Occupational Therapy Non-Pharmacological Interventions for Adults With Chronic Pain: A Rapid Systematic Review

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Abstract

People around the world, someone you know, or even a loved one experience chronic pain that impacts their ability to engage in meaningful activities. According to the World Health Organization, one in two adults in the United States lives with chronic pain. In recent years, prescribing opioids appeared to be a quick, easy fix for pain management. Opioid use, however, is associated with adverse effects to the mind and body and may become a financial burden or addiction for many users. Reducing opioid use while improving chronic pain and function is the leading rehabilitative objective of occupational therapy for chronic pain. Occupational therapy practitioners address and treat many conditions involving chronic pain and educate their clients about effectively managing that pain while participating in desired occupations. This article highlights the evidence of 25 chronic pain intervention studies so that occupational therapists and other healthcare professionals can make evidence-based decisions about the interventions they choose for adults with chronic pain who are working toward maximal occupational engagement.

Key Words:

- Occupational therapy
- Chronic pain
- Non-pharmacological interventions
- Occupations and activities
- Preparatory tasks and methods
- Education and training

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A rapid systematic review of the literature examined non-pharmacological interventions to reduce and manage chronic pain. This review was conducted as part of the Evidence-Based Literature Review Project of Indiana University's Doctor of Occupational Therapy Program. Occupational therapy students conducted this review to provide a comprehensive overview and analysis of 25 studies addressing the effectiveness of some intervention types used in occupational therapy to reduce and manage chronic pain. Findings reveal that there is moderate but limited evidence to support the use of non-pharmacological interventions in reducing and managing chronic pain. This review supports the premise that several occupational therapy intervention types do have a positive effect on adults with chronic pain.

Focused Clinical Question

What is the effectiveness of non-pharmacological interventions for reducing and managing chronic pain in adults?

Objectives of the Evidence-Based Literature Review

Occupational therapy professionals have identified that several adults in the United States live with chronic pain that inhibits them from successfully participating in their desired occupations. This review highlights the available evidence related to non-pharmacological interventions for reducing and managing pain in individuals with chronic pain. This review can be used by clinicians to provide evidence on effective non-pharmacological interventions for individuals with chronic pain, with the fundamental goal of satisfying occupational reengagement.

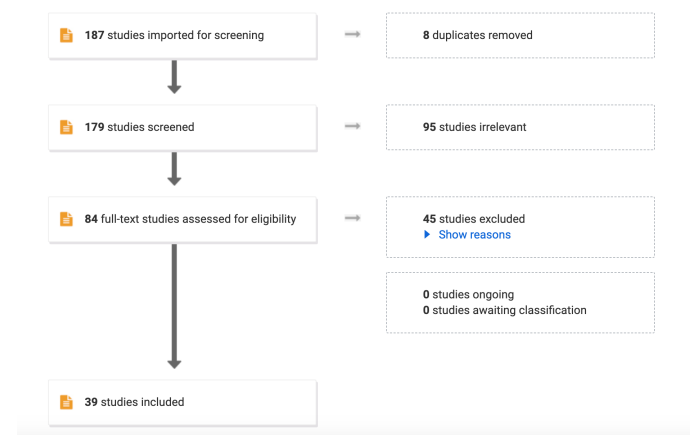## Statement of Problem and Background

Individuals suffer from chronic pain for a multitude of reasons which ultimately impact their ability to engage in meaningful activities. According to the World Health Organization (2019), 20-33% of individuals worldwide live with painful conditions, and one in two adults in the United States live with chronic pain. In recent years, opioid prescriptions became a quick, easy fix for pain management. Opioid use, however, is associated with adverse effects to the respiratory, gastrointestinal, musculoskeletal, cardiovascular, immune, endocrine, and central nervous systems (Baldini, Von Korff, & Lin, 2012). In addition to physical effects on body systems, opioids can be a financial burden for many as well as lead to addiction accompanied by other problems such as depression and isolation. Undoubtedly, opioids are not a long-term solution to reducing chronic pain.

Occupational therapy practitioners in various settings will treat a significant portion of individuals suffering from chronic pain. Chronic diseases and conditions in this review include osteoarthritis (OA), benign chronic pain, and musculoskeletal pain. The role of the occupational therapy practitioner is to educate clients about how to effectively manage their pain while engaging in desired occupations such as work, activities of daily living, leisure, play, social participation, and rest and sleep. According to the Occupational Therapy Practice Framework, pain is a client factor, which sanctions occupational therapy practitioners to treat and manage pain using preparatory methods, such as massage, and through occupations and activities, education and training, advocacy, and group interventions (American Occupational Therapy Association [AOTA], 2017).

Method for Conducting the Evidence-Based Review

This rapid systematic review aimed to examine non-pharmacological interventions for the purpose of pain reduction or management in order to increase occupational engagement and performance in adults. Occupational therapy students conducted database searches in collaboration with librarians from the Indiana University School of Medicine Ruth Lilly Medical Library. The articles included in this review were published between 2014 and 2019 and were collected from searches in the PubMed and CINAHL databases (see Figure 1). Search terms for the PubMed database were *pain management* and *chronic pain*. Search terms for the CINAHL database were *therapy* and *chronic pain management*.

Figure 1. Prisma Diagram

187 studies imported for screening	⟶	8 duplicates removed
179 studies screened	⟶	95 studies irrelevant
84 full-text studies assessed for eligibility	⟶	45 studies excluded ▸ Show reasons
		0 studies ongoing 0 studies awaiting classification
39 studies included		

Inclusion criteria for this review were non-pharmacological interventions, pain as an outcome measure, chronic pain, adult participants, and geographic study location in the United States, Canada, United Kingdom, Ireland, Australia, or New Zealand. Conversely, exclusion criteria were systematic reviews, publication date prior to 2014, and geographic location of study.

Additionally, four articles were hand searched for this review. Searching for *chronic pain* within the American Journal of Occupational Therapy yielded a study about pain management through lifestyle redesign by Uyeshiro Simon and Collins (2017). Review paper citations from that search were also considered. Murphy et al. (2016) was selected for this study from the review paper "Effectiveness of Pacing as a Learned Strategy for People With Chronic Pain: A Systematic Review" (Guy, McKinstry, & Bruce, 2019). In order to collect encompassing literature on available non-pharmacological interventions for chronic pain, PubMed was also searched with the terms *chronic pain* and *massage* to find a variety of other preparatory methods in the literature. A study about massage by Cino (2014)

was selected for this review. Furthermore, a study about AquaStretch by Keane (2017) was selected from a PubMed search with the terms *exercise therapy* and *chronic pain* to yield additional literature on preparatory task interventions for chronic pain management.

Results

This review included a total of 25 studies: 24 Level I studies and one Level II study. The findings have been categorized by type of occupational therapy intervention according to the 3rd edition of the Occupational Therapy Practice Framework: occupations and activities, preparatory tasks and methods, and education and training (AOTA, 2017).

Occupations and Activities

Five Level I randomized controlled trial (RCT) studies found that when compared with respective control groups, the interventions produced a significant decrease in pain. These interventions included yoga, Alexander Technique lessons, Thai Chi, vocal music therapy, and an immersive virtual reality game (Schmid, Van Puymbroeck, Fruhauf, Bair, & Portz, 2019; MacPherson et al., 2015; You et al., 2018; Bradt, Norris, Shim, Gracely, & Gerrity, 2016; Jin et al., 2016). Schmid et al. (2019) noted the yoga intervention also decreased the impact of pain on occupational performance. You et al. (2018) reported Thai Chi showed a decrease in pain severity and pain interference.

Preparatory Tasks and Methods

Six Level I RCT studies were reviewed that tested preparatory tasks and methods to reduce chronic pain in participants. Research involving AquaStretch, aromatherapy massage, postural exercises, and spinal cord stimulation interventions resulted in significant pain reductions for the intervention groups (Keane, 2017; Cino, 2014; Jamal, Feldman, & Pullenayegum, 2016; Kapural et al., 2015). Neither the study about a combined patient-provider intervention (Allen et at., 2017) nor the study about a text message-based social support intervention (Guillory et al., 2015) showed statistically significant pain reduction.

