Current Pain and Headache Reports (2019) 23: 57
https://doi.org/10.1007/s11916-019-0794-9

OTHER PAIN (A KAYE AND N VADIVELU, SECTION EDITORS)

An Update on Cognitive Therapy for the Management of Chronic Pain: a Comprehensive Review

Ivan Urits[1] · Ashley Hubble[2] · Emily Peterson[2] · Vwaire Orhurhu[1] · Carly A. Ernst[3] · Alan D. Kaye[4] · Omar Viswanath[5,6,7]

Published online: 10 July 2019

Abstract

Purpose of Review Psychological approaches to the management of chronic pain have proven to be very effective in allowing patients to better manage their symptoms and with overall functioning.

Recent Findings Cognitive functional therapy (CFT) is centered on a three-step process, beginning with cognitive training, then progressing to functional movement training and exposure with control, and ending with physical activity and lifestyle changes. Cognitive behavioral therapy (CBT) as a technique focuses on identifying and changing maladaptive behaviors, thought patterns, and situations that contribute to psychiatric dysfunction, which may lead to further progression of pain.

Summary The purpose of this review is to provide a comprehensive update of recent advances in the use of both CFT and CBT for the management of chronic pain conditions.

Keywords Psychotherapy · Cognitive behavioral therapy · Cognitive functional therapy · Low back pain · Chronic pain

Introduction

Chronic pain has been best described by a multifaceted pathophysiology of physical, social, and psychological components. Psychological approaches to the management of chronic pain are effective in allowing patients to better process their pain and subsequently improve their ability to manage symptoms and overall functioning. Of these, cognitive functional therapy (CFT) and cognitive behavioral therapy (CBT) are among the most prominently studied and utilized.

CFT is a behavioral approach first developed by physical therapists for individualizing the management of chronic, disabling lower back pain. CFT has been utilized for a variety of musculoskeletal pathologies in addition to low back pain [1, 2]. It is centered on a three-step process, beginning with cognitive training, then progressing to functional movement training and exposure with control, and ending with physical activity and lifestyle changes. The goals of CFT are to allow individuals to identify modifiable risk factors associated with chronic pain, change behaviors and maladaptive thought patterns to regain functionality, and improved pain management.

In contrast, CBT focuses on identifying and changing maladaptive behaviors, thought patterns, and situations that may contribute to psychologic dysfunction. Learning new, more adaptive behaviors leads to improvement in psychologic functioning. The goal of CBT is to identify and change maladaptive thought patterns, behaviors, and environments. CBT has been used for a variety of conditions phobias, panic disorder, generalized anxiety disorder, post-traumatic stress disorder, depression, eating disorders, and chronic pain conditions including headache, fibromyalgia, arthritis, and chronic low back pain [3, 4].

This article is part of the Topical Collection on *Other Pain*

✉ Ivan Urits
iurits@bidmc.harvard.edu

[1] Department of Anesthesia, Beth Israel Deaconess Medical Center, Critical Care, and Pain Medicine, Harvard Medical School, 330 Brookline Ave, Boston, MA 02215, USA

[2] Phoenix Regional Campus, Creighton University School of Medicine, Phoenix, AZ, USA

[3] A.T. Still University Kirksville College of Osteopathic Medicine, Kirksville, MO, USA

[4] Department of Anesthesiology, Louisiana State University Health Sciences Center, New Orleans, LA, USA

[5] Valley Anesthesiology and Pain Consultants, Phoenix, AZ, USA

[6] Department of Anesthesiology, University of Arizona College of Medicine-Phoenix, Phoenix, AZ, USA

[7] Department of Anesthesiology, Creighton University School of Medicine, Omaha, NE, USA

Although they share some theories, motivations, and outcomes, CFT differs from CBT. CFT was developed to treat low back pain and is specifically structured to progress to functional activity changes [1]. At its core, CBT is a treatment strategy for primary psychiatric disorders and does not necessarily require the addition of movement training. CBT has been utilized to treat a wider variety of chronic pain conditions. The purpose of this review, therefore, is to provide a comprehensive update of recent advances in the use of both CFT and CBT for the management of chronic pain conditions.

