pain*, *21*, 56–68.

Paulett, J. D. (1947). Low back pain. *Lancet*, *253*, 272–276.

Resick, P. A., Galovski, T. E., Uhlmansiek, M. O., Scher, C. D., Clum, G. A., & Young-Xu, Y. (2008). A randomized clinical trial to dismantle components of cognitive processing therapy for posttraumatic stress disorder in female victims of interpersonal violence. *Journal of Consulting and Clinical Psychology*, *76*, 243–258.

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

Rowbotham, G. F. (1947). Pain and its underlying pathology. *Journal of Mental Science*, *92*, 595–604.

Sapkas, G. S., Themistocleous, G. S., Mavrogenis, A. F., Benetos, I. S., Metaxas, N., & Papagelopoulos, P. J. (2007). Stabilization of the lumbar spine using the dynamic neutralization system. *Spine*, *30*, 859–865.

Sgroi, M. I., Willebrand, M., Ekselius, L., Gerdin, B., & Andersson, G. (2005). Fear-avoidance in recovered burn patients: Association with psychological and somatic symptoms. *Journal of Health Psychology*, *10*, 491–502.

Smeets, R. J., Vlaeyen, J. W., Kester, A. D., & Knottnerus, J. A. (2006). Reduction of pain catastrophizing mediates the outcome of both physical and cognitive-behavioral treatment in chronic low back pain. *Journal of Pain*, *7*, 261–271.

Snaith, R. P., & Zigmond, A. S. (2000). Hospital Anxiety and Depression Scale (HADS). In A. J. Rush, H. A. Pincus, M. B. First, D. Blacker, J. Endicott, S. K. Keith, et al. (Eds.), *Handbook of psychiatric measures* (pp. 547–548). Washington, DC: American Psychiatric Association.

Spengler, D. M., Bigos, S. J., Martin, N. A., Zeh, J., Fisher, L., & Nachemson, A. (1986). Back injuries in industry: A retrospective study. *Spine*, *11*, 241–245.

Spinhoven, P., Kuile, M., Kole-Snijders, A. M. J., Mansfeld, M. H., den Ouden, D. J., & Vlaeyen, J. W. S. (2004). Catastrophizing and internal pain control as mediators of outcome in the multidisciplinary treatment of chronic low back pain. *European Journal of Pain*, *8*, 211–219.

Strassels, S. A. (2006). After all, pain is a complex sensory and emotional experience (IASP, 1994): Clinical economics and the treatment of persistent pain. *Journal of Pain*, *7*, 802–803.

Sullivan, M. J., Bishop, S. R., & Pivik, J. (1995). The Pain Catastrophizing Scale: Development and validation. *Psychological Assessment*, *7*, 524–532.

Sutton, A. J., Jones, D. R., Abrams, K. R., Sheldon, T. A., & Song, F. (2000). *Methods for meta-analysis in medical research*. London: Wiley.

Tang, N. K. Y., Salkovskis, P. M., Poplavskaya, E., Wright, K. J., Hanna, M., & Hester, J. (2007). Increased use of safety-seeking behaviors in chronic back pain patients with high health anxiety. *Behaviour Research and Therapy*, *45*, 2821–2835.

Turk, D. C., Swanson, K. S., & Tunks, E. R. (2008). Psychological approaches in the treatment of chronic *pain* patients: When pills, scalpels, and needles are not enough. *The Canadian Journal of Psychiatry*, *53*, 213–223.

Vlaeyen, J. W. S., de Jong, J., Geilen, M., Heuts, P. H. T. G., & van Breukelen, G. (2001). Graded exposure in vivo in the treatment of pain-related fear: A replicated single-case experimental design in four patients with chronic low back pain. *Behaviour Research and Therapy*, *39*, 151–166.

Vlaeyen, J. W. S., de Jong, J., Geilen, M., Heuts, P. H. T. G., & van Breukelen, G. (2002). The treatment of fear of movement/(re)injury in chronic low back pain: Further evidence on the effectiveness of exposure in vivo. *Clinical Journal of Pain*, *18*, 251–261.

Vlaeyen, J. W. S., de Jong, J., Sieben, J., & Crombez, G. (2002). Graded exposure in vivo for pain-related fear. In D. C. Turk & R. J. Gatchel (Eds.), *Psychological approaches to pain management: A practitioner's handbook* (2nd ed., pp. 210–233). New York: Guilford Press.

Vlaeyen, J. W. S., Kole-Snijders, A. M. J., Boeren, R. G. B., & van Eek, H. (1995). Fear of movement/(re)injury in chronic low back pain and its relation to behavioral performance. *Pain*, *62*, 363–372.

Vlaeyen, J. W. S., & Linton, S. J. (2000). Fear avoidance and its consequences in chronic musculoskeletal pain: A state of the art. *Pain*, *85*, 317–332.

Vowles, K. E., & McCracken, L. M. (2008). Acceptance and values-based action in chronic pain: A study of treatment effectiveness and process. *Journal of Consulting and Clinical Psychology*, *76*, 397–407.

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

Waddell, G., Newton, M., Henderson, I., Somerville, D., & Main, C. J. (1993). A Fear-Avoidances Beliefs Questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability. *Pain*, *52*, 157–168.

Weisberg, J. N., & Vaillancourt, P. D. (1999). Personality factors and disorders in chronic pain. *Seminars in Clinical Neuropsychiatry*, *4*, 156–166.

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

Wicksell, R. K., Melin, L., Lekander, M., & Olsson, G. L. (2009). Evaluating the effectiveness of exposure and acceptance strategies to improve functioning and quality of life in longstanding

pediatric pain: A randomized controlled trial. *Pain*, *141*, 248–257.

Wicksell, R. K., Melin, L., & Olsson, G. L. (2007). Exposure and acceptance in the rehabilitation of adolescents with idiopathic chronic pain: A pilot study. *European Journal of Pain*, *11*, 267–274.

Williams, L. J., Jacka, F. N., Pasco, J. A., Dodd, S., & Berk, M. (2006). Depression and pain: An overview. *Acta Neuropsychiatrica*, *18*, 79–87.

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

Woods, M. P., & Asmundson, G. J. G. (2008). Evaluating the efficacy of graded in vivo exposure for the treatment of fear in patients with chronic back pain: A randomized controlled clinical trial. *Pain*, *136*, 271–280.