Cognitive Behavioural Therapy in Pain and Psychological Disorders: Towards a Hybrid Future

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Abstract

Cognitive Behavioural Therapy (CBT) is a form of evidence-based talking therapy that emphasises the importance of behaviour and conscious thoughts in shaping our emotional experiences. As pain becomes increasingly accepted as not only a sensory but also an emotional experience, success in using CBT to treat emotional disorders has resulted in the incorporation of cognitive-behavioural principles into the management of chronic pain. Outcomes of CBT-informed interdisciplinary pain management programmes are modest at best, despite rapid methodological improvements in trial design and implementation. Whilst the field searches for new treatment directions, a hybrid CBT approach that seeks to simultaneously tackle pain and its comorbidities shows promise in optimising treatment effectiveness and flexibility. This article provides a brief description of the core characteristics of CBT and the transformation this therapeutic model has brought to our understanding and management of chronic pain. Current evidence on efficacy of CBT for chronic pain is then reviewed, followed by a critical consideration of the advantages and disadvantages of the new hybrid treatment approach that conceptualises and treats chronic pain in connection with its comorbidities. Recent progress made in the area of pain and insomnia is highlighted as an example to project therapeutic innovations in the near future.

Highlights

1. CBT emphasises the role of behaviour and conscious thoughts in shaping our emotional experiences

2. Success in using CBT to treat emotional disorders has led to its application in chronic pain, a sensory and emotional experience.

3. Effects of interdisciplinary pain management programmes based on CBT principles are however modest…

4. …and relatively weak compared to the effects achieved by CBT for emotional disorders

5. A hybrid CBT that simultaneously tackles chronic pain and its comorbidities is proposed as an alternative approach to optimise treatment effect.

1. What is Cognitive-Behavioural Therapy**?**

After decades of research and dissemination, cognitive-behavioural therapy (CBT) is now a household name synonymous with psychological treatment for health and wellbeing in developed countries (1, 2). CBT stands for a form of talking therapy that emphasises the importance of both behaviour and conscious thoughts in shaping our emotional experiences (3-6). Its theoretical foundation extends from the purely behavioural learning principles (e.g., classical and operant conditioning), to incorporate cognitive factors (e.g., beliefs and attribution) in recognition of their roles in influencing our behaviour, affecting how we feel, and even shaping our physiological responses.

Typically, psychological interventions that draw on both behavioural principles and cognitive science – regardless of the extent – are collectively referred to as CBT. Hence, CBT is an umbrella term that includes treatments of different foci, contents, designs, length and interface. Several key features should, however, be recognisable even across different permutations of CBT (5). *First*, in contrast to psychodynamic approaches, CBT focuses on the conscious experience and the here-and-now. The aim of the treatment is to help the patient bring about adaptive learning and desirable changes in their present lives, not their distant past. And so relatedly, *second*, the treatment content of CBT is goal-driven; and duration time-limited. *Third*, a large part of the treatment is about problem-solving and acquisition of new coping skills. Consolidation of learning between treatment sessions in the form of an exercise or a homework assignment is important, as these are the tools to help the patient apply and generalise their new skills to contexts outside of the therapy setting. The ultimate goal is to enable the patient to become their own therapist, and hence, *fourth*, the therapeutic relationship shared between the CBT therapist and the patient is collaborative and supportive, rather than hierarchical and directive. *Finally*, in keeping with the tradition of scientific investigation of human behaviour and cognition, CBT as a field places strong emphasis on defining concepts in measurable terms and putting treatment programmes under the scrutiny of empirical evaluation, ranging from single-case experiments to multi-centre randomised controlled trials. Such tradition lays the foundation of the evidence-

based nature of CBT; and the corresponding training of CBT delivery can be distinguished from that for non-directive counseling, which puts heavier emphasis on conversation and empowerment within a social and cultural context and lighter emphasis on symptom reduction and treatment process and outcome evaluation.

The emergence of CBT was originally embedded within the growing need to address common emotional disturbances such as anxiety and depression (3, 7, 8) but its influence soon spread and led to successful applications in the understanding and treatment of a range of difficult-to-treat psychiatric and medical disorders. These include panic disorder, obsessive-compulsive disorder, posttraumatic disorder, health anxiety, eating disorders, insomnia disorder, schizophrenia, and suicide. Chronic pain is a prevalent, disabling condition affecting 19% of the general population in Europe (9) and as many as 31% of the adult population in the US (10). It is one of the areas that has benefited from the application of CBT principles for the understanding and management the condition. Below I will illustrate the emergence of CBT for chronic pain, beginning with a brief overview of the development in pain conceptualisation that has led to the application of interventions based on cognitive-behavioural principles and further work in evaluating the efficacy of CBT pain management programmes.

2. CBT in Pain
2.1. Theoretical developments
Pain was once thought to be a strictly biological phenomenon that is specifically and proportionally linked to tissue damage or an underlying pathology. However, a shift in thinking was marked by the introduction of the groundbreaking Gate Control Theory (11), which attempts to explain well-documented anomalies that deviate from previous conceptualisations of pain, such as the highly variable relationship between injury and pain, whereby innocuous stimuli may produce pain and that pain may persist or even spread in the absence of injury or after an extensive period of healing. In layman's terms, the Gate Control Theory describes how nerve impulses enter the spinal cord and

travel to the brain for interpretation as pain. Transmission of the signals can go in both the top-down and bottom-up directions, and a gating mechanism in the dorsal horn of the spinal cord functions to modulate the signals, such that whilst the balance of the small and large fibre activities in the spinal cord can facilitate (i.e., open the gate) or inhibit (i.e., close the gate) the afferent signals, the brain can send descending signals to modulate the transmission, exerting central control.

Although the premises of the Gate Control Theory are fundamentally physiological, the theory offers a readily acceptable grounding for psychological explanations of variations in pain responses to flourish. In contrast to nociception, pain was subsequently recognised as a "psychological state", when the International Association for the Study of Pain (IASP) put forward a taxonomical definition of pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (12). The IASP definition brings to the fore that pain is not just a sensory but also an emotional experience, subject to psychological influence.

The shift away from the strictly physiological approach to pain has permitted the application of behavioural and cognitive principles for the study and management of pain. This was spearheaded by the work of Fordyce (13, 14) who detailed how adaptive acute pain behaviour (e.g., grimace, moaning, limping, avoidance of activity, increased use of anagelsics) is reinforced and maintained to become maladaptive and chronic by positive and negative reinforcement, in line with the generic operant conditioning model. Accordingly, it was suggested that chronic pain is best treated as a set of illness behaviour and the intervention should be focused on modifying the environment contingencies that elicit the pain behavior, with a goal to reduce their frequency of occurrence and hence the associated disability (15).