Cognitive Behavioral Therapy

Cognitive behavioral therapy has primarily been studied in patients with psychiatric disorders such as depression, anxiety, and post-traumatic stress disorder. Despite this, CBT has been shown to be effective in patients with a variety of conditions, including headache, fibromyalgia, arthritis, and cancer pain [5]. CBT has been utilized in a variety of ages and stages of pain—specifically patients with acute pain who are at risk of progressing to chronic pain [3]. Studies have suggested that CBT may be more effective in female patients. This could be related to gender differences in empathy, female patients tend to score higher on empathy measures, therefore may be able to form a stronger therapeutic relationship and derive more benefit from CBT [5]. Regimens of CBT vary in structure, including length and number of sessions, and specific techniques. They can encompass a variety of activities such as relaxation exercises, breathing exercises, and cognitive restructuring exercises such as pain journals and identification of thought patterns, and problem-solving activities such as coping skills and lifestyle changes [3, 5].

Neurological Mechanism of Effect

Participation in CBT treatments for pain correlates with neurological changes in a variety of areas of the brain, which may explain the method's efficacy in treating chronic pain patients. Nascimiento et al. used functional magnetic resonance imaging to demonstrate that CBT alters brain function and network connections. After treatment with CBT, patients were noted to have increased activation of the prefrontal cortex, particularly the dorsolateral, ventrolateral, somatosensory, and orbitofrontal cortices [6•]. The prefrontal cortex is activated by acute pain, and is involved in the ability to process, anticipate, and reappraise pain events, as well as the ability to regulate emotions in response to painful stimuli. Patients were noted to have normalization of aberrant connections of the orbitofrontal cortex and inferior parietal lobule within the sensorimotor network [7]. Patients also had increased connectivity between the prefrontal cortex and limbic system and basal ganglia [6•]. This connection is increased in patients with chronic pain. Increased functional connectivity and downregulation in abnormal connectivity after CBT was noted to be correlated to better coping mechanisms [8, 9], even short-term CBT treatment downregulated this abnormal increase in connectivity. Yuan et al. suggest that this connectivity could serve as a biomarker to monitor the effect of CBT in patients [8]. Additionally, patients with chronic pain were found to have increased activity of the insula, dorsolateral prefrontal cortex, and anterior cingulate cortex during mindfulness training, which led to a reduction in pain anticipation and rated unpleasantness [6•]. After treatment with CBT, patients were found to have reduced dorsal posterior cingulate cortex activity which correlated with improvements in rated pain intensity, pain-related cognition, and anxiety regarding pain [7].

Goals of Cognitive Behavioral Therapy

Patients who utilize CBT for management of chronic pain do so for a variety of reasons, including increased function, reduced pain, greater ability to complete activities of daily living, and increased independence. When patients were asked to choose a goal for treatment, a majority of patients (75%) set a physical activity goal, and > 50% set a functional status goal [10]. This suggests that the primary motivator for patients seeking CBT treatment for chronic pain is the interest in maintaining function and activity levels. Treatment should be tailored to the patient's individual goals and focused on improving function and maintaining a patient's ability to perform daily activities. CBT has been used effectively to treat a variety of conditions.

Migraines

Patients suffering from migraine have been effectively treated with CBT [4, 11, 12]. CBT may be a particularly useful modality for the treatment of migraine as it also addresses comorbid psychiatric disorders, common in patients suffering from migraine. In pediatric populations, patients suffering from migraine frequently have comorbid insomnia. Law et al. demonstrated that simultaneous CBT for migraine and insomnia was effective in reducing headache frequency as well as improving sleep quality, sleep hygiene, and headache pain [13]. This approach was comparable to treatment with topiramate and onabotulinum [14, 15]. Hybrid CBT that addresses migraine pain and comorbid psychiatric disorders is advantageous because it allows for greater personalization in treatment as well as requiring fewer visits, since two conditions are being treated simultaneously.

