Published in final edited form as:

Curr Rheumatol Rep. 2013 February ; 15(2): 306. doi:10.1007/s11926-012-0306-y.

Nonpharmacologic Treatment of Pain in Rheumatic Diseases and Other Musculoskeletal Pain Conditions

Natoshia Raishevich Cunningham, Ph.D. and Susmita Kashikar-Zuck, Ph.D.

Division of Behavioral Medicine and Clinical Psychology, Cincinnati Children's Hospital Medical Center

Abstract

Pain is a complex phenomenon influenced by a number of biological, psychological, and social factors. The treatment of pain is most effective when using a multidisciplinary approach consisting of a careful selection of pharmacologic and non-pharmacologic interventions based upon disease factors, pain characteristics, psychological coping abilities and lifestyle factors. In this review we focus on research-based evidence for non-pharmacologic interventions including psychological interventions, physical exercise, patient education, and complementary approaches for pain management in patients with rheumatic diseases and common musculoskeletal pain conditions, such as low back pain. The vast proportion of research studies is on adults with chronically painful conditions but pediatric studies are also reviewed wherever possible to give the reader a more inclusive view of non-pharmacological approaches for pain management across the lifespan.

Keywords

Nonpharmacologic treatments; Rheumatic disease; Rheumatoid arthritis; Pain; Osteoarthritis; Fibromyalgia; Lower back pain; Cognitive-behavioral therapy; Exercise; Patient education; Complementary and alternative medicine

Introduction

Pain associated with rheumatic diseases and musculoskeletal disorders are of significant public health importance. A recent Institute of Medicine (IOM) report indicated that the treatment of chronic pain and costs related to lost productivity totaled over \$ 635 billion per year (1). Many rheumatic and musculoskeletal pain conditions are chronic in nature and require a comprehensive approach to ensure long-term effective pain management. The IOM study committee recommended greater education of healthcare providers about the complex biological and psychosocial aspects of pain to provide more coordinated and effective care for chronically painful conditions.

The prevalence of rheumatic diseases is high and in some cases, such as osteoarthritis, likely to increase in prevalence with an aging population. Osteoarthritis (OA) is the most common joint disorder, which is thought to be a result of aging and wear and tear on a joint. OA is thought to affect more than 80% of people over age 50 and also occurs in younger people

Corresponding author: Susmita Kashikar-Zuck, Ph.D., Professor of Pediatrics, Cincinnati Children's Hospital Medical Center, Division of Behavioral Medicine and Clinical Psychology, MLC 3015, 3333 Burnet Avenue, Cincinnati, Ohio 45229-3026, Phone: 513-636-6337, Fax: 513-636-0602, susmita.kashikar-zuck@cchmc.org; Natoshia Raishevich Cunningham, Ph.D., Postdoctoral fellow, Cincinnati Children's Hospital Medical Center, Division of Behavioral Medicine and Clinical Psychology, MLC 3015, 3333 Burnet Avenue, Cincinnati, Ohio 45229-3026, Phone: 513-636-2403, Fax: 513-636-0602, natoshia.cunningham@cchmc.org.

Disclosure No potential conflicts of interest relevant to this article were reported.

following injury or repetitive stress (2). Rheumatoid arthritis (RA) is a chronic autoimmune disorder that leads to inflammation of the joints, surrounding tissues, and may affect other organs. The prevalence of RA estimated to be 1%-2% of adults (ranging from .3% in people under age 35 to 10% in people over age 65) (3). Fibromyalgia syndrome (FMS) is a condition characterized by widespread pain and tenderness in joints, muscles, tendons, and other soft tissues. FMS condition affects about 2% of adults (3.4% of women and .5% of men); (4, 5) and is estimated to affect up to 6% of school-age children (6, 7). Low back pain is the most highly prevalent musculoskeletal pain condition, with a life-time prevalence of 70–85% (8-10). In a 3 month period, over one quarter of a community sample of adults in the United States report low back pain (11).

There is strong evidence that the extent of tissue damage, disease variables and/or radiological findings often do not explain the intensity of self-reported pain and of pain related disability (12). As such, pain may be best conceptualized via a biopsychosocial framework which posits that a complex interaction of biological, psychological, and social factors determine the severity of pain, pain-related suffering, and the extent of disability associated with pain. There is increasing recognition that factors such as ability to cope with pain, catastrophic thoughts about pain, lifestyle choices, family and social factors all play an important role in the pain experience (13-18). These factors are likely to greatly impact patients' pain and functioning, and perhaps even the course of the disease itself. Therefore, consideration of non-pharmacological interventions should be an essential component of comprehensive care for patients suffering from chronic pain.