Subsequent research into the effect of cognition (pain catastrophising, pain anticipation, pain memory) and affect (anxiety, depression) on pain perception

and coping has led to the incorporation of a cognitive dimension into the primarily behavioural approach to chronic pain (16). Several iterations of the fear-avoidance model of chronic pain have been proposed to explain how different interpretations of the same pain experience could determine whether a person would confront the pain and be on the road of recovery, or display the chronic pain behaviour that would eventually lead to disuse, depression and disability (17-23). There are subtle differences in the emphasis of each iteration of the fear-avoidance model, but the key cognitive factors at play is the interpretation and meaning people ascribe to the pain experience. In the absence of serious pathology, if the pain is considered unpleasant but non-threatening, then the person would perhaps restrict pain-provoking activity in the short term but gradually return to their prior level of activity as the injury heals up and pain dissipates. However, if pain is given a catastrophic meaning suggesting harm or threats to body integrity, the catastrophic meanings ascribed to the pain will give rise to pain-related fear, motivating hypervigilance (such as excessive threat-monitoring behaviour) and behavioural avoidance (of daily activities that may induce or aggravate pain) in the long term (Figure 1a). Such conceptualisation of chronic pain and its associated distress and disability brings the theoretical development closer to the Beckian approach to CBT (Figure 1b) and the generic model of anxiety disorders (Figure 1c). Subsequent modifications to the model to consider the influence of negative affectivity, physiological arousal, and the role of threatening illness information expand the horizon of the examination to align more closely with the multidimensional perspective of pain and the PPP (predisposing, precipitating and perpetuating factors) case formulation framework (23).

INSERT Figure 1 ABOUT HERE

2.2. Treatment implications

Given that avoidant behavior and catastrophising are hypothesised to be key interacting mechanisms underpinning the development and maintenance of disability and disuse in chronic pain, a therapeutic intervention derived from the fear-avoidance model is graded exposure to movements and activities feared by

the patient. In contrast to graded activity that aims to increase the total amount of physical activity, the idea behind graded exposure in vivo is to afford the patient the opportunity to confront their fear. Through engaging in a series of behavioural experiments (24), the patient is also helped to disconfirm or soften prior expectations and catastrophic beliefs that movements will cause (re)injury and further suffering. Typically, the design of the exposure procedure is personalised to the patient's individual fear hierarchy such that patients are first exposed to activities associated with mild to moderate levels of fear before confronting activities that provoke high levels of fear (25-27). Several high-quality single case series and randomised controlled trials have demonstrated the effectiveness of graded exposure over and above psycho-education or graded activity in patients with chronic low back pain (25, 28-32), neck pain patients (33, 34), and complex regional pain syndrome (35), with concurrent reductions in pain-related fear, pain catastrophising and pain-related disability. The results also appeared to maintain well up to 6 months after treatment.

Graded exposure in vivo, however, is not the sole intervention received by chronic pain patients, as psychological treatments tends to be delivered as part of an interdisciplinary pain management programme within specialist pain clinics (36, 37). Within such a context, CBT for chronic pain is much more broadly defined as an amalgamation of interventions that may vary in approach and emphasis (Behaviour Therapy, Cognitive Therapy, Cognitive-Behavioural Therapy, Acceptance Commitment Therapy), format (individual vs. group; outpatient vs. inpatient; face-to-face vs. telemedicine/online), and dosage (amount of input at different frequency and levels of intensity) depending on the availability of resources and expertise. The theoretical principle and evidence-base of these other treatment components, arguably, are not always as well documented as graded exposure.

Nonetheless, the central goal of most pain management programmes based on cognitive-behavioural principles is to help patients better manage problems evolved around maladaptive emotions, cognition and behaviour, rather than focusing on pain elimination. Like CBT for depression and anxiety, main

components of CBT for chronic pain include first and foremost psycho-education, which involves educating the patients about the rationale of the treatment and the impact of cognition and behaviour on their emotions and pain experience. Once a shared understanding of the CBT model of chronic pain is estabilshed, the patients will be taken through a journey of coping skills training ranging from relaxation, physical exercise, pacing, to communication skills training. The idea is that during the course of the treatment, the patients are helped to apply these skills in day-to-day situations and maintain these skills as they are practised in real life. Patients are also taught how to cope with relapse and flare-ups, in the hopes that they will become their own therapists when the therapeutic engagement comes to an end. Table 1 below outlines the aims and methods of several common CBT components often included in interdisciplinary pain management programmes.

INSERT Table 1 ABOUT HERE

2.3. Efficacy of CBT for chronic pain

Notwithstanding the known heterogeneity in treatment content, CBT for chronic pain has typically been evaluated for its efficacy as an overall package in a number of RCTs. A comprehensive Cochrane Review by Eccleston, Williams, & Morley (39) has provided an excellent overview of the efficacy of CBT for the management of chronic pain in general, except headache, among adult patients. Specifically, the systematic review and meta-analysis included 24 meta-analyses based on data pooled from 40 RCTs, published before Jan 2008 involving 4781 participants (Mean age = 48.7 yrs; Median pain duration: 9.9 yrs). The purpose of the analyses was to examine the effect of BT and CBT versus passive or active treatment control interventions on pain, disability, and mood at post-treatment and at follow-up (6-12 months after treatment). In these analyses, passive treatment control interventions referred to control procedures in RCTs that were labeled as "waiting list control" or "treatment as usual". Active treatment control interventions were those that involved a protocolised treatment that engaged the patients, e.g., a self-help booklet, a support group, an exercise class, an educational programme, or a medical procedure. Of the 6 outcome

comparisons made for CBT against passive treatment control interventions, 2 revealed a significant effect showing that CBT had a small effect on pain (Standardised Mean Difference = -0.19; 95% Confidence Interval: -0.32, -0.05; I2 = 24%) at post-treatment and on mood (SMD = -0.16; 95% CI: -0.31, -0.01; I2 = 0%) at follow-up. Similarly, of the 6 outcome comparisons made for CBT against active treatment control interventions, 4 revealed a significant effect showing that CBT had a small effect on disability (SMD = -0.16; 95% CI: -0.31, -0.02; I2 = 0%) at post-treatment and on all 3 outcome measures at follow-up (Pain: SMD = -0.15; 95% CI: -0.28, -0.02; I2 = 0%. Disability: SMD = -0.21; 95% CI: -0.36, -0.06; I2 = 15%. Mood: SMD = -0.16; 95% CI: -0.29, -0.03; I2 = 0%). The quality of trials included was assessed qualitatively using the 'high', 'unclear' and 'low 'risk traffic light system and quantitatively using the Yates et al. scale (40). Qualitatively, the majority of the studies were considered to have 'adequate' study (65.4%), treatment (53.8%) and design (61.5%) quality. Quantitatively, the mean overall quality of the studies was 19.3 (Standard Deviation = 4.8; Range = 9-28). The mean design quality score was 14.4 (SD= 3.7; Range = 7-23) and the mean treatment quality score was 4.9 (SD= 2.2; Range = 1-8).