Abdominal Pain

Functional abdominal pain in children and adolescents is often multifactorial, involving a combination of gut hypersensitivity, behavioral and mood disturbances, and dysfunction of central pain pathways [16, 17]. Related to the complex nature of functional abdominal pain, it may be most effective to

approach children and adolescents from a biopsychosocial perspective. CBT is often recommended, but results are varied, ranging from no significant difference to some decrease in pain intensity and rated symptom severity [18–20]. Studies have shown that CBT tends to be more effective when active coping strategies are reinforced and parent and child cognition regarding their condition is addressed [19].

Gynecological Pain

Gynecological pain is another field where CBT has been proven effective, particularly in patients with chronic pelvic pain, which frequently has no identifiable cause [21]. Specifically, somatocognitive therapy, which combines CBT and physical therapy techniques, has been shown to improve motor patterns and pain severity in chronic pelvic pain patients, even 1 year after treatment [22, 23]. Behavioral interventions including relaxation and pain management training have also been shown to reduce the symptoms of primary and secondary dysmenorrhea, decreased rated symptom severity, less missed school, and more functional activity [24]. Similar interventions have also proven to reduce the impact of vasomotor symptoms such as hot flashes and night sweats in menopausal patients [25].

Fibromyalgia

Fibromyalgia is a disorder characterized by chronic pain and symptoms are frequently exacerbated by emotional stress [26]. CBT is effective at reducing tender point scores in fibromyalgia patients, both in person and via online therapy, making it an effective and accessible resource for the management of chronic fibromyalgia pain [27]. In juvenile populations, the FIT Teens CBT intervention protocol has been successful in improving psychological coping mechanisms as well as increasing functional status. Patients were shown to have improved pain as well as improvement in catastrophic thought patterns and movement phobia [28]. When this intervention was used in a group setting, patients had similar outcomes and had positive feedback regarding increased social support and the ability to modify exercises based on individual needs, comfort, and functional level [12].

Arthritic Pain

CBT is also effective at managing pain from osteoarthritis. There are a variety of approaches to managing osteoarthritis pain, including pharmacotherapy, patient education, exercise, weight loss, and surgical management such as arthroscopy and joint replacement [29]. Significant improvement in pain symptoms and functionality was shown when CBT was combined with other modalities such as pain-coping skills training, lifestyle management, and home-based practice [30]. Additionally, since weight plays a major role in the severity of osteoarthritis symptoms, behavioral weight management in combination with CBT resulted in clinically significant symptom improvement in the studied population [30].

Cognitive Functional Therapy

CFT represents a novel behavioral approach devised to target biopsychosocial factors considered barriers to recovery in patients with non-specific chronic low back pain (NSCLBP) [31, 32•]. This includes modifiable causes that drive pain, pain-related distress, and disability [31]. Lower back pain is ranked as the leading cause of disability globally, and in the majority of people (90–95%), a single pathoanatomical cause cannot be identified [31]. Without serious pathology, incapacitating lower back pain can be attributed to a neurobiological and behavioral response to a perceived threat [31]. The response is regulated by changes across the neuroendocrine-immune-motor systems, which are influenced by a combination of pathoanatomical, genetic, physical, psychological, social, lifestyle, and other health factors unique to every individual [31]. As such, an acute presentation of low back pain may represent a pain "flare" driven by multifaceted causes that generate pain as an output, as opposed to a response to tissue injury [31]. A multidimensional clinical reasoning framework that is flexible is crucial to understand these intricate processes that drive pain [31].

Mechanism of Effect

The methodology of CFT is based on a multidisciplinary clinical reasoning framework, developed by incorporating foundational behavioral psychology and neuroscience within physical therapy practice to normalize provocative movements while discouraging pain behaviors [31, 32•, 33]. It differs from CBT by the integration of both cognitive and physical factors, while CBT mostly focuses on psychological treatment [34]. The process of CFT provides patients with a comprehensive understanding of their pain while using pain and behavioral control strategies to encourage healthy lifestyle behaviors [31]. Ultimately, the purpose is to develop self-efficacy in patients with disabling lower back pain, thus ending the cycle of pain-related distress and disability [31]. Individuals can make sense of their pain and develop a personalized treatment plan that aligns with their personal goals [31]. CFT involves four components including the following: cognitive training, functional movement training, functional integration, and physical activity and lifestyle training [31]. Sullivan et al. combined and renamed functional movement training and functional integration to "exposure with control" to better reflect the therapeutic process [31].