In the following sections, we discuss each of the categories of non-pharmacological interventions giving greater emphasis to those that have the strongest support based on research evidence. When available, non-pharmacological pain interventions for children will also be reviewed.

Cognitive Behavioral Therapy (CBT) and other psychological therapies

CBT approaches have the strongest evidence base and will be discussed first, followed by related therapies such as biofeedback and acceptance and commitment therapy (ACT). CBT was originally developed to target mood issues in adults (19) and has been adapted to treat individuals with chronic pain (13, 20, 21). CBT is a structured self-management intervention that teaches a blend of cognitive (distraction, guided imagery, cognitive restructuring) and behavioral (activity pacing, pleasant activities, relaxation training) strategies to improve coping, increase functioning, and reduce pain in individuals with rheumatic diseases (22). Coping skills are taught via clinician instruction, guided practice, and home practice in either individual or group-based sessions (a typical course of treatment is between 8-12 sessions). Given the difficulties of coping with persistent (often daily) pain and increased mood and anxiety problems in individuals with rheumatic disease and the demonstrated effectiveness of CBT for treating psychological distress, CBT may be a particularly beneficial approach (23, 24).

Coping skills learned in CBT, such as relaxation strategies, may also be taught using biofeedback, which uses computer assisted instruction in reducing sympathetic arousal such as decreasing muscle tension or increasing peripheral body temperature, with an aim of increasing relaxation and decreasing pain (25). While the evidence is mixed regarding the use of biofeedback as a stand-alone intervention in individuals with chronic pain; there is good support of its use in the context of CBT and multidisciplinary care.

There is substantial research examining the role of CBT and related approaches in the treatment of chronic pain, with a Cochrane review of 40 trials concluding that CBT appears to have a small positive effect on pain, disability, and mood for adults with a broad range

rheumatic diseases (including low back pain, RA, FMS, and OA) and other chronic pain conditions, and some evidence that impact on mood symptoms are maintained after 6 months (20). The impact of CBT on specific types of rheumatic disease and musculoskeletal pain was not explicitly investigated in this review. Based on other reviews, small to moderate effects of psychological therapies (e.g., CBT, relaxation, biofeedback) have been found for adults with RA on pain, functional disability, psychological status, coping, and self-efficacy, with evidence of maintenance of gains over time (26). Similarly, CBT for adults with FMS suggests modest improvements in pain, fatigue, physical functioning and mood, with increased effects when CBT was used in combination with exercise (27). Further, there is some evidence that treatment gains are maintained over 6-30 months (28-30). However, other studies suggest treatment gains dissipate over time (31, 32); thus, the use of booster sessions following initial treatment may be beneficial. For adults with chronic back pain, a meta-analysis found positive effects of CBT in improving pain intensity, pain-related interference, health-related quality of life, and depression (33). CBT has also shown promising effects for children with rheumatic disease including juvenile idiopathic arthritis (JIA) and juvenile fibromyalgia, (34-36). In a recent well-controlled trial of CBT compared to education-only sessions, positive effects were found for both conditions, but CBT had much stronger effects on improving functioning among children and adolescents with fibromyalgia (37). Table 1 provides recommendations for the use of CBT.

More recently, other therapeutic approaches are also being offered for the treatment of chronic pain, such as acceptance and commitment therapy (ACT). The ACT approach conveys an active willingness to have pain present without attempts at control or avoidance while continuing to participate in valued activities (38, 39). ACT focuses on reduction of distressing influences on pain via exposure (40). Several studies of the use of ACT in adults with chronic pain found gains in emotional, social, and physical function compared to a waitlist condition and benefits were maintained at three months following treatment (40, 41). One study in children with chronic pain found that ACT approaches can also be useful for younger patients (42). Although early studies are promising, additional research with more controlled studies are still needed.