As the number of RCTs of CBT for chronic pain has rapidly increased in a short space of time, Williams et al. (41) provided an update to the 2009 review involving 35 RCTs of 4788 participants published before September 2011. This review had similar but slightly more stringent inclusion criteria, raising the bar of entry from 10 to 20 participants in each treatment arm. This decision was to minimise potential risk of bias associated with trials of small sample size and to address the overall tendency for smaller or poor-quality trials to produce more positive results (42-44). A total of 65 trials were identified and 42 met inclusion criteria, of which 16 were new entries since the 2009 review and 35 of these trials provided data for the meta-analysis. The included studies showed an improvement in their overall methodological quality as expected. Using the same method of comparisons, the pattern of findings was broadly similar to those shown in the 2009 review (see Figure 2a & 2b). Although the longer term effect on pain and mood found for CBT against active treatment control interventions no longer upheld at follow up, the effects of CBT against passive treatment

control interventions were noticeably more consistent and appeared to be stronger across all 3 major outcome measures.

INSERT Figure 2 ABOUT HERE

Based on both sets of review, the authors concluded that there was a sufficiently large evidence base to show that CBT had a small to moderate beneficial effect on key outcome measures of importance to chronic pain, particularly at immediately after treatment and when compared to passive control interventions. The magnitude of the effect was not as big as hoped, but may accurately reflect the true extent of "complexity of behaviour change and the social and psychological influences that maintain disability in chronic pain patients" (45). Whilst there are many theoretical and practical issues remain to be addressed to move the field forward (see discussion of (41) for an insightful analysis), CBT can be useful in reducing pain, disability and psychological distress, in par with other established drug and physical treatments for chronic pain (46, 47).

2.4. Challenges beyond perfecting RCT methodology

Interested readers are referred to Williams et al., Morley et al., and Eccelston (48, 49), for a detailed analysis on the theoretical and practical issues remained to be addressed by the field. Two additional challenges are highlighted below, as we consider the connections between CBT for chronic pain and CBT for other psychological disorders.

First, despite the more consistent effect of CBT, the magnitude of the controlled effect size is small according to Cohen's interpretation (1992) as well as relative to what can be achieved in CBT for other common emotional disorders (51), as summarised in Table 2. Using mood - the most favourable outcome measure in the 2012 Cochrane review - for example, the maximum effect size was 0.38 immediately after treatment but attenuated to 0.26 at follow-up. These statistics mean that a person randomly drawn from the CBT group has only a 61% chance

of being better off than a person randomly drawn from the passive control group (i.e., the probability of benefit) when the comparison is made at post-treatment; the probability of benefit reduces to 57% when the comparison is made at 6- to 12- month follow-up. The deficits in effect size and probability of benefit evident in Table 2 raise the question that, perhaps, the field is far from maximising the potential of CBT for the management of chronic pain. It is also noted that, for 2 of the 3 key outcome measures (i.e., pain intensity and disability), the effect of CBT for chronic pain did not sustain at follow-up as it would normally be expected for CBT for common emotional disorders. This is surprising given the heavy skills learning component in various pain management packages.

INSERT Table 2 ABOUT HERE

Second, the overwhelming majority of the chronic pain patients seen in day-to-day clinical practice are presented with some kind of physical or psychological comorbidity (52, 53). More often than not, those reporting comorbid issues are also those who reported more severe pain, greater disability, and poorer quality of life (54). Outside of the clinical setting, Von Korff and colleagues (2005) estimated that 87% of the general population living with chronic spinal pain also reported at least 1 other mental disorder, chronic physical diagnosis, and/or other chronic pain conditions. Importantly, the presence of these comorbidities explained approximately a third of the association between chronic pain and disability. Similar findings were reported by McWilliams and associates (2003) focusing on the co-occurrence of chronic pain with psychiatric disorders. Significant cross-sectional associations were observed between chronic pain and mood and anxiety disorders (odds ratios = 1.92 - 4.27), with the strongest associations being found for panic disorder (OR = 4.27) and post-traumatic stress disorder (OR = 3.69). Additionally, the presence of more than one comorbid psychiatric disorders was significantly linked to increased disability. Together, these findings converge to suggest that the purely pain-focused treatment approach may be inadequate for tackling the complex psychological issues experienced by chronic pain patients, which could be simultaneously be maintained by the pain *and* the co-existing comorbid physical and psychiatric

conditions. A radical reconceptualisation of our treatment approach to chronic pain is warranted if we were to break through the treatment effect size ceiling and to improve the quality of care to become more patient-centred, rather than diagnosis-focused.

3. A hybrid approach

A hybrid approach to the treatment of chronic pain is an exciting new direction, whereby the treatment is developed and applied to simultaneously address multiple issues linked to chronic pain rather than exclusively focusing in on pain management or reduction (57-59). The concept represents a departure from the conventional practice that confines the matching of interventions to well-defined diagnostic labels. It explicitly acknowledges that complex conditions, such as chronic pain, do not exist in isolation, but interacts with co-occurring physical and mental comorbidities that may in return impact on pain management.

3.1. Advantages

By adopting a broader conceptualisation of the distress and disability experienced by chronic pain, the hybrid approach gives clinicians the flexibility to draw up treatment and rehabilitation plans based on individual case formulations rather than relying on predetermined protocolised treatment packages. It also facilitates better customisation of treatment, an action point that has been called for by multiple leaders of the field (36, 39, 41, 48, 60).

The hybrid treatment approach is arguably a more appropriate strategy for managing chronic pain, which by definition is intractable. Simultaneous efforts targeting common comorbidities offer new treatment entry points to break unhelpful patterns of pain-related cognition and behavior that give rise to the distress and disability. Instead of fixating on managing pain, a hybrid approach diversifies the treatment goal, allowing the patient to reframe their relationship with pain and offering the opportunity to move away from pain control and to focus their efforts on addressing other issues affecting quality of life and on attaining more achievable goals (61). It also opens up possibilities of introducing treatment components that target transdiagnostic processes, e.g., hypervigilance,

worry, catastrophising, appraisal biases, avoidance, safety-seeking behavior, and thought-suppression (62-64). The result of these changes may streamline the process of imparting core coping skills that are essential for wellbeing and optimal functioning, especially within the modern healthcare eco-system where time and resources are limited.

Practically, the hybrid approach downplays the importance of establishing the 'primary' and 'secondary' hierarchy of co-occurring disorders and helps to bypass the artificial boundary between physical and mental health. This is in line with shifts in thinking around comorbidities management (65-67) and can serve to simplify the navigation through complex health care pathways by offering treatment of multiple problems under one roof and reducing the number of contact points. It may also help to avoid situations in which patients are stuck in gaps between physical and mental health care services. It is not uncommon to hear of accounts of treatment seeking experience in which patients found themselves refused treatment by mental health services because the psychological symptoms were considered to be 'caused' by pain (thus the patient 'should' be seen by pain specialists), or by pain management services because the psychological symptoms are thought to be too severe impacting on pain management efforts (and hence specialist psychological input 'should' be received first, before the patient is re-referred to the pain service for rehabilitation).