The cognitive component of CFT, specifically focused on making sense of their pain, is a process that outlines how

circumstances, negative beliefs regarding pain, and maladaptive emotional and behavioral responses lead to a cycle of pain, distress, and disability [31]. Realistic, self-motivated goals are generated and individuals reflect on techniques to help them break the vicious cycle of pain [31]. Meanwhile, structural integrity of the spine and the implications of radiological imaging are reinforced [31]. The "exposure with control" component involves targeting and controlling sympathetic responses and safety behaviors that occur during painful, feared, or avoided functional tasks, and is considered experiential learning [31].When relaxation of the body and emotional regulation are attained via directed body relaxation strategies, slow diaphragmatic breathing, and body scanning, the person is exposed to movements deemed painful, feared, or avoided [31]. Throughout this process, body control is focused away from pain and toward other parts of the body, which leads to invalidation of fear-avoidance beliefs [31]. This approach progressively allows individuals to resume valued activities without escalation of their pain and distress [31]. If there are deficits in muscle strength or endurance, targeted functional conditioning is provided [31]. The last component encompasses physical activity and lifestyle training and is a key to CFT [31]. An exercise program is personalized to fit an individual's preference and goals with an emphasis placed on normalization of movements when movement avoidance ensues [31]. Sleep disturbances are also addressed by exploring body relaxation, breathing regulation, guided meditation, physical activity, and training of rolling and posturing in bed [31].

Clinical Efficacy

In a randomized control trial, Fersum et al. showed a long-term superiority compared to physical therapist-lead exercise and manual therapy (MT-EX) in patients with non-specific chronic low back pain (NSCLBP) using a classification-based cognitive functional therapy (CB-CFT) [31]. Out of 121 eligible patients, 62 were assigned to CB-CFT and 59 to the MT-EX group [35]. Both groups experienced substantial improvement with their intervention; however, after adjustment for baseline scores, the CB-CFT group exhibited superior outcomes across all domains measured directly after and at 12-month post-intervention for primary and secondary outcomes [35]. Regarding pain intensity, there was a clinically significant improvement when compared to the MT-EX group [35]. Similarly, a multiple case-cohort study of 26 patients with 3 phases demonstrated that CFT significantly reduced disability and pain in people with disabling NSCLBP, maintained at 12 months after intervention [33]. Participants received a targeted intervention focused on changing cognitive, movement, and lifestyle behaviors considered to be provocative and maladaptive [33]. Secondary psychosocial outcomes such as depression, anxiety, back beliefs, fear of physical activity, catastrophizing, and self-efficacy also improved after this intervention [33].

While this approach has generally been applied to individuals with disabling lower back pain, it is also applicable for other painful musculoskeletal disorders, including chronic, non-specific neck pain [31, 34]. Meziat-Filho et al. describes a case of a patient with 18 years of chronic non-specific neck pain who catastrophized and assumed that pain indicated tissue damage [34]. She was hypervigilant, sensitive to stress, and had movement impairment of the neck [34]. An MRI several years prior showed a herniated disc at C5-C6 [34]. The patient underwent CFT intervention with the primary goal directed at changing her belief that the structural damage on MRI caused her pain, given that numerous people with herniated discs are asymptomatic [34]. After 1 month of integrated cognitive and manual therapy with active exercises, her pain and disability resolved almost completely [34]. Many people with disabling lower back pain attribute their pain to a structural or anatomical vulnerability of the spine, though evidence increasingly supports the notion that psychosocial factors including depression, anxiety, self-efficacy, catastrophizing, distress, negative beliefs, and maladaptive coping are associated [33, 34]. These factors are also seen in patients with chronic neck pain, as in this case. Given the nearly equal prevalence of neck pain and lower back pain, and shared beliefs regarding the cause of pain, CFT could be adapted for patients with non-specific neck pain [34].