Education and Training

Thirteen Level I RCT studies and one Level II clinical efficacy study were reviewed within the education and training interventions. Seven of the studies showed statistically significant improvements in either pain reduction, pain interference, or pain severity (Dowd et

al., 2015; Ilgen et al., 2016; Guarino et al., 2018; Rutledge et al., 2018; Dear et al., 2017; Damush et al., 2016; Wilson et al., 2018). Those studies evaluated (respectively) an online mindfulness-based cognitive therapy intervention, a pain management intervention, a web-based cognitive behavior therapy (CBT) intervention, nurse-delivered CBT and nurse-delivered supportive psychotherapy telehealth interventions, a remote-delivered chronic pain management program provided in online and workbook formats, pain self-management training, and an online pain self-management intervention. Taylor et al. (2018) reported pain control improvement using cognition interventions for managing pain in OA. Heapy et al. (2017) compared interactive voice-response CBT to in-person CBT and reported a reduction in pain approximately 3-6 months post-baseline, but no significant pain reduction after nine months. Three studies did not have statistically significant results, which included the research on a pain management program, an electronic-health education app, and a functional restoration program (Burke, Denson, & Mathias, 2016; Kravitz et al., 2018; McGeary, Blount, Peterson, Gatchel, Hale, & McGeary, 2016). The only Level II finding in this rapid systematic review was a Lifestyle Redesign® intervention by Uyeshiro Simon and Collins (2017), which reported very small reductions in pain but none of these results were statistically significant. Focused results, however, did show a significant improvement in occupation performance and satisfaction (Uyeshiro Simon & Collins, 2017). Lastly, a study using an energy conservation intervention reported decreased pain scores in the intervention and control groups during the first 10 weeks, but only the control group reported decreased pain for more than six months (Murphy et al., 2016).

Comparisons among studies that used similar pain outcome measures across this rapid systematic review are expressed in Figures 2 and 3.
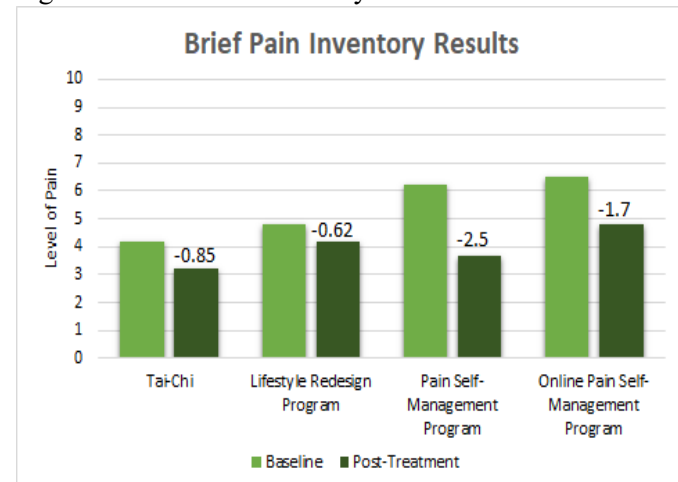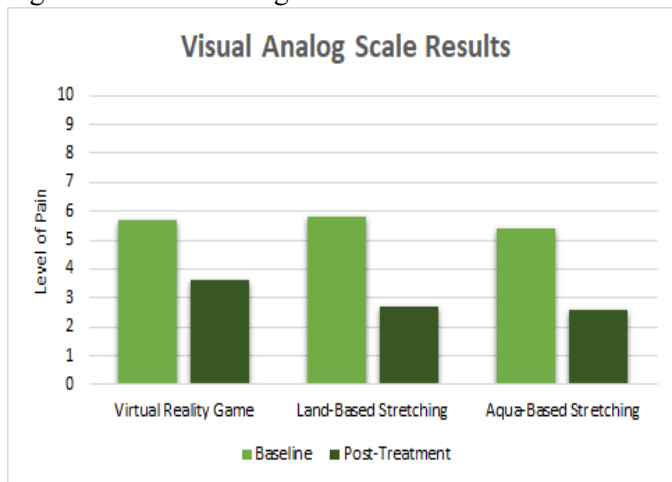
Figure 2. Brief Pain Inventory Results

Figure 3. Visual Analog Scale Results

Limitations

There were several limitations for this review. First, the reported evidence in three-fourths of the studies did not include treatment effect sizes or precision estimates of the treatment effects. Data from only eight of the 25 articles reported confidence limits or Cohen's d treatment effect sizes.

Second, the generalizability of many of the articles discussed in this paper are suspect because several involved niche populations. For instance, two articles of this review focused on active military personnel, another on inner-city dwelling African Americans, and another on older adults. While there may be some generalizability of these populations to the general population, it is unclear to what degree.

Finally, several of these studies look just at chronic pain in general and do not delve into specific diagnoses. Specific intervention recommendations for specific conditions would be useful.

Implications for Practice

The results from this rapid systematic review provide a moderate amount of evidence supporting non-pharmacological interventions for reducing and managing chronic pain. This evidence supports occupations and activities, preparatory tasks and methods, as well as education and training as effective intervention types to reduce and manage chronic pain. The results from five RCTs provide occupational therapists with strong evidence to support occupation and activity intervention types as effective methods to reduce and manage chronic pain. Occupational therapists practicing in skilled nursing facilities or community-based wellness centers should consider incorporating into their programs interventions such as yoga, Alexander Technique exercises, Thai Chi, vocal music

therapy, and specialized immersive virtual reality games for chronic pain management due to their strong supporting evidence. Furthermore, implementing these interventions may yield long-term effects for managing chronic pain in adults by ultimately reducing pain.

The articles focusing on preparatory tasks and methods found that AquaStretch, aromatherapy massage, postural exercises, and spinal cord stimulation significantly reduced pain. Therefore, implementing these interventions would ultimately improve occupational performance by reducing pain and managing chronic pain. Incorporating such interventions into community-based settings such as home health or wellness and fitness centers as well as long-term care facilities will increase the capacity to engage in meaningful occupations.

Seven articles reported statistically significant results for pain reduction, pain interference, or pain severity utilizing education and training intervention types, such as mindfulness, web-based CBT, online pain self-management, nurse-delivered CBT telehealth and nurse-delivered supportive psychotherapy telehealth, remote-delivered chronic pain management program provided in online and workbook formats, pain self-management training, and an online pain self-management intervention. Education and training intervention types are often overlooked in therapy sessions due to the limited time or focus placed elsewhere. Incorporating education interventions into therapy, however, will impart clients with chronic pain management strategies and benefits accessible at any time, not just during therapy sessions. Chronic pain is a concern in several occupational therapy settings and numbers continue to rise. Therefore, occupational therapists should consider non-pharmacological approaches for clients who are struggling to engage in meaningful activities due to overbearing chronic pain.

Conclusions

Based on this review, occupational therapists can suggest non-pharmacological interventions to clients with chronic pain as part of, or supplements to, a pain-management protocol. There is moderate evidence in this review supporting the effectiveness of non-pharmacological health management and maintenance interventions for managing chronic pain in adults. The available evidence is sufficient to determine the effects on improved health outcomes, but confidence in the estimate is often not reported.

Due to the absence of reported confidence intervals and effect sizes in some of the articles, it is unclear how large the effects are. It is unknown if these effects are above and beyond other types of pain interventions

and/or if these effects justify what might be higher costs to implement. Additional research is needed that includes these effect sizes and confidence intervals. Also, additional research is needed to recommend specific interventions for specific conditions that fall under the classification of chronic pain.

Acknowledgements

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Evidence Table for Non-Pharmacological Interventions for Adults with Chronic Pain

Author/Year	Level of Evidence/Study Design/Participants/Inclusion Criteria	Intervention and Control Groups	Outcome Measures	Results
Allen, A. D., Oddone, E. Z., Coffman, C. J., Jeffreys, A. S., Bosworth, H. B., Chatterjee, R., … Dolor, R.J. (2017) doi:10.7326/M 16-1245	Level I Cluster Randomized Control Trial $N = 537$ 26% male 74% female M age = 63.3 yr *Inclusion Criteria* • patients with OA of the hip or knee along with self-reported joint symptoms (pain, aching, stiffness, or swelling in or around hip or knee) • participants had to be overweight (BMI $\geq$ 25 kg/m^2)	*Intervention 1* Patient intervention $n = 128$ Twelve-month intervention focused on physical activity, weight management, and cognitive behavioral strategies to manage pain. Telephone calls with a counselor were scheduled 2x/month for the first six months. Goal planning and action planning were major components of this intervention. *Intervention 2* Provider intervention $n = 140$ Patient Care Professionals were to assess and consider various treatment options for patients. Treatment options included: refer to physical therapist, refer for evaluation for knee brace, refer to weight management program, refer to physical activity program, perform or refer for intra-articular injection, recommend topical	Secondary outcome measure: Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain subscale	The participants receiving the patient-provider intervention did not have greater improvement in the WOMAC-pain subscale than those in the patient or provider intervention groups when compared to usual care. No differences in improvement compared with usual care were observed in any of the treatment groups. Patient-provider intervention (*p = 0.49*) Patient intervention (*p = 0.37*) Provider intervention (*p = 0.60*)