3.2. Recent development in pain and insomnia as an example

Although the overlaps between pain and anxiety (56, 68) and between pain and depression (69-71) are better recognised, the co-occurrence of pain and sleep has received more attention in recent years and witnessed a surge in research efforts in understanding the nature of comorbidity and in developing specific hybrid treatments for improving treatment efficacy and patient outcomes (57, 72-75). The co-existing problem of sleep and pain is widespread. In the general population, around two-thirds of individuals living with chronic pain report a reduced ability to sleep because of their pain (9). At the more severe end of the spectrum, it has been estimated that between 50 and 90% of patients seeking

treatment from hospital pain clinics report insomnia of a severity that warrants clinical attention (76-78). Further, it is understood that chronic pain patients who experience insomnia are also those who report higher pain intensity, anxiety, depression, physical and psychosocial disability (9, 79-86). Left untreated, the majority of the insomnia cases would persist (87) continuing to undermine efforts of pain management and compound the level of pain, distress and disability. Such detrimental effect is observed both on a day-to-day basis (88-92) and over longer periods (93).

The development of hybrid treatments for chronic pain and insomnia is only in its infancy, but it is certainly a movement gaining momentum at a time when the term 'secondary insomnia' is being phased out (94) and epidemiological evidence is accumulating to show that sleep is a risk factor and a potential cause of a range of physical and mental illnesses, directly and indirectly increasing the risk of mortality (95). The momentum is also bolstered by demands from the pain patients themselves, explicitly stating the negative impact on pain management when they are not sleeping well (96, 97) and indicating that their wish to receive more support and help in obtaining better sleep (9, 98, 99). These patient demands make a lot of sense, as increasing evidence has shown that sleep disruption can aggravate pro-inflammatory responses, amplify pain experience, weaken endogenous pain inhibitory control, reduce pain tolerance, and increase bodily symptoms (100-103).

Yet, sleep thus far is not a main focus of many existing pain management programmes, although standard sleep hygiene advice - which is not considered as an effective stand-alone treatment for insomnia (104, 105) - is usually given to patients as part of the psychoeducation component of the intervention. Naturally, sleep is not a major outcome measure when evaluating the impact of these pain management programmes. Of the few trials that do measure sleep pre-and post-treatment, a couple of studies have demonstrated that sleep does not necessarily improve after completion of a course of CBT for pain, even when improvements are found for pain coping skills and pain-related functional outcomes (106, 107). A couple others have shown a slight improvement in

subjective ratings of sleep, but "against a backdrop of poor patterns of night time sleep" with no improvement in key quantitative sleep efficiency and quantity parameters (108, 109). In contrast, a series of RCTs evaluating the application of CBT for insomnia (CBT-I) in chronic pain patients have shown promise (57, 110, 111). As summarised in a recent meta-analysis involving 11 RCTS involving 1066 patients, psychological sleep treatments in chronic pain patients are associated with not only improvement in sleep quality; significant improvements were also found for pain and fatigue at post-treatment and for fatigue and depression at follow-up up to 12 months (112).

Capitalising on these promises, in the last 5 years or so at least three different groups in the US and the UK have independently published initial findings evaluating the feasibility and utility of hybrid treatments for chronic pain and comorbid insomnia. Two pilot RCTs were conducted with mixed groups of chronic pain patients recruited from secondary care (58, 113) and one multi-centre 3-arm RCTs was tested with older osteoarthritis patients from primary care (114-116). The timing of these publications clusters around the same time, reflecting a consensus that 'going hybrid' may be a promising direction for future treatment development.

There are variations between these hybrid treatment programmes in term of the selection of treatment components. The hybrid treatment in Tang et al. (58) was designed to target cognitive-behavioural processes maintaining chronic pain and insomnia. The weekly treatment was delivered by psychologist on a one-to-one basis over 4 weeks. The selection of treatment components was informed by existing treatment manuals (117-119), systematic reviews on treatment effectiveness (39, 41, 120), and research on transdiagnostic processes maintaining these disorders (121-125). Equal emphasis was given to pain and sleep. The 8 treatment components included (i) sleep psycho-education, (ii) stimulus control, (iii) sleep restriction, (iv) cognitive therapy for insomnia, (v) individual pain formation, (vi) goal setting & behavioural activation, (vii) reducing pain catastrophising & safety-seeking behavior, and (viii) reversing mental defeat for the management of chronic pain. The intervention used in Pigeon et al. (113) was much more extensive and contained 16 elements

commonly seen in pain management and insomnia treatment packages. The intervention was delivered individually by psychologist over 10 weekly sessions. Specifically, the intervention included (i) pain psychophysiology education, (ii) relaxation training, (iii) pacing, (iv) pain-specific cognitive therapy, (v) activity planning, (vi) problem-solving, (vii) communication skills, and (viii) flare-up planning and relapse prevention for the management of chronic pain; (ix) sleep education, (x) sleep restriction, (xii) stimulus control, (xiii) sleep hygiene, (xiv) sleep-specific cognitive therapy, (xv) relaxation training, and (xvi) relapse prevention for the management of insomnia. Similarly, the combined treatment in Vitiello et al. (115) incorporated CBT-I components such as sleep hygiene education, stimulus control, sleep restriction and daily sleep monitoring into a standard programme of pain management with pain education, physical activation, goal setting, relaxation, activity pacing, guided imagery and cognitive restructuring. However, the treatment was more didactic in nature, delivered in classes of 5-12 patients over six weekly 90-minute sessions.

Despite these differences, both Tang et al. (58) and Pigeon et al. (113) found their respective hybrid treatments produced significantly better results in not only sleep, but also mood, fatigue and pain-related outcomes compared to waitlist controls. Pitching against standard programmes of CBT for pain or insomnia per se, the hybrid intervention showed a huge advantage over CBT for pain on most outcomes and a small advantage over CBT for insomnia in reducing insomnia severity in chronic pain patients (113). These preliminary findings were upheld in the multi-centre RCTs by Vitiello et al. (115), in which the hybrid treatment logged the best outcome in reducing insomnia severity compared to both the education-only control and the CBT for pain groups. Although pain severity and arthritis outcomes did not differ among the 3 treatment arms, a subsequent secondary analysis using data across all groups revealed that long-term (9- and 18-month) improvements on multiple measures of sleep, chronic pain, and fatigue were significantly predicted by short-term (2-month) improvements in sleep. These findings support the idea that sleep treatment can have a beneficial impact on pain and other aspects of wellbeing, even though these effects may take time to emerge.

3.3. Challenges and issues remained

It appears as though the hybrid treatment approach has clear potential for enhancing treatment effectiveness of existing pain management programmes. Further replications would, however, be required to demonstrate reliability and generalisability across different subgroups of pain patients (e.g., musculoskeletal versus neuropathic versus inflammatory pain; regional versus diffuse pain) and treatment contexts (e.g., primary versus secondary care). It would be also important to rule out that the better outcomes associated with hybrid treatment over standard pain or insomnia treatment was not merely an artifact of the longer treatment duration, extended treatment content, or other confounders, such as researchers' allegiance and enthusiasm, not controlled for in the aforementioned outcome studies.

Whilst additional help with sleep was something specifically requested by patients for improving their management of chronic pain (9, 98, 99), it is unclear if the treatment experience has been found positive and beneficial by this patient group. None of the previous trials on hybrid pain and sleep treatment was published with an accompanying treatment process evaluation. To inform patient-centred care, future studies should consider including qualitative analyses as such to shed light on the acceptability of the new treatment approach. Additionally, qualitative feedback from treatment providers would be useful in terms of informing the therapist training, treatment delivery and dissemination processes, all of which are yet to be refined at this infancy stage of treatment development. Practical questions like "who with what training should be delivering the treatment in what dosage, format, and sequence?" and "where should we situate the service within the existing clinical care pathway to achieve optimal long-term cost-effectiveness?" need to be answered. Answers to these questions will have important implications for future research funding and service development.