Advances in Techniques of Delivering Psychotherapy

Typically, CBT is performed during an in-person session. Novel technological advancements for performing CBT offer the possibility of improving access and decreasing a barrier to entry. Functional gastrointestinal disorders (FGIDs), most commonly irritable bowel syndrome (IBS), are associated with substantial personal, societal, and economic cost [36]. A bi-directional association between FGIDs and poorer psychological wellbeing has been suggested, highlighting the possible role of psychological treatments [36]. Exposure-based CBT in face-to-face format were found to be beneficial in managing symptoms in adults and adolescents with IBS; however, numerous people experience difficulties in accessing treatment due to cost, stigma, distance from specialist services, and lack of availability of trained health practitioners [36, 37]. The delivery of CBT treatment via the internet (iCBT) is one strategy for increasing access to CBT, and was shown by Hunt et al. to reduce symptoms and improve quality of life up to 3 months' post-treatment [36]. Lalouni et al. presented similar results in children with pain-related functional gastrointestinal disorders (P-FGIDs) [37].

In children, P-FGIDs are associated with a lower quality of life, anxiety, depression, and school absence [37]. Lalouni et al. evaluated the acceptability, feasibility, and potential

clinical efficacy of Internet-CBT for children aged 8–12 with P-FGIDs [37]. Advantages of internet-CBT include geographical independence, decreased therapist time, cost-effectiveness, and the ability of families to participate in treatment without missing school or work [37]. After an average of 19 min per week in treatment, most children were satisfied with the psychologist's support (28/31, 90%), reported an improvement in their ability to deal with symptoms (27/31, 87%), and reached clinically significant change in primary outcome measure at post-treatment and 6-month follow-up (15/31, 48%), defined as a 30% improvement [37]. A decrease in school absenteeism due to abdominal symptoms was also decreased from 85% pre-treatment to 32% at 6-month follow-up [37]. The study concluded that this treatment may be highly feasible and clinically effective, though results need to be confirmed in a randomized controlled trial [37].

Since iCBT is designed for patients with FGIDs, it is uncertain whether the methodology associated with transdiagnostic treatment approaches may benefit adults with FGIDs [36]. Transdiagnostic iCBT treatments are utilized for a broad range of psychological disorders with most of the published literature involving physically healthy patients with anxiety and depression, though preliminary trials have explored this treatment option for pain conditions, chronic kidney disease, cancer, and epilepsy [36]. Dear et al. examined the feasibility of a transdiagnostic iCBT intervention, the chronic conditions course, for adults with FGIDs, which involved five core lessons delivered over 8 weeks [36]. Core cognitive and behavioral skills were taught to help adults suffering from chronic health conditions manage their mental and health functional abilities [36]. A clinical psychologist was available weekly by email or telephone with clinician time amounting to 42.70 min per patient [36]. Clinically significant improvements in symptoms of FGID, anxiety, and depression were seen at post-treatment with further improvement at 3-month follow-up [36]. Pain catastrophizing and mental health-related quality of life also demonstrated clinically significant improvement, but physical health-related quality of life did not [36]. These outcomes highlight the potential value of transdiagnostic internet delivered programs for adults with FGIDs [36].

Chronic pain sufferers commonly have subjective cognitive complaints and objective cognitive impairments in attention, concentration, speed of information processing, and executive functions, which can impact the ability to self-regulate pain and emotion [38]. One method of cognitive enhancement in these patients is to strengthen neural pathways involved in cognition through repetitive challenging and mentally stimulating exercises, referred to as cognitive training [38]. It is often performed in a computerized format and has demonstrated variable success in recent years [38]. Baker et al. trialed a computerized cognitive training protocol in 30 adults (15 training and 15 controls) with chronic pain, intending to reduce cognitive difficulties [38]. The computerized method was chosen due to accessibility, wide availability for relatively low cost dissemination, and encouraging research evidence in populations with similar cognitive complaints [38]. After an 8-week online course of game-like cognitive training exercises and weekly supervision by video call, a mixed model intention-to-treat analyses revealed significant effects of training on a global neurocognitive score, driven by executive function performance (attention switching and memory) [38]. This provides preliminary evidence that supervised cognitive training may be feasible for improving cognitive skills in people with chronic pain compared with an active control, though functional and clinical outcomes still need to be established [38].