		nonsteroidal anti-inflammatory drug or capsaicin, add gastroprotective agent or remove nonsteroidal anti-inflammatory drug in patients at high risk for peptic ulcer disease, discuss new or alternate pain medication, and refer to orthopedic evaluation for joint replacement surgery. *Intervention 3* Patient-provider intervention *n* = 140 Combination of interventions 1 and 2. *Control* Usual care *n* = 129 Usual treatment for osteoarthritis.		
Bradt, J., Norris, M., Shim, M., Gracely, E. J., & Gerrity, P. (2016) doi:10.1093/jmt/thw004	Level I RCT *N* = 55 18% male 82% female *M* age = 54.5 yr *Inclusion Criteria* • 18 years of age or older • have a diagnosis of chronic benign pain ≥ 6 months	*Intervention* Vocal Music Therapy (VMT) *n* = 28 Treatment program consisted of eight 60-minute weekly group therapy sessions (6-8 participants in each group) administered by lead investigator, a board-certified music therapist with expertise in chronic pain management. VMT sessions consisted of following essential components: 1. music-guided deep breathing to transition from prior activities and bring focus to body.	Physical functioning was measured by the Interference Scale (9 items) and General Activities Scale (18 items) of the Westhaven-Yale Multidimensional Pain Inventory (MPI). Participants rated their average pain intensity, as well as average pain coping, during the past week using an 11-point (0–10) numeric rating scale.	There was a moderate treatment effect of VMT on pain interference at the end of the treatment program (*d* = 0.6; 95% CI, 0.01 to 1.22); however, by week 12, this effect had decreased to 0.23 (95% CI, -0.39 to 0.86). As for pain, both the VMT and WLC groups reported decreases in average weekly pain, but pain reductions were greater in the VMT group than the control group at the end of treatment (*d* = 0.6; 95% CI, -0.01 to 1.2).

		2. brief verbal check-in 3. toning and humming experiences to enhance body awareness, release bodily tensions, develop caring attitude toward one's body. 3. verbal processing of somatic experiences evoked by the toning exercises. 4. vocal improvisations initiated by therapist or participants: music therapist could offer a brief vocal melodic phrase for group to sing in a repetitive manner. Group encouraged to add harmonies and additional vocal phrases. Percussion instruments or body percussion were typically added to provide rhythmic drive and energy. Music therapist also used circle songs for vocal improvisation segment. *Control* Waitlist Control (WLC) group *n* = 27 Participants received care as usual at the health center. After completion of the follow-up measures (week 12), they participated in the 8-week VMT treatment program.	VMT participants rated their present pain intensity before and after each VMT session.	This difference between the groups was smaller at follow-up (d = 0.26; 95% CI, -0.36 to 0.89). Participants in both groups improved their coping with pain, with VMT participants reporting slightly greater improvements at follow-up (d = 0.2;, 95% CI, -0.36 to 0.88). Results of examining the effect of VMT on weekly pre-session pain reports suggest a decrease in pain intensity over the time span of eight sessions. (d = 0.5;, 95% CI, 0.15 to 2.34).
Burke, A. L. J., Denson, L. A., & Mathias, J. L. (2016)	Level I RCT *N* = 346	*Intervention* Standardized waitlist management plus educational session (EXP) *n* = 66 Three-hour powerpoint education	Pain acceptance measured with the Chronic Pain Acceptance Questionnaire (CPAQ)	Results of the CPAQ did not show a difference, indicating the EXP group's attendance to the educational session did not influence this measure

doi:10.1093/pm /pnw125	43% male 57% female

M age = 44.1 yr

Inclusion Criteria • adults who were newly referred to the Pain Management Unit of Royal Adelaide Hospital between November 2011 and November 2013 | session given to these participants and educated them on the chronic pain processes, the clinical unit and what to expect from treatment, the role of psychological factors in pain and ways to manage pain (e.g., relaxation, mind- fulness, challenging thinking, etc.), goal setting, sleep hygiene, distraction/attention focus, self-care, exercise, activity pacing, and medication.

Control Treatment as usual (TAU) with standardized waitlist management *n* = 126 Treatment for chronic pain as they were before. No change in treatment.

Did not attend (DNA) *n* = 154 Did not treat at all. | Pain-related interference measured with the Brief Pain Inventory: Pain-related Interference (BPI-PI)

Pain severity measured with the Brief Pain Inventory: Pain Severity (BPI-PS) | ($p = 0.48$).

Measures of pain-related interference (BPI-PI) did not show difference between TAU and EXP groups ($p = 0.53$).

Measures of pain severity (BPI-PS) were not different between groups ($p = 0.70$). |
| Cino, K. (2014) doi:10.1177/08 980101145283 78 | Level I RCT

N = 118

25% male 75% female

M age = 83 yr

Inclusion Criteria | *Intervention* Aromatherapy massage *n* = 39-40 M technique hand massage with 1% lavender essential oil diluted in the massage oil. M technique involves light-touch massage with a set pressure combined in a fixed pattern.

Intervention | Geriatric Multidimensional Pain Illness Inventory (GMPI) to measure pain intensity and suffering, life interference, and emotional distress. Higher scores indicate increase in pain intensity.

Iowa Pain Thermometer (IPT) is a modified vertical | GMPI Pain and Suffering Posttest Aromatherapy massage ($M = 12.256$; 95% CI, 4.0 to 26.0) Massage only ($M = 12.417$; 95% CI, 4.0 to 32.0) Nurse presence ($M = 16.684$; 95% CI, 4.0 to 36.0)

IPT between group differences for massage only compared to nurse presence group |

	• 60 years or older with chronic pain • residents of long-term facility for at least 3 months • Brief Mental Status score ≥ 8 out of 15	Massage only n = 39-40 M technique without lavender aromatherapy. M technique was completed identical to comparing intervention excluding the diluted lavender essential oil. *Control* Nurse presence n = 39-40 Nurse presence involved conversation of the client's choice with no touch between participant and nurse. Attentive conversation lasted 20 minutes.	Verbal Descriptor Scale with a graphic display on thermometer. It is a self-report pain intensity scale (0 = no pain to 12 = the most pain imaginable).	6-weeks post-treatment ($t = -2.803$, $p = 0.006$, $d = -2.43713$). IPT between group differences for aromatherapy massage compared to nurse presence 6-weeks post-treatment ($t = 1.287$, $p = 0.202$, $d = -1.10594$). Statistically significant results were found on the GMPI Pain and Suffering post-test scores to make the notion that aromatherapy massage and massage only does decrease pain and suffering. Furthermore, IPT pain score found pain score to decrease overtime, but there were not statistically significant differences between groups.
Damush, T. M., Kroenke, K., Bair, M. J., Wu, J., Tu, W., Krebs, E. E., & Poleshuck, E. (2016) doi:10.1002/ejp.830	Level I RCT N = 250 44% male 56% female M age = 55.1 yr *Inclusion Criteria* • pain located in the low back, hip or knee; have persisted 3 months or	*Intervention* Antidepressant case management with pain self-management program n = 123 Stepped care consisted of 12 weeks of antidepressant therapy, followed by a six-session pain self-management (PSM) program delivered over 12 additional weeks. Outcome assessments were conducted at baseline and 12 months by interviewers blinded to the treatment arm.	Pain interference was assessed primarily with the Brief Pain Inventory (BPI)	The 2.5-point reduction on the 0-10 BPI pain interference scale represents a clinically important difference (Kroenke et al., 2009).