4. Conclusion

The developing of a feasible hybrid treatment for pain and insomnia has taken advantage of the growing wealth of research evidence into the links and

association between the two conditions (72, 73). Given the equally fascinating links of pain with depression (52, 53), PTSD (126-128), substance misuse (129-131), obesity (132-135), to name but a few, the hybrid treatment approach could easily be adopted to provide more concentrated care in these areas depending on the patient's need. This is especially relevant considering that, with a more refined understanding of the connections between these oft-seen comorbidities, a modular treatment design could be engineered to expand the breadth and flexibility of clinical service and enhance patients' choice. The adoption of the hybrid treatment framework may even facilitate a more rapid transfer of theoretical and psychological treatment advances in the linked fields, stimulating innovations in the years to come.

5. References

1.   PubMed Health. Cognitive behavioural therapy 2016 [cited 2017]. Available from: https://http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0072481/.
2.   NHS UK. Cognitive behavioural therapy (CBT) 2016 [cited 2017]. Available from: http://www.nhs.uk/conditions/Cognitive-behavioural-therapy/Pages/Introduction.aspx.
3.   Beck AT. Cognitive therapy and the emotional disorders: New York; 1976.
4.   Beck JS. Cognitive behavior therapy: Basics and beyond: Guilford Press; 2011.
5.   Hawton K, Salkovskis PM, Kirk J, Clark DM. Cognitive behaviour therapy for psychiatric problems: A practical guide. New York, NY, US: Oxford University Press; 1989. xii, 456 p.
6.   Clark DM, Fairburn CG. Science and practice of cognitive behaviour therapy. New York, NY, US: Oxford University Press; 1997. xiv, 437 p.
7.   Ellis A. Rational-emotive therapy: FE Peacock Publishers; 1989.
8.   Ellis A. Reason and emotion in psychotherapy: New York; 1962.
9.   Breivik H, Collett B, Ventafridda V, Cohen R, Gallacher D. Survey of chronic pain in Europe: Prevalence, impact on daily life, and treatment. European Journal of Pain. 2006;10(4):287-.
10.   Johannes CB, Le TK, Zhou X, Johnston JA, Dworkin RH. The prevalence of chronic pain in United States adults: results of an Internet-based survey. The Journal of Pain. 2010;11(11):1230-9.
11.   Melzack R, Wall P. Pain Mechanisms: A New Theory. Science. 1965;150(3699):971-9.
12.   Merskey H, Bogduk N. Classification of chronic pain: description of chronic pain syndromes and definition of pain terms. Seattle: IASP press; 1979.
13.   Fordyce WE. Behavioral concepts in chronic pain and illness1976.
14.   Fordyce WE. Behavioral methods for chronic pain and illness: CV Mosby; 1976.

15.   Fordyce WE, Shelton JL, Dundore DE. The modification of avoidance learning pain behaviors. Journal of Behavioral Medicine. 1982;5(4):405-14.
16.   Turk DC, Meichenbaum D, Genest M. Pain and behavioral medicine: A cognitive-behavioral perspective. New York: Guilford Press; 1983.
17.   Lethem J, Slade P, Troup J, Bentley G. Outline of a fear-avoidance model of exaggerated pain perception—I. Behaviour research and therapy. 1983;21(4):401-8.
18.   Slade P, Troup J, Lethem J, Bentley G. The fear-avoidance model of exaggerated pain perception—II: Preliminary studies of coping strategies for pain. Behaviour research and therapy. 1983;21(4):409-16.
19.   Philips H. Avoidance behaviour and its role in sustaining chronic pain. Behaviour research and therapy. 1987;25(4):273-9.
20.   Vlaeyen JW, Kole-Snijders AM, Boeren RG, Van Eek H. Fear of movement/(re) injury in chronic low back pain and its relation to behavioral performance. Pain. 1995;62(3):363-72.
21.   Asmundson GJ, Taylor S. Role of anxiety sensitivity in pain-related fear and avoidance. Journal of behavioral medicine. 1996;19(6):577-86.
22.   Vlaeyen JW, Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. Pain. 2000;85(3):317-32.
23.   Asmundson GJ, Norton PJ, Vlaeyen JW. Fear-avoidance models of chronic pain: an overview2004. 3-24 p.
24.   Bennett-Levy JE, Butler GE, Fennell ME, Hackman AE, Mueller ME, Westbrook DE. Oxford guide to behavioural experiments in cognitive therapy: Oxford University Press; 2004.
25.   Vlaeyen JW, de Jong J, Geilen M, Heuts PH, van Breukelen G. 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. 2001;39(2):151-66.
26.   Vlaeyen JW, de Jong J, Sieben J, Crombez G. Graded exposure in vivo for pain-related fear2002. 210-33 p.
27.   Leeuw M, Goossens ME, van Breukelen GJ, Boersma K, Vlaeyen JW. Measuring perceived harmfulness of physical activities in patients with chronic low back pain: the Photograph Series of Daily Activities—short electronic version. The Journal of Pain. 2007;8(11):840-9.
28.   Vlaeyen JW, de Jong J, Geilen M, Heuts PH, van Breukelen G. The treatment of fear of movement/(re) injury in chronic low back pain: further evidence on the effectiveness of exposure in vivo. The Clinical journal of pain. 2002;18(4):251-61.
29.   de Jong JR, Vlaeyen JW, Onghena P, Cuypers C, den Hollander M, Ruijgrok J. Reduction of pain-related fear in complex regional pain syndrome type I: the application of graded exposure in vivo. Pain. 2005;116(3):264-75.
30.   Boersma K, Linton S, Overmeer T, Jansson M, Vlaeyen J, de Jong J. Lowering fear-avoidance and enhancing function through exposure in vivo: a multiple baseline study across six patients with back pain. Pain. 2004;108(1):8-16.
31.   Woods MP, Asmundson GJ. 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. 2008;136(3):271-80.

32.   Leeuw M, Goossens ME, van Breukelen GJ, de Jong JR, Heuts PH, Smeets RJ, et al. Exposure in vivo versus operant graded activity in chronic low back pain patients: results of a randomized controlled trial. Pain. 2008;138(1):192-207.

33.   de Jong JR, Vangronsveld K, Peters ML, Goossens ME, Onghena P, Bulté I, et al. Reduction of pain-related fear and disability in post-traumatic neck pain: a replicated single-case experimental study of exposure in vivo. The Journal of Pain. 2008;9(12):1123-34.

34.   de Jong JR, Vlaeyen JW, van Eijsden M, Loo C, Onghena P. Reduction of pain-related fear and increased function and participation in work-related upper extremity pain (WRUEP): effects of exposure in vivo. PAIN®. 2012;153(10):2109-18.