Conclusion

Psychosocial factors play a significant role in patients with chronic pain; therefore, therapeutic approaches may benefit from psychological strategies such as CBT [33]. Multiple randomized controlled trials have demonstrated that CBT successfully improves pain across a broad spectrum of syndromes including headaches, fibromyalgia, arthritis, cancer, NSCLBP, and FGIDs. It also addresses comorbid psychiatric conditions often seen in chronic pain syndromes. CBT's success may be attributed to its ability to alter brain function and connectivity in nociceptive and non-nociceptive areas of the brain, and reduction in posterior cingulate cortex activity, correlating with improvements in pain intensity, pain-related cognition, and anxiety related to pain [6•]. Despite these achievements, access to psychological treatment remains a challenge for many people.

Innovative technological advances have allowed for new delivery formats including internet-based treatments, thus decreasing barriers to treatment access. Internet-delivered CBT has been increasingly utilized due to decreased therapists time, cost-effectiveness, and geographic independence [37]. Transdiagnostic iCBT treatments also offer the unique advantage of reducing the need for clinicians to be trained in multiple treatment protocols, as one treatment meets the needs of a several patients [37]. These novel technologies have demonstrated clinically significant reductions in symptoms of FGIDs, improvement in cognitive skills in chronic pain patients, and have increased access to those with limited ability to attend in person sessions [37, 38].

Disabling chronic low back pain is a complex process influenced by a combination of factors unique to every individual, necessitating a multidimensional clinical reasoning framework to understand and treat these intricacies [38]. CFT integrates both cognitive and physical factors, which differentiates it from CBT. It was designed for individuals with NSCLBP, but has proven success in a patient with

chronic non-specific neck pain [34]. Multiple studies have demonstrated superior efficacy in decreasing disability and pain in people with NSCLBP, and improvement in self-efficacy, depression, anxiety, fear of physical activity, and catastrophizing. Promising results suggest that CFT should be compared with other conservative interventions for the management of musculoskeletal pain disorders in large randomized clinical trials.

Compliance with Ethical Standards

Conflict of Interest Ivan Urits, Ashley Hubble, Emily Peterson, Vwaire Orhurhu, Carly Ernst, and Omar Viswanath declare no conflict of interest. Alan D. Kaye discloses that he is on the Speakers Bureau for Depomed, Inc. and Merck.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

References

Papers of particular interest, published recently, have been highlighted as:
- Of importance