	longer despite conventional analgesic treatment, defined as prior use of at least two different analgesics; and be at least moderate in severity • depression had to be of at least moderate severity: PHQ-9 score ≥ 10 and endorsement of depressed mood and/or anhedonia (Kroenke et al., 2001a)	*Control* Usual care *n* =127 Patients randomized to the usual care arm were informed they had depressive symptoms and that they should seek advice from their primary care provider about treatment. There were no other attempts by study personnel to influence depression or pain management unless a psychiatric emergency (e.g. suicidal ideation) arose.		
Dear, B. F., Gandy, M., Karin, E., Ricciardi, T., Fogliati, V. J., McDonald, S., … Titov, N. (2017) doi:10.1097/j.pain.0000000000000916	Level I RCT *N* = 178 18% male 82% female *M* age = 47.84 yr *Inclusion Criteria* • experienced pain > 6 months • pain has been assessed by General Practitioner (GP) or specialist within the last 3 months • at least 18 years of age • resident of Australia • regular access to computer and internet	*Intervention* Internet Group *n* = 84 Internet-delivered pain-management program based on principles of cognitive behavior therapy. The goal of this program was to provide information that helps participants to understand and deconstruct their symptoms and difficulties; teach a range of self-management skills to help participants manage their symptoms and difficulties; and reduce pain-related disability and improve emotional well-being by encouraging the practice and adoption of the skills taught within the program. *Control* Workbook Group	*Primary Measures* Pain Disability Index (PDI) *Secondary Measures* Wisconsin Brief Pain Questionnaire *Tertiary Measures* Pain Self-Efficacy Scale (PSEQ) Chronic Pain Acceptance Questionnaire (CPAQ-8) Pain Catastrophizing Scale (PCS)	*Primary Measures* Internet and Workbook Groups improved from baseline to post treatment across all the primary outcome domains ($P = 0.001$). Further improvements were observed from posttreatment to 3-month follow-up on both measures of disability (PDI: $P = 0.003$) with some evidence of further improvement from 3-month follow-up to 12-month follow-up on one measure of disability (PDI: $P = 0.026$). *Secondary Measures* Workbook Group had lower average pain levels ($P = 0.013$). Both groups improved pain levels from pretreatment to posttreatment ($P = 0.001$). The Workbook Group

	• not currently experiencing very severe symptoms of depression	n = 94 The Workgroup Group received the Pain Course in a spiral-bound, hard copy workbook that was sent to participants by registered mail. The workbook version was printed in color, and the content was identical to the online version of the Pain Course. Participants in the Workbook Group were provided with a prescribed timetable for working through the Pain Course, which matched the release of the materials for the Internet Group.		had lower average pain levels at post treatment (P = 0.001) and after 3-month follow up (P = 0.015) when compared to the Internet Group. Internet Group reported improvements from posttreatment to 3-month follow up (P = 0.022). Internet Group also showed improvements from 3-month to 12-month follow ups (P = 0.005). No difference in scores were identified between the two groups at 12-month follow up (P = 0.302). *Tertiary Measures* Results indicated that both the Internet and Workbook Groups improved from baseline to post treatment across all the tertiary outcome domains (Ps = 0.001). Further improvements were observed for both groups from posttreatment to 3-month follow-up in pain catastrophizing (PCS: P = 0.001).
Dowd, H., Hogan, M. J., McGuire, B. E., Davis, M. C., Sarma, K. M., Fish, R. A., & Zautra, A. J. (2015)	Level I RCT N = 124 10% = male 90% = female M age = 44.53 yr	*Intervention* Mindfulness in Action (MIA) n = 62 The intervention drew on mindfulness meditation aspects of the mindfulness-based stress reduction approach integrated within cognitive therapy. An audiovisual version of the program was developed for this study. Each	Two numerical rating scales from the BPI32 were used to measure level of pain intensity "right now" and on average. The Pain Catastrophizing Scale	Ratings of average pain did not change significantly over time nor was there a difference between groups in the lack of change over time (time and time × group effects Fs < 0.83, ns). Ratings of pain "right now" showed a marginal downward trend over time (time F = 5.98, P < 0.02; time

doi:10.1097/AJP.00000000000 00201	*Inclusion Criteria* • volunteers with self-reported chronic pain listed on a research database based at National University of Ireland, Galway	session included a pre-recorded presentation designed to build skills associated with mindfulness and instructions on how to cultivate and sustain positive emotional experiences, particularly within social relationships. Individual sessions were approximately of 20 minutes' duration and each session also included a recommended audio-recorded meditation component that participants were asked to access daily. Participants in the MIA group received twice weekly emails inviting them to visit the Mindfulness in Action Web site and to view the session material and to practice the suggested mindfulness meditation. *Control* Psychoeducation program (PE) $n = 62$ PE was based on many of the common elements found within pain management psychoeducation programs such as explaining pain within a biopsychosocial model, information about activity pacing, encouragement to be active, and cognitive-behavioral skills such as problem solving and the role of unhelpful thoughts. Some of the materials were drawn from a self-management chronic pain	A brief 8-item version of the Chronic Pain Acceptance Questionnaire	slope estimate = -0.36, $t = -1.90$, $P = 0.07$) that did not vary by group (time × group $F = 0$, ns). On the CPAQ-8, pain acceptance ratings increased over time (time $F = 26.42$, P < 0.0001), and the magnitude of the change was similar across groups (time × group $F = 0.52$, ns). Post hoc probes including both groups indicated that acceptance increased from T_1 to T_2 (time slope estimate = 2.18, $t = 3.40$, $P = 0.002$), and remained stable from T_2 to T_3 (time slope estimate = 1.75, $t = 1.59$, ns) such that T3 levels of acceptance were significantly higher than those at T_1 (time slope estimate = 1.96, $t = 3.59$, $P = 0.001$). Pain catastrophizing ratings decreased over time (time $F = 11.20$, $P = 0.002$), and the magnitude of the change was similar across groups (time × group $F = 2.30$, ns). Post hoc probes indicated that catastrophizing decreased from T_1 to T_2 (time slope estimate = 3.34, $t = -3.51$, $P = 0.001$), and remained stable from T_2 to T_3 (time slope estimate = -1.21, $t = -0.83$, ns), such that T_3 levels of catastrophizing were significantly

		handbook. This program was presented in a series of emails containing written information about chronic pain self-management. The purpose of the PE program was to have an active comparator treatment based on established pain education material. Participants in the PE group received twice weekly emails with psychoeducational material related to chronic pain.		lower than those at T_1 (time slope estimate = -2.22, t = -3.16, P = 0.003).
Guarino, H., Fong, C., Marsch, L. A., Acosta, M. C., Syckes, C., Moore, S. K., … Rosenblum, A. (2018) doi:10.1093/pm /pnx334	Level I RCT $N = 110$ 40% male 60% female M age = 51.3 yr *Inclusion Criteria* • ≥ 18 years old • moderate to severe pain (defined as rating one's worst pain in the past week as 5 on the 10-point Brief Pain Inventory [BPI]) for at least 3 months • receiving long-term opioid therapy for pain • endorse at least four items (with any response	*Intervention* Treatment as usual + web-based CBT $n = 55$ The Take Charge of Pain program was based on CBT principles to teach patients strategies for restructuring dysfunctional thinking about pain and skills for coping with pain and reducing its impact on one's life. The program consisted of 27 self-paced modules that are housed within a home page. This intervention is given online and accessed through a computer. Modules take approximately 20-30 minutes to complete. *Control* Treatment as usual (TAU) $n = 55$ Usual care was provided to patients at the pain practice study site, which	*Primary Measures* Multidimensional Pain Inventory (MPI): Pain Severity and Pain Interference Subscales *Secondary Measures* Pain Catastrophizing Scale (PCS)	*Primary Measures* A significant time effect was found for pain severity and pain interference, with patients in both conditions reporting significant reductions in baseline levels of these variables during the active intervention that were generally maintained in the post intervention period. MPI Pain Severity (P = 0.547) MPI Pain Interference (P = 0.560) *Secondary Measures* A significant treatment-by-time effect was also found for pain catastrophizing; on average, participants in the web-CBT condition reported an 8.08-point reduction in baseline PCS scores across the intervention period, as compared with a 3.43-point reduction reported by TAU

	> 0) on the Current Opioid Misuse Measure (COMM) in relation to the past 30 days	typically included opioid pharmacotherapy along with other medications and medical interventions, such as nerve blocks and injections, as indicated. No psychological or behavioral treatment therapies were included for this group.		participants ($P = 0.040$).
Guillory, J., Pamara, C., Henderson, C. R., Shengelia, R., Lama, S., Warmington, M., … Reid, M. C. (2015) doi:10.1097/AJP.0000000000000193	Level I Pilot RCT $N = 68$ 25% male 75% female M age = 48.55 yr *Inclusion Criteria* • chronic, noncancer pain on most days of every month over preceding 3-month period • no new medication during the study • English speakers • 30-80 years old • New York state residents • own Android or iPhone smartphone capable of downloading novel pain tracking app	*Intervention* Standard care with SMS text 2x/day $n = 36$ Participants continued standard care for their chronic noncancer pain and received an SMS text message for support 2x/day. *Control* Standard care $n = 35$ Participants continued standard care for their chronic noncancer pain.	Pain and Pain Interference (Scale 0-10) on TrackApp	Patients receiving social support messages reported lower visual, general, relation, and sleep pain, and higher levels of positive affect during the intervention period (weeks 2 and 3) compared with baseline ratings in week 1 ($P = 0.027, 0.0001, 0.001, 0.004, 0.002$, respectively). Ratings of visual, general, relation, and sleep pain, and positive affect for patients in the control condition did not differ between the intervention period (weeks 2 and 3) and baseline (week 1) ($P = 0.633, 0.349, 0.449, 0.764, 0.444$, respectively).
Heapy, A. A., Higgins, D. M.,	Level I RCT	*Intervention* Interactive Voice Response (IVR)	The Numeric Rating Scale (NRS) was used to measure	Using the NRS, 3-month post baseline, there was a **0.77 decrease**