35.   de Jong JR, Vlaeyen JW, Onghena P, Goossens ME, Geilen M, Mulder H. Fear of movement/(re) injury in chronic low back pain: education or exposure in vivo as mediator to fear reduction? The Clinical journal of pain. 2005;21(1):9-17.

36.   Gatchel RJ, McGeary DD, McGeary CA, Lippe B. Interdisciplinary chronic pain management: past, present, and future. American Psychologist. 2014;69(2):119.

37.   The British Pain Society. Guidelines for Pain Management Programmes for adults: An evidence-based review prepared on behalf of the British Pain Socie. London, UK: The British Pain Society, 2013.

38.   Society TBP. Guidelines for Pain Management Programmes for adults; An evidence-based review prepared on behalf of the British Pain Society The British Pain Society; 2013.

39.   Eccleston C, Williams A, Morley S. Psychological therapies for the management of chronic pain (excluding headache) in adults (Review). The Cochrane library. 2009 (3).

40.   Yates SL, Morley S, Eccleston E, Williams A. A scale for rating the quality of psychological trials for pain. Pain. 2005;117:314-25.

41.   Williams ACdC, Eccleston C, Morley S. Psychological therapies for the management of chronic pain (excluding headache) in adults. The cochrane library. 2012.

42.   Ioannidis JP. Why most published research findings are false. PLos med. 2005;2(8):e124.

43.   Furlan AD, Clarke J, Esmail R, Sinclair S, Irvin E, Bombardier C. A critical review of reviews on the treatment of chronic low back pain. Spine. 2001;26(7):E155-E62.

44.   Nüesch E, Trelle S, Reichenbach S, Rutjes AW, Bürgi E, Scherer M, et al. The effects of excluding patients from the analysis in randomised controlled trials: meta-epidemiological study. BMJ. 2009;339:b3244.

45.   Blyth FM, Macfarlane GJ, Nicholas MK. The contribution of psychosocial factors to the development of chronic pain: The key to better outcomes for patients? Pain. 2007;129(1-2):8-11.

46.   Hellum C, Johnsen LG, Storheim K, Nygaard ØP, Brox JI, Rossvoll I, et al. Surgery with disc prosthesis versus rehabilitation in patients with low back pain and degenerative disc: two year follow-up of randomised study. Bmj. 2011;342:d2786.

47.   Fairbank J, Frost H, Wilson-MacDonald J, Yu L-M, Barker K, Collins R. Randomised controlled trial to compare surgical stabilisation of the lumbar

spine with an intensive rehabilitation programme for patients with chronic low back pain: the MRC spine stabilisation trial. Bmj. 2005;330(7502):1233.

48.	Morley S, Williams A, Eccleston C. Examining the evidence about psychological treatments for chronic pain: Time for a paradigm shift? Pain. 2013;154(10):1929-31.

49.	Eccleston C. A normal psychology of everyday pain. International Journal of Clinical Practice. 2013;67(s178):47-50.

50.	Cohen J. A power primer. Psychological bulletin. 1992;112(1):155.

51.	Butler AC, Chapman JE, Forman EM, Beck AT. The empirical status of cognitive-behavioral therapy: a review of meta-analyses. Clinical psychology review. 2006;26(1):17-31.

52.	Arnow BA, Hunkeler EM, Blasey CM, Lee J, Constantino MJ, Fireman B, et al. Comorbid depression, chronic pain, and disability in primary care. Psychosomatic medicine. 2006;68(2):262-8.

53.	Knaster P, Karlsson H, Estlander A-M, Kalso E. Psychiatric disorders as assessed with SCID in chronic pain patients: the anxiety disorders precede the onset of pain. General hospital psychiatry. 2012;34(1):46-52.

54.	Bair MJ, Wu J, Damush TM, Sutherland JM, Kroenke K. Association of depression and anxiety alone and in combination with chronic musculoskeletal pain in primary care patients. Psychosomatic medicine. 2008;70(8):890.

55.	Von Korff M, Crane P, Lane M, Miglioretti DL, Simon G, Saunders K, et al. Chronic spinal pain and physical–mental comorbidity in the United States: results from the national comorbidity survey replication. Pain. 2005;113(3):331-9.

56.	McWilliams LA, Cox BJ, Enns MW. Mood and anxiety disorders associated with chronic pain: an examination in a nationally representative sample. Pain. 2003;106(1):127-33.

57.	Tang NK. Cognitive-behavioral therapy for sleep abnormalities of chronic pain patients. Current rheumatology reports. 2009;11(6):451.

58.	Tang NK, Goodchild CE, Salkovskis PM. Hybrid cognitive-behaviour therapy for individuals with insomnia and chronic pain: a pilot randomised controlled trial. Behaviour Research and Therapy. 2012;50(12):814-21.

59.	Tang NK, Salkovskis PM, Hodges A, Wright KJ, Hanna M, Hester J. Effects of mood on pain responses and pain tolerance: an experimental study in chronic back pain patients. Pain. 2008;138(2):392-401.

60.	Turk DC, Audette J, Levy RM, Mackey SC, Stanos S, editors. Assessment and treatment of psychosocial comorbidities in patients with neuropathic pain. Mayo Clinic Proceedings; 2010: Elsevier.

61.	Eccleston C, Crombez G. Worry and chronic pain: a misdirected problem solving model. Pain. 2007;132(3):233-6.

62.	Harvey AG. Cognitive behavioural processes across psychological disorders: A transdiagnostic approach to research and treatment: Oxford University Press, USA; 2004.

63.	Fairburn CG, Cooper Z, Shafran R. Cognitive behaviour therapy for eating disorders: A "transdiagnostic" theory and treatment. Behaviour research and therapy. 2003;41(5):509-28.

64.	Cappuccio FP, D'Elia L, Strazzullo P, Miller MA. Sleep duration and all-cause mortality: a systematic review and meta-analysis of prospective studies. Sleep. 2010;33(5):585.

65.   van Weel C, Schellevis FG. Comorbidity and guidelines: conflicting interests. The Lancet. 2006;367(9510):550-1.

66.   Starfield B, Lemke KW, Bernhardt T, Foldes SS, Forrest CB, Weiner JP. Comorbidity: implications for the importance of primary care in 'case'management. The Annals of Family Medicine. 2003;1(1):8-14.

67.   Linton SJ. A transdiagnostic approach to pain and emotion. Journal of applied biobehavioral research. 2013;18(2):82-103.

68.   Asmundson GJ, Katz J. Understanding the co‐occurrence of anxiety disorders and chronic pain: state‐of‐the‐art. Depression and anxiety. 2009;26(10):888-901.

69.   Banks SM, Kerns RD. Explaining high rates of depression in chronic pain: A diathesis-stress framework. Psychological bulletin. 1996;119(1):95.

70.   Romano JM, Turner JA. Chronic pain and depression: does the evidence support a relationship? Psychological bulletin. 1985;97(1):18.

71.   Fishbain DA, Cutler R, Rosomoff HL, Rosomoff RS. Chronic pain-associated depression: antecedent or consequence of chronic pain? A review. The Clinical journal of pain. 1997;13(2):116-37.