1. O'Sullivan K, Dankaerts W, O'Sullivan L, O'Sullivan PB. Cognitive functional therapy for disabling nonspecific chronic low Back pain: multiple case-cohort study. Phys Ther. 2015;95:1478–88.
2. O'Sullivan PB, Caneiro JP, O'Keeffe M, Smith A, Dankaerts W, Fersum K, et al. Cognitive functional therapy: an integrated behavioral approach for the targeted management of disabling low back pain. Phys Ther. 2018;98:408–23.
3. Ehde DM, Dillworth TM, Turner JA. Cognitive-behavioral therapy for individuals with chronic pain: efficacy, innovations, and directions for research. Am Psychol. 2014;69:153–66.
4. Ng QX, Venkatanarayanan N, Kumar L. A systematic review and meta-analysis of the efficacy of cognitive behavioral therapy for the management of pediatric migraine. Headache. 2017;57:349–62.
5. Lim JA, Choi SH, Lee WJ, *et al.* Cognitive-behavioral therapy for patients with chronic pain: implications of gender differences in empathy. Med. (United States). (2018).
6. • Nascimento SS, Oliveira LR, DeSantana JM. Correlations between brain changes and pain management after cognitive and meditative therapies: a systematic review of neuroimaging studies. Complement Ther Med. 2018;39:137–45. **A review of neuromechanisms by which cognitive therapy impacts chronic pain**.
7. Yoshino A, Okamoto Y, Okada G, Takamura M, Ichikawa N, Shibasaki C, et al. Changes in resting-state brain networks after cognitive-behavioral therapy for chronic pain. Psychol Med. 2018;48:1148–56.
8. Yuan M, Zhu H, Qiu C, Meng Y, Zhang Y, Shang J, et al. Group cognitive behavioral therapy modulates the resting-state functional connectivity of amygdala-related network in patients with generalized social anxiety disorder. BMC Psychiatry. 2016;16.
9. Shpaner M, Kelly C, Lieberman G, Perelman H, Davis M, Keefe FJ, et al. Unlearning chronic pain: a randomized controlled trial to investigate changes in intrinsic brain connectivity following cognitive behavioral therapy. NeuroImage Clin. 2014;5:365–76.
10. Heapy AA, Wandner L, Driscoll MA, LaChappelle K, Czlapinski R, Fenton BT, et al. Developing a typology of patient-generated behavioral goals for cognitive behavioral therapy for chronic pain (CBT-CP): classification and predicting outcomes. J Behav Med. 2018;41:174–85.
11. Cousins S, Ridsdale L, Goldstein LH, Noble AJ, Moorey S, Seed P. A pilot study of cognitive behavioural therapy and relaxation for migraine headache: a randomised controlled trial. J Neurol. 2015;262:2764–72.
12. Kashikar-Zuck S, Tran ST, Barnett K, Bromberg MH, Strotman D, Sil S, et al. A qualitative examination of a new combined cognitive-behavioral and neuromuscular training intervention for juvenile fibromyalgia. Clin J Pain. 2016;32:70–81.
13. Law EF, Wan Tham S, Aaron RV, Dudeney J, Palermo TM. Hybrid cognitive-behavioral therapy intervention for adolescents with co-occurring migraine and insomnia: a single-arm pilot trial. Headache. 2018;58:1060–73.
14. Diener HC, Dodick DW, Aurora SK, Turkel CC, DeGryse R, Lipton RB, et al. OnabotulinumtoxinA for treatment of chronic migraine: results from the double-blind, randomized, placebo-controlled phase of the PREEMPT 2 trial. Cephalalgia. 2010;30:804–14.
15. Silberstein SD, Lipton RB, Dodick DW, Freitag FG, Ramadan N, Mathew N, et al. Efficacy and safety of topiramate for the treatment of chronic migraine: a randomized, double-blind, placebo-controlled trial. Headache. 2007;47:170–80.
16. Chiou FK, How CH, Ong C. Recurrent abdominal pain in childhood. Singap Med J. 2013:195–200.
17. Scharff L, Simons LE. Functional abdominal pain. In: Pain in children: a practical guide for primary care. (2008).
18. Fisher E, Law E, Palermo TM, Eccleston C. Psychological therapies (remotely delivered) for the management of chronic and recurrent pain in children and adolescents. Cochrane Database Syst Rev. 2014.
19. van der Veek SM, de Haan E, Derkx H, Benninga MA, Boer F. Psychological factors addressed in cognitive behaviour therapy for paediatric functional abdominal pain: which are most important to target? J Health Psychol. 2017.
20. Levy RL, Langer SL, Walker LS, Romano JM, Christie DL, Youssef N, et al. Cognitive-behavioral therapy for children with functional abdominal pain and their parents decreases pain and other symptoms. Am J Gastroenterol. 2010;105:946–56.
21. Yosef A, Allaire C, Williams C, Ahmed AG, al-Hussaini T, Abdellah MS, et al. Multifactorial contributors to the severity of chronic pelvic pain in women. Am J Obstet Gynecol. 2016;215:760.e1–760.e14.
22. Haugstad GK, Kirste U, Leganger S, Haakonsen E, Haugstad TS. Somatocognitive therapy in the management of chronic gynaecological pain. A review of the historical background and results of a current approach. Scand J Pain. 2011;2:124–9.
23. Haugstad GK, Haugstad TS, Kirste UM, Leganger S, Wojniusz S, Klemmetsen I, et al. Continuing improvement of chronic pelvic pain in women after short-term Mensendieck somatocognitive therapy: results of a 1-year follow-up study. Am J Obstet Gynecol. 2008;199:615.e1–8.
24. Proctor M, Murphy PA, Pattison HM, Suckling J, Farquhar CM. Behavioural interventions for primary and secondary dysmenorrhoea. Cochrane Database Syst Rev. 2007.
25. Hunter MS. Cognitive behavioral interventions for the treatment of menopausal symptoms. Expert Rev Obstet Gynecol. 2012;7:321–6.
26. Goldenberg DL, Burckhardt C, Crofford L. Management of fibromyalgia syndrome. J Am Med Assoc. 2004;292:2388–95.
27. Menga G, Ing S, Khan O, et al. Fibromyalgia: can online cognitive behavioral therapy help? Ochsner J. 2014.