Goulet, J. L., LaChapelle, K. M., Driscoll, M. A., Czlapinski, R. A., … Kerns, R. D. (2017) doi:10.1001/jamainternmed.2017.0223	*N* = 125 78% male 22% female *M* age = 57.9 yr *Inclusion Criteria* • electronic health record-verified back condition • at least moderate pain intensity (≥ 4 on 0-10 numeric rating scale) for at least 3 months • self-reported ability to walk one block • access to touch tone telephone • absence of medical or psychiatric conditions that could impair participation	Cognitive Behavioral Therapy (CBT) *n* = 62 Received weekly prerecorded therapist feedback based on their IVR-reported activity, coping-skills practice and pain outcomes. *Control* In-person CBT *n* = 63 Attended weekly, in-person, individual 30-40 minute CBT sessions with a therapist at a clinic. Participants in both groups received a treatment manual specific to assigned intervention and IVR monitoring of pain, sleep, activity levels, and pain-coping skill practice over a 10-week timespan.	pain over the past week with a scale from 0 (no pain) to 10 (worst imaginable pain). Pain-related functioning and interference was measured with the West Haven-Yale Multidimensional Pain Inventory. The Roland and Morris Disability Questionnaire was used to assess pain-related interference.	**in pain** (95% CI, -1.39 to -0.29) for IVR-CBT and a 0.84 decrease in pain (95% CI, -1.29 to -0.26)) for in-person CBT. **IVR-CBT was noninferior** to in-person CBT in posttreatment NRS with a mean difference of 0.07 (95% CI, -0.67 to 0.80). Both groups demonstrated statistically significant reductions in average pain intensity at 3 and 6 months post baseline, but not after 9 months. There were not significant differences between IVR-CBT or in-person CBT for pain-related interference, sleep, quality of life, or depressive symptoms.
Ilgen, M. A., Bohnert, A. S. B., Chermack, S., Conran, C., Jannausch, M., Trafton, J., & Blow, F. C. (2016) doi:10.1111/add.13349	Level I RCT *N* = 129 89% male 11% female *M* age = 51.7 yr *Inclusion Criteria* • average pain intensity >	*Intervention* Improving Pain during Addiction Treatment (ImPAT) *n* = 65 Combined principles of CBT and acceptance-based approaches to pain management related to avoiding use of substances and coping mechanisms. *Control* *n* = 64	Pain intensity was assessed by the Numeric Rating Scale (NRS), with an 11-point scale: 0 (no pain) to 10 (worst imaginable pain). Pain-related functioning and interference was measured with the West Haven-Yale Multidimensional Pain Inventory.	NRS measures had a mean 1.3 **decrease in pain for the ImPAT** group ($p < 0.05$). NRS measures had a mean 0.7 decrease in pain for the control group ($p < 0.05$). **ImPAT pain-related functioning** was **significantly greater** relative to the control condition ($p < 0.05$).

	4 on NRS over past 3 months • currently receiving substance-use disorder services • ≥ 18 years old • able to speak and understand English	Received psychoeducation program, within normal therapy, related to substance use. Both group participants received the same amount of therapist/patient contact, 10 one-hour sessions delivered over 10 weeks.		
Jamal, A. N., Feldman, B.M., Pullenayegum, E. (2016) doi:10.3899/jrheum.151368	Level I RCT $N = 151$ 40% male 60% female M age $= 49.8$ yr *Inclusion Criteria* • 18-70 years old • unresolved neck pain of at least 2 months but not more than 12 months • comprehend English • live in Middlesex Count of Southwestern Ontario	*Intervention I* Pillow $n = 38$ Received a neck support pillow to be used during sleep. *Intervention II* Exercise $n = 38$ Received a program of active neck and postural exercises. *Intervention III* Pillow and exercise $n = 38$ Received a neck support pillow to be used during sleep and a program of active neck and postural exercises. *Control* Thermal modalities and massage $n = 37$ Effleurage massage for 5 minutes and a moist hot or cold pack, according to their preference, for 20	Northwick Park Neck Pain Questionnaire (NPQ) assessed neck-related pain, sleep and function; scores range from 0 (no pain) to 36 (dysfunction).	Main effects of pillow or exercise alone on NPQ scores were not statistically significant ($p > 0.05$). The **interaction between pillow and exercise** was **statistically significant** ($p < 0.05$).

		minutes during therapy. All study participants were seen by the same physical therapist throughout the course of treatment. Treatments were 2 days for the first three weeks and 1 day for the second three weeks with a followup visit at week 10.		
Jin, W., Choo, A., Gromala, D., Shaw, C., & Squire, P. (2016) doi:10.3233/978-1-61499-625-5-154	Level I RCT $N = 20$ 20% male 80% female Age range 30 to 75 years old *Inclusion Criteria* • ≥ 18 years of age • diagnosis of chronic pain	*Intervention* Immersive virtual reality (VR) technology n = not recorded In the VR intervention group, subjects spent 10 minutes playing Cryoslide using the Oculus Rift DK2 and noise-cancelling headphones. *Control* Self-mediated n = not recorded In the self-mediated control group, subjects were asked to spend 10 minutes engaging in the daily pain distracting activities that they used to [sic], such as meditating, reading, playing mobile games or listening to audiobooks. During the washout period, subjects filled out the Post-Intervention Questionnaire, which was used to collect pain intensity data at present and during the past 10 minutes. The entire	Visual Analog Scale (VAS) questionnaire used to collect pain intensity data (score from 0 to 100, with 0 representing no pain and 100 representing the excruciating pain). Amount of time thinking specifically about their pain	Pain intensity during and after the interventions was measured. For pain intensity after the interventions, the two groups of the VR intervention and self-mediated control were not significantly different using repeated measures ANOVA (F (2, 38) = 1.377, p = 0.265). However, for pain intensity during the intervention, there was a significant difference between the VR intervention and control groups (F (2, 38) = 21.473, $p < 0.001$, r = 0.505). Compared to the baseline, there was a **36.7% reduction in pain intensity during the VR intervention** using Bonferroni post hoc tests (95% CI, -31.443 to -11.657; $p < 0.001$). Compared to the control group, the **VR intervention group** also had a **significant reduction in pain intensity** (95% CI, -27.397 to -6.953; $p = 0.001$). There was no significant difference between the baseline and control group in pain intensity ($p = 0.336$).

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		study session lasted for 35-45 minutes per subject.		In comparison to the control group, subjects in the **VR intervention group** reported a **56% reduction in the amount of time thinking specifically about their pain** ($p < 0.001$, $r = 0.75$); subjects also reported a statistically significant effect on losing track of time ($p < 0.001$, $r = 0.78$) in the VR intervention compared to the control condition.
Kapural, L., Yu, C., Doust, M. W., Gilner, B. E., Vallejo, R., Sitzman, B. T., … Burgher, A. H. (2015) doi:10.1097/ALN.0000000000000774	Level I RCT $N = 198$ 40% male 60% female M age = 54.9 yr *Inclusion Criteria* • chronic intractable pain of trunk and/or limbs • conservative therapy for last 3 months • average back and leg pain intensity of 5 or more on Visual Analog Scale • appropriate candidate for surgical procedures	*Intervention* High-frequency (HF10) therapy $n = 101$ Subjects participating in HF10 therapy received 30μs pulses delivered at 10,000 Hz with amplitude adjusted to optimal analgesic response. Intraoperative testing and programming were not needed for HF10 therapy subjects. The tips of the two leads are placed in the posterior spinal epidural space of T8 and T9. *Control* Traditional spinal cord stimulation (SCS) $n = 97$ Paresthesia testing and associated drive programming were performed intraoperatively to overlap the region of the subjects back and leg pain. The leads were anchored to the respected supraspinous	Visual Analog Scale (VAS) assessed back and leg pain, on a scale from 0 (no pain) to 10 (worst imaginable pain) Global Assessment of Functioning (GAF) measures how much a person's pain and symptoms affect his or her day-to-day life on a scale of 0 to 100.	Over 12 months, mean VAS for **back pain decreased 67%** from 7.4 ± 1.2 to approximately 2.5 **with HF10 therapy** compared with a 44% decrease from 7.8 ± 1.2 to approximately 4.3 for traditional SCS. Mean VAS **leg pain decreased** 70% with HF10 therapy compared with a decrease of 49% with traditional SCS. Also, **35.5% of HF10 therapy subject**s **decreased or eliminated opioid analgesic usage** compared with 26.4% of traditional SCS subjects. Functionally, at 12 months, 70.8% of subjects receiving HF10 therapy had no to transient symptoms on the GAF compared with 59.3% of traditional SCS subjects.