72.   Smith MT, Haythornthwaite JA. How do sleep disturbance and chronic pain inter-relate? Insights from the longitudinal and cognitive-behavioral clinical trials literature. Sleep medicine reviews. 2004;8(2):119-32.

73.   Finan PH, Goodin BR, Smith MT. The association of sleep and pain: an update and a path forward. The Journal of Pain. 2013;14(12):1539-52.

74.   Moldofsky H. Sleep and pain. Sleep medicine reviews. 2001;5(5):385-96.

75.   Lavigne G SB, Choiniere M, Soja P. Sleep and Pain. Seattle: IASP Press; 2010.

76.   Atkinson J, Ancoli-Israel S, Slater MA, Garfin SR, Gillin C. Subjective sleep disturbance in chronic back pain. The Clinical Journal of Pain. 1988;4(4):225-32.

77.   Tang NK, Wright KJ, Salkovskis PM. Prevalence and correlates of clinical insomnia co‐occurring with chronic back pain. Journal of sleep research. 2007;16(1):85-95.

78.   McCracken LM, Williams JL, Tang NK. Psychological flexibility may reduce insomnia in persons with chronic pain: a preliminary retrospective study. Pain Medicine. 2011;12(6):904-12.

79.   Chiu YH, Silman AJ, Macfarlane GJ, Ray D, Gupta A, Dickens C, et al. Poor sleep and depression are independently associated with a reduced pain threshold. Results of a population based study. PAIN. 2005;115(3):316-21. PubMed PMID: 00006396-200506000-00012.

80.   McCracken LM, Iverson GL. Disrupted sleep patterns and daily functioning in patients with chronic pain. Pain Research and Management. 2002;7(2):75-9.

81.   Morin CM, Gibson D, Wade J. Self-Reported Sleep and Mood Disturbance in Chronic Pain Patients. The Clinical Journal of Pain. 1998;14(4):311-4. PubMed PMID: 00002508-199812000-00007.

82.   Nicassio PM, Moxham EG, Schuman CE, Gevirtz RN. The contribution of pain, reported sleep quality, and depressive symptoms to fatigue in fibromyalgia. PAIN. 2002;100(3):271-9. PubMed PMID: 00006396-200212000-00008.

83.   Pilowsky I, Crettenden I, Townley M. Sleep disturbance in pain clinic patients. PAIN. 1985;23(1):27-33. PubMed PMID: 00006396-198509000-00005.

84.   Smith MT, Perlis ML, Smith MS, Giles DE, Carmody TP. Sleep Quality and Presleep Arousal in Chronic Pain. Journal of Behavioral Medicine. 2000;23(1):1-13.

85.   Wilson KG, Watson ST, Currie SR. Daily diary and ambulatory activity monitoring of sleep in patients with insomnia associated with chronic musculoskeletal pain. PAIN. 1998;75(1):75-84. PubMed PMID: 00006396-199803000-00008.

86.   Haythornthwaite JA, Hegel MT, Kerns RD. Development of a sleep diary for chronic pain patients. Journal of Pain and Symptom Management. 1991;6(2):65-72.

87.   Morphy H, Dunn KM, Lewis M, Boardman HF, Croft PR. Epidemiology of insomnia: a longitudinal study in a UK population. SLEEP-NEW YORK THEN WESTCHESTER-. 2007;30(3):274.

88.   Affleck G, Urrows S, Tennen H, Higgins P, Abeles M. Sequential daily relations of sleep, pain intensity, and attention to pain among women with fibromyalgia. Pain. 1996;68(2):363-8.

89.   Tang NK, Goodchild CE, Sanborn AN, Howard J, Salkovskis PM. Deciphering the temporal link between pain and sleep in a heterogeneous chronic pain patient sample: a multilevel daily process study. Sleep. 2012;35(5):675-87A.

90.   Tang NK, Sanborn AN. Better quality sleep promotes daytime physical activity in patients with chronic pain? A multilevel analysis of the within-person relationship. PloS one. 2014;9(3):e92158.

91.   Edwards RR, Almeida DM, Klick B, Haythornthwaite JA, Smith MT. Duration of sleep contributes to next-day pain report in the general population. PAIN®. 2008;137(1):202-7.

92.   Lewandowski AS, Palermo TM, De la Motte S, Fu R. Temporal daily associations between pain and sleep in adolescents with chronic pain versus healthy adolescents. Pain. 2010;151(1):220-5.

93.   Campbell P, Tang N, McBeth J, Lewis M, Main CJ, Croft PR, et al. The role of sleep problems in the development of depression in those with persistent pain: a prospective cohort study. Sleep. 2013;36(11):1693-8.

94.   NIH. NIH State-of-the-Science Conference on Manifestations and Management of Chronic Insomnia in Adults: Final Panel Statement.: NIH; 2005 [updated 2005]. Available from: https://consensus.nih.gov/2005/insomniastatement.htm.

95.   Cappuccio FP, Cooper D, D'Elia L, Strazzullo P, Miller MA. Sleep duration predicts cardiovascular outcomes: a systematic review and meta-analysis of prospective studies. European heart journal. 2011;32(12):1484-92.

96.   Ramlee F, Afolalu EF, Tang NK. Do people with chronic pain judge their sleep differently? A qualitative study. Behavioral Sleep Medicine. 2016:1-16.

97.   Tang NK, Salkovskis PM, Hodges A, Soong E, Hanna MH, Hester J. Chronic pain syndrome associated with health anxiety: A qualitative thematic comparison between pain patients with high and low health anxiety. British Journal of Clinical Psychology. 2009;48(1):1-20.

98.   Turk DC, Dworkin RH, Revicki D, Harding G, Burke LB, Cella D, et al. Identifying important outcome domains for chronic pain clinical trials: an IMMPACT survey of people with pain. PAIN®. 2008;137(2):276-85.

99.   Casarett D, Karlawish J, Sankar P, Hirschman K, Asch DA. Designing pain research from the patient's perspective: what trial end points are important to patients with chronic pain? Pain Medicine. 2001;2(4):309-16.

100.   Haack M, Mullington JM. Sustained sleep restriction reduces emotional and physical well-being. Pain. 2005;119(1):56-64.

101.   Irwin MR, Olmstead R, Carrillo C, Sadeghi N, FitzGerald JD, Ranganath VK, et al. Sleep loss exacerbates fatigue, depression, and pain in rheumatoid arthritis. Sleep. 2012;35(4):537-43.

102.   Moldofsky H, Scarisbrick P. Induction of neurasthenic musculoskeletal pain syndrome by selective sleep stage deprivation. Psychosomatic medicine. 1976;38(1):35-44.

103.   Smith M, Edwards R, McCann U. The effects of sleep de-privation on pain inhibition and spontaneous pain in women. Sleep (New York, NY). 2007;30:494-505.

104.   Morin CM, Hauri PJ, Espie CA, Spielman AJ, Buysse DJ, Bootzin RR. Nonpharmacologic treatment of chronic insomnia. An American Academy of Sleep Medicine review. Sleep. 1999;22(8):1134-56.