Physical Activity/Exercise

Exercise and participation in regular physical activity is generally recommended for adults with rheumatic diseases and musculoskeletal pain. The American College of Rheumatology and the American Pain Society recommend aerobic exercise and physical therapy (including flexibility and muscle conditioning exercises) in individuals with rheumatologic conditions including OA (43, 44), RA (43, 45), and FMS (22). This section first reviews recommendations for the three main types of exercises: (a) flexibility and range-of-motion, (b) muscle conditioning and resistance training, and (c) aerobic exercise. Each kind of exercise is thought to play an important role in physical intervention for individuals with rheumatic disease and musculoskeletal pain. In addition to improving strength, joint protection, movement and aerobic capacity, exercise approaches can also be effective in decreasing fear-avoidance related to activity and reduce disability associated with pain (46). It is recommended that exercise programs follow a slow and gradual progression, otherwise individuals may be at risk for increased pain and injury that may lead to lack of adherence and program discontinuation (22). Table 1 provides recommendations regarding the use of exercise as well.

Flexibility/Range of motion

Flexibility/range of motion exercises may be beneficial in improving symptoms associated with rheumatic diseases including pain, stiffness, and lack of mobility. Improved posture

and greater comfort during movement also reduces the risk for sprains and strains and allows patients to safely undertake more strenuous forms of exercise like conditioning and aerobic exercise. Current guidelines (43-45) recommend stretching or flexibility exercise every day for patients with OA or RA. For adults with chronic back pain, flexibility exercise is recommended 2 or more days a week for 30 minutes per day (46). For individuals with FMS, flexibility/range of motion may also be beneficial in the context of an exercise program that also includes muscle strengthening (47).

Conditioning/Resistance training

For a variety of reasons including inflammatory processes, medications and deconditioning, patients with arthritis suffer from decreased muscle function (strength, endurance, power) which in turn affects joint support and protection during load-bearing activities. Therefore, muscle-strengthening exercises are an important component of treatment for OA and RA and are recommended two times per week for individuals (22, 44, 45). Patients with rheumatic diseases and musculoskeletal pain who are severely deconditioned and/or have significant difficulty with physical activity may benefit from beginning with appropriate conditioning opportunities supervised by professionals, with the healthcare team helping to monitor progress (Guidelines for RA/OA). For individual with FMS, strengthening programs are can also be useful and are recommended to improve overall disease activity, without associated pain flares secondary to exercise (47). To further optimize gains, it is recommended that individuals with rheumatic disease, and particularly those with joint hypermobility, stretch to the point of slight resistance to avoid pain secondary to exercise. For adults with lower back pain, strengthening exercise is an important component of most intervention programs and appears to yield positive results (46).

Aerobic Exercise

Aerobic exercise may also yield a variety of health benefits including greater cardiovascular fitness, endurance and improved overall physical functioning. Moderate aerobic exercise (60% to 70% of age-adjusted maximum heart rate) is recommended two to three times per week for individuals with RA and OA (22). Because many forms of aerobic exercise can increase joint stress, low impact activities may be preferred. In addition, proper attention to body biomechanics, adequate pacing and protection of joints is needed when participating in aerobic activities. Aerobic exercise is also recommended for individuals with FMS at a slight to moderate intensity (i.e., two to three times per week) (48), with one review concluding stronger support for aerobic exercise compared to other non-pharmacological intervention approaches (49). Aerobic exercise may also be beneficial for individuals with lower back pain, but one study suggested that the effects may be more pronounced for improving mood rather than impacting pain (50).

Research evidence for exercise

Overall, the research support for the effects of aerobic exercise on functioning and pain symptoms in individuals with rheumatic disease and musculoskeletal pain is strong. For individuals with RA, aerobic exercise combined with muscle strength training is related to increased function, aerobic capacity and muscle strength, with no deleterious effects (51). In individuals with OA, aerobic exercise is beneficial; though no differences in improvements for low versus high intensity exercise were noted (52). For individuals with OA, longer term effects have been noted for aerobic exercises (53, 54) while interventions that are aqua-based may have beneficial short-term effects (53). For adults with FMS, the current evidence base supports supervised aerobic exercises in improving physical capacity and FM symptoms, with some recent evidence suggesting that strength training and aerobic exercise can be equally effective in reducing FMS pain (55). For individuals with FMS, exercise may be most beneficial at moderate/high-intensity (56). However, exercising at this level may be

problematic for individuals with FMS to maintain (57). Thus, lower intensity activities such as walking and water exercise may be recommended when patients first initiate an exercise program (58). For individuals with back pain, a review of a broad range of exercise programs (most of which including a strengthening component) were found to have a positive effect on symptoms, with effects maintained at follow-up (46). There is some research to support the positive impact of aerobic exercise in pediatric patients with chronic musculoskeletal pain conditions such as juvenile fibromyalgia and other types of musculoskeletal pain (59-61).