		ligaments.		No subjects receiving HF10 reported stimulation-related discomfort or paresthesia compared to 46.5% of traditional SCS subjects reported uncomfortable stimulation.
Keane, L. G. (2016) doi:https://doi.org/10.1016/j.jbmt.2016.07.004	Level I RCT $N = 29$ 17% male 83% female *M* age = 46 yr *Inclusion Criteria* • men and women aged 18-70 years • self-reported chronic lower back pain (CLBP) for 3 mo+ • no previous surgeries on lower back • no specific injuries to lower back	*Intervention* Land-based stretching (LBS) $n = 10$ Land-based stretching involved static and dynamic stretching for the lumbo-pelvic-hip complex and upper body stretches recommended by the National Academy of Sports. *Intervention* AquaStretch $n = 10$ AquaStretch is a one-on-one approach with assisted technique focusing on myofascial release technique performed in shallow water using weighted resistance. *Control* $n = 9$ Instructed to continue normal physical activity throughout the study.	Visual Analog Scale (VAS) is a pain perception measurement on a scale of 0 (no pain) to 10 (worst pain ever). Subjects submitted a VAS score once a week. Modified Oswestry Low Back Pain Questionnaire (MOLBPQ) was used to measure self-reported disability. Measured 3 times total: on first day, at week 6, and at week 12.	According to the VAS pain measurement scale, the average pre-scores for each group: Control group = 4.38 AquaStretch = 5.4 LBS = 5.75 Average post-scores were: Control group = 4.89 AquaStretch = 2.6 LBS = 2.65 **Significant** ($p < 0.05$) **reduction in pain** ($P = 0.006$) observed in **AquaStretch** group. Statistical significance ($p < 0.05$) was NOT observed in the control group ($P = 1$). Statistical significance ($p < 0.05$) was NOT observed in the LBS group for pain reduction ($P = 0.339$). According to the MOLBPQ, the average pre-scores for each group: Control group = 40 AquaStretch = 45.6 LBS = 34

| | | | | Average post-scores for MOLBPQ: Control group = 31.56 AquaStretch = 33.2 LBS = 25.8

Statistical significance ($p < 0.05$) was NOT observed in the control group ($P = 1$) for perceived disability. A statistically significant ($p < 0.05$) **improvement** was observed in the **AquaStretch group** for **pain reduction and perceived disability** ($P = 0.001$). Statistical significance ($p < 0.05$) was NOT observed in the LBS group for perceived disability ($P = 0.35$). |
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| Kravitz, R. L., Schmid, C. H., Marois, M., Wilsey, B., Ward, D., Hays, R. D., ... Servadio, J. L. (2018) doi:10.1001/ja mainternmed.2 018.3981 | Level I RCT

$N = 215$

53% male 47% female

M age = 55.5 yr

Inclusion Criteria • English-speaking adults • 18-75 years old • musculoskeletal pain for at least 6 weeks at the time of screening | *Intervention* mHealth app $n = 108$ mHealth app provided reminders to take designated treatments on assigned days and to respond to daily questions on pain and treatment-associated adverse effects.

Control Baseline clinic visits $n = 107$ Clients completed assessments under the supervision of research assistants. Clients received usual | Patient-Reported-Outcomes Measurement Information System (PROMIS) pain-related interface 8-item short-form scale (full scale range 41-78)

Patient-reported pain intensity (PROMIS 3a short-form) | Difference in change between intervention group and control group on the PROMIS is ($M = -1.36$ points; 95% CI, -2.91 to 0.19 points; $P = .09$).

Difference in change between intervention group and control group on PROMIS 3a short-form, specifically pain intensity, is ($M = 0.31$; 95% CI, -1.18 to 1.81, $P = .06$ overall).

Results indicate **no statistically significant differences between intervention group and control** |

	• had smartphone or tablet with data plan • reported a score ≥ 4 out of 10 on at least 1 item of the 3-item pain, enjoyment, and general activity questionnaire	care		**group** on measures of PROMIS and pain intensity on PROMIS 3a short-form.
MacPherson, H., Tilbrook, H., Richmond, S., Woodman, J., Ballard, K., Atkin, K., ... Hopton, A. (2015) doi:10.7326/M15-0667	Level I RCT $N = 517$ 31% male 69% female M age = 53.2 yr *Inclusion Criteria* • 18 years or older • neck pain lasting at least 3 months • score of at least 28% on the Northwick Park Questionnaire for neck pain	*Intervention* Alexander Technique $n = 173$ Alexander Technique involves methods of self-care that reduce habits of poor posture, excessive muscle tension, malcoordination, stress, or pain. *Intervention* Acupuncture $n = 172$ Acupuncture involved a series of needles inserted into muscle tissue for the promotion of healing and pain reduction. *Control* Usual care $n = 172$ Usual care involved routine general and neck pain-specific treatments provided to primary care patients such as prescribed medications, physical therapy visits, and other health professional visits.	Northwick Park Neck Pain Questionnaire (NPQ) 3, 6, and 12 months post-treatment Chronic Pain Self-Efficacy Scale using the 5-question pain management subscale scored from 0 to 8, where higher scores are indicating better self-efficacy	Differences between acupuncture and usual care on neck pain NPQ scores at 3 months ($M = $ -6.22; 95% CI, -8.75 to -3.70) and after 12 months ($M = $ -3.92; 95% CI, -6.87 to -0.97). Differences between Alexander Technique and usual care on neck pain NPQ scores at 3 months ($M = $ -3.60; CI 95%, -6.08 to -1.13) and after 12 months ($M = $ -3.79; CI 95%, -6.66 to -0.91). **Chronic Pain** Self-Efficacy scores **improved for both intervention groups** compared to usual care. Self-efficacy scores for the acupuncture intervention group compared to usual care: ($M = $ -3.31; CI 95%, -5.62 to -0.99). Self-efficacy scores for Alexander Technique intervention compared to usual care: ($M = $ -2.03; CI 95%, -5.29 to 1.22). **Acupuncture interventions and Alexander Technique**

				interventions both led to significant reductions in neck pain compared to usual care at 12 months. However, improvements in self-efficacy scores may rationalize long-term benefits found from both interventions at 12 months.
McGeary, C. A., Blount, T. H., Peterson, A. L., Gatchel, R. J., Hale, W. J., & McGeary, D. D. (2016) doi:10.1007/s10926-015-9605-2	Level I RCT *N* = 44 *Intervention group* 58% male 42% female *M* age = 35.88 yr *Control group* 67% male 33% female *M* age = 35.6 yr *Inclusion Criteria* • active duty military service members • chronic musculoskeletal pain as primary concern	*Intervention* Functional restoration *n* = 26 Functional restoration involved 3 weeks of intense group and individual cognitive behavioral therapy, biofeedback, and physical therapy. *Control* Treatment as usual *n* = 18 Treatment as usual involved usual care within the military medical system.	Multidimensional Pain Inventory (MPI) is a 52-item self-report questionnaire that aims to measure pain severity, interference from pain, and significant other responses to pain. Million Visual Analog Scale (MVAS) is a 15-item visual analog measure of pain disability. Total functional disability scores range from 0 to 150, where higher scores indicate greater functional disability. Questions focus on pain disability and function. Pain Visual Analog Scale (VAS) used an 11-point scale marked on a 10 cm line.	Perceived higher punishing responses were significantly related to worsen physical health related quality of life (*p* = 0.037) and pain interference (*p* = 0.026). Perceptions of significant others' responses may be impacted by psychosocial and physical pain outcomes and potentially change after treatment. However, **no statistically significant data is present**.
Murphy, S., Kratz, A., Kidwell, K., Lyden, A.,	Level I RCT *N* = 193	*Intervention* Tailored activity pacing *n* = 64	Pain severity was measured using the pain subscale taken from the WOMAC, a five item scale that	Participants of the **general activity pacing intervention** had a **significant decrease in their pain** from baseline to 10 weeks;