28. Kashikar-Zuck S, Black WR, Pfeiffer M, Peugh J, Williams SE, Ting TV, et al. Pilot randomized trial of integrated cognitive-behavioral therapy and neuromuscular training for juvenile fibromyalgia: the FIT teens program. J Pain. 2018;19:1049–62.
29. Nelson AE, Allen KD, Golightly YM, Goode AP, Jordan JM. A systematic review of recommendations and guidelines for the management of osteoarthritis: the chronic osteoarthritis management initiative of the U.S. bone and joint initiative. Semin Arthritis Rheum. 2014;43:701–12.
30. Ismail A, Moore C, Alshishani N, Yaseen K, Alshehri MA. Cognitive behavioural therapy and pain coping skills training for osteoarthritis knee pain management: a systematic review. J Phys Ther Sci. 2017;29:2228–35.
31. Sullivan PO, Caneiro JP, O'Keeffe M, Dankaerts W, Fersum K, Sullivan KO. Cognitive functional therapy: Phys Theray 98(5), 408–423 (2018).
32.• O'Keeffe M, Purtill H, Kennedy N, et al. Individualised cognitive functional therapy compared with a combined exercise and pain education class for patients with non-specific chronic low back pain: study protocol for a multicentre randomised controlled trial. BMJ Open. 2015;5(6):1–10. **A study protocol for the implementation of cognitive functional therapy for the management of chronic low back pain**.
33. Sullivan KO, Dankaerts W, Sullivan LO, Sullivan PBO. Back pain: multiple case-cohort study. 95(11) (2015).
34. Meziat-Filho N, Lima M, Fernandez J, Reis FJJ. Cognitive functional therapy (CFT) for chronic non-specific neck pain. J Bodyw Mov Ther. 2018;22(1):32–6.
35. Vibe Fersum K, O'Sullivan P, Skouen JS, Smith A, Kv??le A. Efficacy of classification-based cognitive functional therapy in patients with non-specific chronic low back pain: a randomized controlled trial. Eur J Pain (United Kingdom) 17(6), 916–928 (2013).
36. Dear BF, Fogliati VJ, Fogliati R, Gandy M, McDonald S, Talley N, et al. Transdiagnostic internet-delivered cognitive-behaviour therapy (CBT) for adults with functional gastrointestinal disorders (FGID): a feasibility open trial. J Psychosmatic Res. 2018;108:61–9.
37. Lalouni M, Ljótsson B, Bonnert M, Hedman-Lagerlöf E, Högström J, Serlachius E, et al. Internet-delivered cognitive behavioral therapy for children with pain-related functional gastrointestinal disorders: feasibility study. JMIR Ment Heal. 2017;4(3):e32.
38. Baker KS, Georgiou-Karistianis N, Lampit A, Valenzuela M, Gibson SJ, Giummarra MJ. Computerised training improves cognitive performance in chronic pain. Pain. 2018;159:1.