A common problem that has been noted in the literature (62) is that while exercise can be highly effective in reducing pain and disability, benefits appear to be relatively short term because patients struggle with long-term adherence to exercise programs. Further research is needed into the best ways to motivate patients to effectively integrate more exercise and physical activity into their lifestyles (27)

Patient Education

Education programs are essential part of multidisciplinary care for children and adults with RA, OA, and FMS. Based on the guidelines of the American Pain Society, patient education is recommended as an essential first step in pain management prior to pharmacologic intervention or other forms of intervention (44, 45). Pain education programs for individuals with rheumatic diseases may consist of education about the specific rheumatologic condition, biopsychosocial factors impacting the pain experience, the role of possible concurrent conditions (e.g., depression, headache, IBS), pain management options (e.g., education-based self-management programs, CBT, physical training, complimentary therapies), and the use of medications for symptom management (44). Involvement of patient and family may be beneficial. The goal of such programs is to improve patients' ability to self-manage pain and reduce impairment.

One of the most popular patient educations for RA, OA, and related rheumatologic conditions is The Arthritis Self-Management Program (63). This program is group-based and delivered once a week, for six weeks (2 hours each week), in community settings. Workshops are facilitated by two trained leaders, at least one of which is a lay person who has arthritis themselves. Subjects covered include: 1) techniques for coping with pain and associated symptoms (e.g., fatigue, negative emotions), 2) use of medications, 3) effective communication with family and medical providers, 4) healthy lifestyle behaviors (diet, exercise, sleep), 5) making informed treatment decisions, and 6) problem solving strategies.

Research is mixed regarding the impact of stand-alone patient education programs in improving patient outcomes. Warsi and colleagues found relatively small effects of self-management education programs for adults with arthritis (RA and OA combined) on outcomes of pain and disability (64). The results of a meta-analysis of the impact of patient education on individuals with RA and OA found moderate support use of education interventions, with stronger effects for individuals with RA (65). A more recent Cochrane review found the effect of patient education alone for RA may be small to moderate, with limited evidence of maintenance of gains over time (66). This review examined 31 RCTs of patient education for adults with RA and found significant intervention effects at first follow-up for scores on disability, joint counts, patient global assessment, psychological status, and depression, with trend effects for pain. However, at final follow-up, no significant effects of patient education were found, although there was a trend for patient education to be associated with lower disability scores.

For adults with FMS, a review of 4 interventions that utilized education interventions found that while education was superior to no treatment at all (e.g., wait list control), other active nonpharmacologic treatments (e.g., exercise, CBT, or education combined with other modalities) were generally superior in improving a range of outcomes (e.g., pain, disability, depression) as compared to patient education alone (49). On the other hand, several studies have documented equal improvement was shown in patient education versus CBT in adults with FMS; (32, 67) however, these findings are somewhat dated. A more recent study in adults with hip OA found that patient education was equally effective in improving pain levels as compared with supervised exercise (68). Similarly, education was found to yield similar outcomes on adults with low back pain compared to physical therapy or chiropractor visits, with the latter approaches demonstrating only marginally better outcomes on pain severity and disability (68).

There is currently limited evidence of the impact of patient education programs for youth with rheumatic disease. This may be due to patient education programs being embedded into other non-pharmacological treatment approaches, such as in CBT programs. A recent Cochrane review found no RCTs of patient education or other psychological studies in youth with rheumatic diseases (69). Since the publication of that review, Kashikar-Zuck and colleagues found patient education yielded significant improvements in disability, depressive symptoms and pain in youth with juvenile fibromyalgia, but that CBT had stronger effects overall, particularly in the reduction of functional disability (37). For youth with RA, one multiple baseline design that examined educational and behavioral strategies found increased medication compliance for 2 out of 3 patients in (11); however the effect of this approach on other outcomes (e.g., pain, disability) was not reported.

Overall, patient education is likely a vital component of an intervention approach for individuals with rheumatic diseases; however, the impact of patient education alone in improving outcomes for individuals with rheumatic diseases is not well supported.