Geisser, M., & Williams, D. (2016) doi:10.1097/j.pain.0000000000000549.	38% male 62% female *M* age = 64.7 yr *Inclusion Criteria* • age ≥ 50 • reported pain for at least 3 months duration • reported at least mild to moderate pain severity overall (a score of ≥ 4 and at least 2 activities with at least moderate pain on the Western Ontario and McMaster Universities Osteoarthritis Index [WOMAC] pain subscale). • radiographic evidence of osteoarthritis in a corresponding knee or hip joint (≥ 2 on the Kellgren Lawrence scale) • live in the community • have adequate cognitive ability (scoring ≥ 5 on the 6-item screener to identify cognitive impairment) • able to enter ratings on Actiwatch-Score accelerometer used in study • have consistent, typical sleep schedule (usual	In addition to the learning module, participants received an individualized summary report. This report was generated from activity and symptom data collected during the home monitoring period and comprised a personalized pacing schedule based on the associations between symptoms and physical activity for the individual. The report consisted of a graphic (called the "actogram") of all activity data collected from the Actiwatch-Score; activity periods that appeared to indicate prolonged high or low activity were circled as potential periods of overactivity or sedentary behavior. In addition, daily and weekly averages of each individual's symptoms and activity counts were presented alongside comparison values from a large sample of participants with knee or hip OA from the study team's previous research studies (to indicate whether the person was generally low/average/high on symptoms and activity relative to a sample of individuals with the same condition). Several graphs were created to show associations between an individual's physical activity and symptoms, and information from participant's daily activity logs that had information about the types of activities that	measures pain severity in different activities due to knee or hip pain.	however, participants of the usual care group had decreased pain from baseline to six months.

| | wake-up time before 11am and bedtime before 2am) | were engaged in were integrated into the reports to highlight particular examples where pacing could be helpful. These data were presented with the goal of discussing each individual's unique association symptoms and activity. The end of the report had pacing recommendations based on the aggregate activity and symptom data. Reports were created by a study team member (AL) and discussed with the study principal investigator (SM) to review and refine treatment recommendations. The treating therapist received the report at least one day before the first scheduled treatment session in order to become familiar with the participant's symptoms and activity patterns. This individual report was then discussed throughout the sessions of the tailored intervention.

Intervention
General activity pacing
n = 66
Unlike the tailored activity pacing intervention, neither the participants nor the treating therapists in the general activity pacing intervention received information or data about the home monitoring period. Participants in the general activity pacing intervention received the same learning module and time in | | |
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		the session was spent communicating with the therapist about usual activity and symptoms and recalling instances in which symptoms interfered with activity. *Control* Usual care $n = 63$ Participants of the control (usual care) condition were instructed to continue with their usual care for OA. These participants only came in for assessments at baseline, 10 weeks, and 6 months using the same procedures as participants in the pacing interventions. They also participated in monthly health status calls similar to participants of the pacing interventions. At the end of the 6 months, participants were offered the learning module used in the pacing interventions.		
Rutledge, T., Atkinson, J. H., Holloway, R., Chircop-Rollick, T., D'Andrea, J., Garfin, S. R., … Slater, M. (2018) doi:10.1016/j.jpain.2018.03.017	Level I RCT $N = 61$ 81% male 19% female Intervention group *M* age = 62.5 ± 11.3 yr Control group	Both treatments (cognitive-behavioral therapy [CBT] and supportive care [SC]) were adapted to a telephone format and delivered by a primary care nurse trained by a clinical psychologist specializing in pain management. The treatment phases of both conditions contained 12 total sessions. Treatment session 1 was face-to-face, of 2 hours' duration, introducing the treatment rationale. Treatment sessions 2-12	Pain interference with everyday function was assessed with the Roland-Morris Disability Questionnaire. Pain intensity was measured with the numeric rating scale (NRS). Improvements in pain and function were rated on the	Intervention group Significant improvement (≥ 30% **reduction**) in **pain interference** RMDQ score. baseline vs post-treatment 11.4 ± 5.9 vs 9.4 ± 6.1 $p < 0.05$, $d = 0.33$ Significant improvement (≥ 30% **reduction**) in **pain intensity** NRS score.

	M age = 64.3 ± 12.7 yr	were completed via telephone, in 30-minute sessions (2x/weekly sessions during weeks 1-4 and one weekly session during weeks 5-8). Total contact time for both treatments was 8 hours.	Clinical Global Impressions Scale (CGI).	baseline vs post-treatment 4.9 ± 2.1 vs 4.0 ± 1.9 $p < 0.05$, $d = 0.45$
	Inclusion Criteria • participants were male and female Veterans • age 18-75 • nonspecific low back pain (thoracic vertebra at level 6 or below) • experience of pain "on a daily basis" ≥ 6 months at a minimum intensity ≥ 4 on a 10-point scale • not a back-surgery candidate		Depressive symptom severity was assessed with the Beck Depression Inventory-2 (BDI-2).	
		Intervention Cognitive behavioral therapy *n* = 30 Each CBT session followed manualized protocol emphasizing behavior change and self-management. Participants received a set of structured written materials accompanying each session to provide core educational information, guide learning and skills development, and structure self-monitoring exercises for respective session. Each treatment session included CBT lessons and specific physical exercises that were reviewed at the start of the subsequent phone sessions. Weekly content was cumulative, with most important content emphasized in earlier sessions to permit greater opportunities for practice. Week 1: treatment rationale, pain education, introduction of exercise & activity logs Week 2: activity pacing, relaxation training Week 3: pain cognitions, cognitive distortion		Control group Significant improvement (≥ 30% **reduction**) in **pain interference** RMDQ score. baseline vs post-treatment 11.1 ± 5.4 vs 9.1 ± 5.2 $p < 0.05$, $d = 0.38$ Significant improvement (≥ 30% **reduction**) in **pain intensity** NRS score. baseline vs post-treatment 5.0 ± 1.9 vs 3.8 ± 2.1 $p < 0.05$, $d = 0.60$

		Week 4: sleep hygiene Week 5: review & practice of wks 1-4 Week 6: pain behaviors, sexual activity with back pain Week 7: review & practice of wks 1-6 Week 8: self-management, maintenance *Control* Supportive care $n = 31$ Intent of SC arm was to provide a rigorous comparison group that controlled for nonspecific benefits of therapy and allow for evaluation of any unique benefits of behavioral and goal-setting focus of CBT treatment. Core ingredients of the SC treatment: • education by distribution of standard text, *The Back Pain Help Book* • active listening by therapist to participant's concerns • use of Rogerian principles: client-centered approach emphasizes facilitating client's inbuilt propensity toward growth and development. Aim is to enhance client's feelings of self-worth, reduce the level of incongruence between ideal and actual self, and help client become fully functioning despite adversity. Therapist's		

		objective in SC is to be nonjudgmental "sounding board," to form "authentic" warm relationships with clients, to express "unconditional positive regard," and to show empathy to clients.		
Schmid, A. A., Van Puymbroeck, M., Fruhauf, C. A., Bair, M. J., & Portz, J. D. (2019) doi:10.3233/WOR-192919	Level I RCT *N* = 83 32% male 68% female *M* age = 51.4 ± 10.5 yr *Inclusion Criteria* • current patient at an outpatient pain clinic in a relatively small city • at least 6 months chronic pain • > 18 years old • no physical activity restriction • no consistent yoga in past year • willingness to provide consent to enter & participate in study	*Intervention* Yoga *n* = 44 Hour-long yoga sessions were offered 2x/week for 8 weeks (16 sessions). The yoga protocol was a standardized and progressive intervention that included sitting, standing, and floor postures. Yoga sessions included physical postures, breath work (to connect the movement to the breath), mantras, and meditation. The yoga teacher was an occupational therapist or a physical therapist to allow for enhanced modification of postures to best meet pain- and disability-related needs of study participants. *Control* Usual care *n* = 39 Usual care included: monthly physician visits; vital sign monitoring and recording (i.e. blood pressure, heart rate, pulse oxygen); management of pain medication; goal setting; nutritional counseling; a limited number of visits to a	Pain-related disability was reported through the Brief Pain Inventory. The impact of pain on occupational performance and everyday life was assessed by the newly developed Occupational Impact of Pain Screening Tool (OIPS).	Intervention group The scores for the **impact of pain on occupational performance and everyday life** significantly <u>**decreased**</u> (9%↓) with a moderate effect size. 50.67±16.62 vs 45.88±18.24 *p* = 0.010, *d* = 0.50