105.   Morgenthaler T, Kramer M, Alessi C, Friedman L, Boehlecke B, Brown T, et al. Practice parameters for the psychological and behavioral treatment of insomnia: an update. An American Academy of Sleep Medicine report. SLEEP-NEW YORK THEN WESTCHESTER-. 2006;29(11):1415.

106.   Redondo JR, Justo CM, Moraleda FV, Velayos YG, Puche JJO, Zubero JR, et al. Long‐term efficacy of therapy in patients with fibromyalgia: A physical exercise‐based program and a cognitive‐behavioral approach. Arthritis Care & Research. 2004;51(2):184-92.

107.   Gustavsson C, von Koch L. Applied relaxation in the treatment of long-lasting neck pain: a randomized controlled pilot study. Journal of Rehabilitation Medicine. 2006;38(2):100-7.

108.   Becker N, Sjøgren P, Bech P, Olsen AK, Eriksen J. Treatment outcome of chronic non-malignant pain patients managed in a Danish multidisciplinary pain centre compared to general practice: a randomised controlled trial. Pain. 2000;84(2):203-11.

109.   Ashworth P, Burke B, McCracken L, editors. Does a pain management programme help you sleep better? CLINICAL PSYCHOLOGY FORUM-NEW SERIES-; 2008: BRITISH PSYCHOLOGICAL SOCIETY.

110.   Currie SR WK, Pontefract AJ, deLaplante L. Cognitive-behavioral treatment of insomnia secondary to chronic pain. Consult Clin Psychol. 2000;68:407-16.

111.   Edinger JD, Wohlgemuth WK, Krystal AD, Rice JR. Behavioral insomnia therapy for fibromyalgia patients: a randomized clinical trial. Archives of internal medicine. 2005;165(21):2527-35.

112.   Tang NK, Lereya ST, Boulton H, Miller MA, Wolke D, Cappuccio FP. Nonpharmacological treatments of insomnia for long-term painful conditions: a systematic review and meta-analysis of patient-reported outcomes in randomized controlled trials. Sleep. 2015;38(11):1751.

113.   Pigeon WR, Moynihan J, Matteson-Rusby S, Jungquist CR, Xia Y, Tu X, et al. Comparative effectiveness of CBT interventions for co-morbid chronic pain & insomnia: a pilot study. Behaviour research and therapy. 2012;50(11):685-9.

114.	Von Korff M, Vitiello MV, McCurry SM, Balderson BH, Moore AL, Baker LD, et al. Group interventions for co-morbid insomnia and osteoarthritis pain in primary care: The lifestyles cluster randomized trial design. Contemporary clinical trials. 2012;33(4):759-68.
115.	Vitiello MV, McCurry SM, Shortreed SM, Balderson BH, Baker LD, Keefe FJ, et al. Cognitive‐behavioral treatment for comorbid insomnia and osteoarthritis pain in primary care: The lifestyles randomized controlled trial. Journal of the American Geriatrics Society. 2013;61(6):947-56.
116.	Vitiello MV, McCurry SM, Shortreed SM, Baker LD, Rybarczyk BD, Keefe FJ, et al. Short-term improvement in insomnia symptoms predicts long-term improvements in sleep, pain, and fatigue in older adults with comorbid osteoarthritis and insomnia. PAIN®. 2014;155(8):1547-54.
117.	Carney CE, Edinger JD. Overcoming Insomnia: A Cognitive-Behavioral Therapy Approach Workbook: Oxford University Press; 2008.
118.	Harvey AG, Sharpley AL, Ree MJ, Stinson K, Clark DM. An open trial of cognitive therapy for chronic insomnia. Behaviour Research and Therapy. 2007;45(10):2491-501.
119.	Espie C, Morin C. Insomnia: A clinical guide to assessment and treatment.[References]. 2003.
120.	Morley S, Eccleston C, Williams A. Systematic review and meta-analysis of randomized controlled trials of cognitive behaviour therapy and behaviour therapy for chronic pain in adults, excluding headache. Pain. 1999;80(1):1-13.
121.	Afolalu EF, Moore C, Ramlee F, Goodchild CE, Tang NK. Development of the pain-related beliefs and attitudes about sleep (PBAS) scale for the assessment and treatment of insomnia comorbid with chronic pain. Journal of Clinical Sleep Medicine. 2016.
122.	Tang NK, Salkovskis PM, Poplavskaya E, Wright KJ, Hanna M, Hester J. Increased use of safety-seeking behaviors in chronic back pain patients with high health anxiety. Behaviour Research and Therapy. 2007;45(12):2821-35.
123.	Tang NK, Salkovskis PM, Hanna M. Mental defeat in chronic pain: initial exploration of the concept. The Clinical Journal of Pain. 2007;23(3):222-32.
124.	Tang NK, Goodchild CE, Hester J, Salkovskis PM. Mental defeat is linked to interference, distress and disability in chronic pain. Pain. 2010;149(3):547-54.
125.	Tang NK, Goodchild CE, Hester J, Salkovskis PM. Pain-related insomnia versus primary insomnia: a comparison study of sleep pattern, psychological characteristics, and cognitive-behavioral processes. The Clinical journal of pain. 2012;28(5):428-36.
126.	Otis JD, Keane TM, Kerns RD. An examination of the relationship between chronic pain and post-traumatic stress disorder. Journal of rehabilitation research and development. 2003;40(5):397.
127.	Asmundson GJ, Coons MJ, Taylor S, Katz J. PTSD and the experience of pain: research and clinical implications of shared vulnerability and mutual maintenance models. The Canadian Journal of Psychiatry. 2002;47(10):930-7.
128.	Sharp TJ, Harvey AG. Chronic pain and posttraumatic stress disorder: mutual maintenance? Clinical psychology review. 2001;21(6):857-77.
129.	Turk DC, Swanson KS, Gatchel RJ. Predicting opioid misuse by chronic pain patients: a systematic review and literature synthesis. The Clinical journal of pain. 2008;24(6):497-508.

130.   Chou R, Fanciullo GJ, Fine PG, Miaskowski C, Passik SD, Portenoy RK. Opioids for chronic noncancer pain: prediction and identification of aberrant drug-related behaviors: a review of the evidence for an American Pain Society and American Academy of Pain Medicine clinical practice guideline. The Journal of Pain. 2009;10(2):131-46. e5.

131.   Fishbain DA, Rosomoff HL, Rosomoff RS. Drug abuse, dependence, and addiction in chronic pain patients. The Clinical journal of pain. 1992;8(2):77-85.

132.   Janke EA, Collins A, Kozak AT. Overview of the relationship between pain and obesity: What do we know? Where do we go next? Journal of rehabilitation research and development. 2007;44(2):245.

133.   Okifuji A, Hare BD. The association between chronic pain and obesity. Journal of pain research. 2015;8:399.

134.   Shiri R, Karppinen J, Leino-Arjas P, Solovieva S, Viikari-Juntura E. The association between obesity and low back pain: a meta-analysis. American journal of epidemiology. 2010;171(2):135-54.

135.   Amy EA, Kozak AT. "The more pain I have, the more I want to eat": obesity in the context of chronic pain. Obesity. 2012;20(10):2027-34.