Complementary and alternative medicine (CAM)

The use of CAM interventions in individuals with rheumatic disease in the United States is increasingly common, with estimates for CAM use ranging between 18% to 94% (70, 71). A recent review of CAM interventions for individuals with rheumatic diseases concluded that there is as of now, insufficient research for acupuncture, osteopathic medicine, massage, and chiropractic manipulation, though patient satisfaction is reportedly high for the chiropractic intervention (72).

On the other hand, there may be specific benefits of CAM interventions depending on the type of rheumatologic condition treated (Table 2). For example, chiropractic manipulation may be beneficial for individuals with lower back pain (71, 73). Acupuncture is another commonly practiced CAM intervention and appears to show positive effects in particular in improving outcomes for individuals with lower back pain (71, 74). For individuals with OA, there is a moderate evidence base for acupuncture in pain relief particularly for patients with knee OA (75-78); In addition, evidence for use of massage therapy is moderate for individuals with OA/low-back pain but inconclusive for OA pain at other sites (76). There is inconsistent evidence for the use of Tai chi, an ancient martial art originating in traditional Chinese medicine, in improving pain symptoms individuals with OA, with one review supporting the use of Tai chi (76) while another review discourages the use of this approach due to lack of evidence (79). For individuals with RA, acupuncture may be beneficial (80); while the benefit of other approaches, such as Tai chi, is less clear due to low methodological quality of investigations in this area (76, 81-83)

In individuals with FMS, several systematic reviews suggest acupuncture may be associated with pain reduction (84, 85); however, the methodological rigor of the studies has been questioned, with better controlled trials failing to replicate results (86). Several reviews support the use of massage for adults with FMS (84, 87), particularly for improving outcomes of mobility and reducing helplessness (87). Carson and colleagues (2010) found preliminary support for the use of yoga in improving pain, fatigue, stiffness, and mood problems in individuals with FMS compared to those receiving standard care (88). For youth with fibromyalgia, several patients reported using massage, acupuncture, and chiropractic care along with their medical treatments and found them to be useful based upon their self-report (86). Overall, additional evaluation of CAM therapies is necessary using better controlled studies though at this time, preliminary studies for the use of acupuncture, massage and yoga seem to be promising.

Conclusions

Quality of life and functioning for individuals with rheumatic disease and other musculoskeletal pain conditions may be enhanced by complementing standard medical practice with empirically-supported non-pharmacologic interventions. Overall, a number of non-pharmacological treatment approaches, including CBT, exercise and patient education, have shown beneficial effects in improving patient outcomes in the context of multidisciplinary care. Emerging evidence suggests that combined non-pharmacologic approaches (e.g., exercise and CBT) may be beneficial, particularly for patients with higher levels of distress and disability (89). Although there is great potential for non-pharmacologic interventions, the common theme is the need for patient involvement and motivation to incorporate new coping methods and lifestyle changes (such as a commitment to regular exercise). More work is needed to examine the impact of factors such as patient motivation and patient adherence in promoting the effective implementation of self-management programs in comprehensive pain care.

References

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

* Of importance

- 1*. Committee on Advancing Pain Research C, Education, Medicine Io. Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research. 2011The National Academies Press This statement from the Institute of Medicine (IOM) is important as it assesses the state of pain science in the domains of research, care, and education and provides recommendations to advance the field.
2. Sharma, L. Epidemiology of osteoarthritis. In: Moskowitz, RW.; Howell, OS.; Altman, RD.; Buckwalter, JA.; Goldberg, VM., editors. Osteoarthritis: Diagnosis and medical/surgical management. 3rd ed. W. B. Sanders; Philadelphia: 2001. p. 3-17.
3. Harris, ED.; Zorab, R. Rheumatoid arthritis. WB Sanders; Philadelphia: 1997.
4. Wolfe F, Cathey MA, Hawley DJ. Prevalence of primary and secondary fibrositis. Journal of Rheumatology. 1994; 10:965–8. [PubMed: 6582268]
5. Wolfe F, Ross CK, Anderson SK, Russell IJ. Aspects of fibromyalgia in the general population: Sex, pain threshold, and fibromyalgia symptoms. Arthritis & Rheumatism. 1995; 38(1):19–28. [PubMed: 7818567]
6. Buskila D, Press J, Gedalia A, Klein M, Neumann L, Boehm R, et al. Assessment of nonarticular tenderness and prevalence of fibromyalgia in children. Journal of Rheumatology. 1993; 20:368–70. [PubMed: 8474077]