		massage therapist or acupuncturist; and monthly self-management sessions. Self-management education sessions led by the Pain Clinic nurse focused on health and wellness programming.		
Taylor, S. S., Oddone, E. Z., Coffman, C. J., Jeffreys, A. S., Bosworth, H. B., & Allen, K. D. (2018) doi:10.1007/s12529-017-9689-5	Level I Cluster RCT $N = 300$ 91% male 9% female M age = 61.1 ± 9.2 yr *Inclusion Criteria* • participants recruited from primary care providers in the Department of Veterans Affairs HealthCare System Ambulatory Care Service in Durham, NC. • hip OA &/or knee OA • overweight (body mass index ≥ 25) • engage in low physical activity	*Intervention* Osteoarthritis (OA) group $n = 151$ The OA intervention lasted 12 months and focused on physical activity, weight management, and cognitive-behavior pain management strategies. A counselor taught CBT skills alongside general exercise and dietary strategies via telephone. Calls were scheduled 2x/month for the first 6 months, then monthly for the last 6 months. Cognitive restructuring was taught during months 9 & 10. Intervention components included goal setting, action planning, and motivational interviewing strategies. Participants were given written patient educational materials, an OA exercise video, and an audio CD of relaxation exercises. *Control group* Usual care $n = 149$ Usual medical care recommended by their providers	The physical function subscale of the Western Ontario and McMaster Universities Index (WOMAC) assessed difficulty completing everyday physical tasks. Pain control was measured using two items from the Coping Strategies Questionnaire. Catastrophizing was measured using the Pain Catastrophizing Scale (PCS). Perceived ability to cope with arthritis symptoms was measured with the Arthritis Self-Efficacy Scale.	From baseline to 12 months, the intervention group showed a significantly greater improvement in physical functioning (c) compared to the control group $c = -3.39$, SE = 1.54, $p = 0.04$ Assessed in an independent model, arthritis self-efficacy (a_1b_1) significantly mediated the link between intervention group and baseline to 12-month change in physical functioning $a_1b_1 = -0.86$; SE = 0.41; 95% CI, -1.75 to -0.16 Assessed in an independent model, pain control (a_1b_1) significantly mediated the link between intervention group and baseline to 12-month change in physical functioning $a_1b_1 = -0.88$; SE = 0.38; 95% CI, -1.72 to -0.21
Uyeshiro	Level II	*Intervention Group*	The Pain Self-Efficacy	PSEQ total scores increased by 4.46

Simon, A., & Collins, C. E. R. (2017) doi:10.5014/ajot.2017.025502	Clinical Efficacy Study N = 45 29% male 71% female M age = 42.6 yr *Inclusion Criteria* • referred to Lifestyle Redesign by their physicians • live in southern California	Lifestyle Redesign® n = 45 Lifestyle Redesign® includes the use of treatment modules to promote patient education and implementation of behavior changes into daily routines. Module topics and duration of treatment spent on each module were determined by the therapist's evaluation and ongoing assessment of the patient's needs. Given the range of chronic pain conditions treated, individual sessions allowed for in-depth patient education and tailoring of interventions to address diagnosis-specific lifestyle factors. The number of sessions and duration (weeks) of treatment varied depending on the patient's plan of care, which was determined by the treating occupational therapist after evaluation. Each session was approximately 45-60 minutes long. *No Control Group*	Questionnaire (PSEQ) is used to rate how confident people feel in performing different activities, despite pain. Higher scores indicate higher self-efficacy. Brief Pain Inventory (BPI) rates pain severity on average, its highest and lowest in the past 24 hr, and the degree to which their pain interferes with different dimensions of feeling and function.	points on average, which was a **significant improvement** in the patient's perceived **ability to engage** in functional activity despite pain (p = 0.003). BPI scores showed small decreases in average, worst pain levels, pain interference and pain severity composite scores, but none of these changes were statistically significant. Lifestyle Redesign® occupational therapy can **significantly improve patient functioning, pain self-efficacy, and quality of life.** More rigorous research about lifestyle-based occupational therapy treatment is warranted, both with chronic pain and with other chronic conditions. This study demonstrates the need for more occupational therapists to incorporate lifestyle techniques into existing practices and into chronic pain management care.
Wilson, M., Finlay, M., Orr, M., Barbosa-Leiker, C., Sherazi, N., Roberts, M. L. A., … Roll, J.	Level I RCT N = 60 56% male 44% female	*Intervention* Online pain self-management n = 31 Participants received an 8-week subscription to Goalistics Chronic Pain Management Program (CPMP), a self-directed Internet-based self-management program	The Pain Self-Efficacy Questionnaire (PSEQ) assessed the confidence one has to conduct activities while experiencing persisting pain. The Brief Pain Inventory	Intervention group Significant **improvement** over time t(11) = -2.41, p = 0.04 in pre and post **pain self-efficacy** values in those who engaged in treatment 19.33 ± 12.30 vs 33.33 ± 14.2

| M. (2018) doi:10.1016/j.addbeh.2018.04.019 | *M* age = 44.3 ± 12.0 yr

Inclusion Criteria
• participants recruited from two outpatient opioid treatment clinics in the state of Washington
• ability to read and write English
• ≥ 18 years of age
• diagnosis of chronic non-cancer pain lasting > 3 months | intended for a general population of patients with persistent non-cancer pain. Online learning modules include didactic materials, homework exercises, and self-monitoring activities that target four areas of pain management: cognitive, emotional, behavioral, and social pain determinants. The modules present written information combined with an interactive activity to teach new pain management concepts and skills. Daily planning calendars and trackers supplement the program materials in order to schedule, practice, and evaluate skills taught in the modules.

Control
Wait-list attention placebo control
n = 29
Control group received a weekly email communication from research staff including educational tips in the form of a website link on pain management and were asked to report on any progress with their health goals. After 8 weeks of data collection from the intervention group, the control group was given information on how to access the online CPMP. | (BPI) assessed pain interference and pain severity. | Those who engaged in treatment had **lower <u>pain interference</u>** scores at the end of treatment compared to those who did not engage
B = -1.79, SE = 0.87, *p* = 0.48

Those who engaged in treatment had **lower <u>pain severity</u>** scores at the end of treatment compared to those who did not engage
B = -3.28, SE = 0.93, *p* = 0.001 |
| You, T., Ogawa, E. F., | Level I
RCT | Classes were conducted in neighborhood community centers | Pain severity and pain interference with daily | Tai Chi group |

Thapa, S., Cai, Y., Zhang, H., Nagae, S., … Leveille, S. G. (2018) doi:10.1007/s40520-018-0922-0	*N* = 54 24% male 76% female *M* age = 75 ± 8 yr *Inclusion Criteria* • participants recruited from Boston and surrounding areas • ≥ 65 years old • chronic multisite (≥ 2 sites) musculoskeletal pain • increased fall risk (≥ 1 falls in the past year) or current use of cane or walker • able to walk 20 feet without personal assistance • able to communicate in English	with easy access to transportation and parking. Participants were directed to websites that provided videos covering movement sequences learned from the class and handouts created by the exercise instructors demonstrating exercise used in the clases. Participants were encouraged to practice at home at least once per week. *Intervention* Tai Chi *n* = 22 An experienced Tai Chi instructor led participants in a 12-week group-based program (1-hr class, 2x/week), based on the Yang Style 8-Form. Each session included 10 minutes of warm-up with joint rotations and balance, 45 minutes of Tai Chi practice with Tai Chi walking drills and the 8 form, and 5 minutes of cool down and breathing exercises. *Control* Light physical exercise *n* = 23 A certified exercise physiologist led participants in the light physical exercise group through a 12-week group-based program (1-hr class, 2x/week). The control exercise program matched the physical	activities were assessed using the Brief Pain Inventory (BPI).	Significant **decrease** (18.56%↓) in **<u>pain severity</u>** score 4.58±1.73 vs -0.85±1.41 *p* < 0.01 Significant **decrease** (25%↓) in **<u>pain interference</u>** score 4.20±2.53 vs -1.05±2.20 *p* < 0.05

		aspects of Tai Chi in terms of intensity and duration but did not include the cognitively challenging aspects of Tai Chi to allow for evaluation of the Tai Chi benefits beyond the light physical exercise aspects of the intervention. Each control group exercise session included 10 minutes of warm up; 30 minutes of normal walking, light-intensity resistance exercise, and stretching; and 20 minutes of health education discussions.		