7. Wolfe F, Smythe HA, Yunus MB, Bennett RM, Bombardier C, Goldenberg DL, et al. The american college of rheumatology 1990 criteria for the classification of fibromyalgia. *Arthritis & Rheumatism*. 1990; 33(2):160–72. [PubMed: 2306288]
8. Andersson GBJ. Epidemiological features of chronic low-back pain. *The Lancet*. 1999; 354:581–5.
9. Deyo RA, Weinstein JN. Low Back Pain. *New England Journal of Medicine*. 2001; 344(5):363–70. [PubMed: 11172169]
10. Van Tulder MW. Treatment of low back pain: myths and facts. *Der Schmerz*. 2001; 15:499–503.
11. Deyo RA, Mirza SK, Martin BI. Back Pain Prevalence and Visit Rates: Estimates From U.S. National Surveys, 2002. *Spine*. 2006; 31(23):2724–7. 10.1097/01.brs.0000244618.06877.cd. [PubMed: 17077742]
12. Birket-Smith M. Somatization and chronic pain. *Acta Anaesthesiologica Scandinavica*. 2001; 45(9):1114–20. [PubMed: 11683662]
13. Turk DC, Rudy TE. Cognitive factors and persistent pain: A glimpse into pandora's box. *Cognitive Therapy and Research*. 1992; 16(2):99–122.
14. Palermo TM, Chambers CT. Parent and family factors in pediatric chronic pain and disability: An integrative approach. *Pain*. 2005; 119:1–4. [PubMed: 16298492]
15. Evers AWM, Kraaimaat FW, Geene R, Jacobs JWJ, Bijlsma J. Pain coping and social support as predictors of long-term functional disability and pain in early rheumatoid arthritis. *Behaviour Research and Therapy*. 2003; 41(11):1295–310. [PubMed: 14527529]
16. Turner JA, Jensen MP, Romano JM. Do beliefs, coping, and catastrophizing independent predict functioning in patients with chronic pain? *Pain*. 2000; 85(1-2):115–25. [PubMed: 10692610]
17. Keefe FJ, Abernethy AP, Campbell LC. Psychological Approaches to Understanding and Treating Disease-Related Pain. *Annual Review of Psychology*. 2005; 56:601–30.
18. Haythornthwaite JA, Menefee LA, Heinberg LJ, Clark MR. Pain coping strategies predict perceived control over pain. *Pain*. 1998; 77(1):33–9. [PubMed: 9755016]
19. Beck, AT.; Rush, AJ.; Shaw, BF.; Emery, G., editors. *Cognitive therapy of depression*. Guilford Press; New York: 1979.
20. Eccleston C, Williams AC, Morley S. Psychological therapies for the management of chronic pain (excluding headache) in adults. *Cochrane Database of Systematic Reviews*. 2010; (4)
21. Keefe FJ, Affleck G, Lefebvre JC, Starr K, et al. Pain coping strategies and coping efficacy in rheumatoid arthritis: A daily process analysis. *Pain*. 1997; 69(1-2):35–42. [PubMed: 9060010]
22. Burckhardt, CS.; Goldenberg, DL.; Crofford, L.; Gerwin, R.; S, G.; Jackson, DA., et al. *APS Clinical Practice Guidelines Series*. American Pain Society; Glenview, IL: 2005. Guidelines for the management of fibromyalgia syndrome pain in adults and children.
23. Thieme K, Turk DC, Flor H. Comorbid depression and anxiety in fibromyalgia syndrome: Relationship to somatic and psychosocial variables. *Psychosomatic medicine*. 2004; 66(6):837–44. [PubMed: 15564347]
24. Evers AW, Kraaimaat FW, Geenen R, Jacobs JW, Bijlsma J. Longterm predictors of anxiety and depressed mood in early rheumatoid arthritis: a 3 and 5 year followup. *Journal of Rheumatology*. 2002; 29(11):2327–36. [PubMed: 12415588]
25. Gatchel RJ, Robinson RC, Pulliam C, Maddrey AM. Biofeedback with pain patients: evidence for its effectiveness. *Seminars in Pain Medicine*. 2003; 1(2):55–66.
26. Astin JA, Beckner W, Soeken K, Hochberg MC, Berman B. Psychological interventions for rheumatoid arthritis: A meta-analysis of randomized controlled trials. *Arthritis care & research*. 2002; 47(3):291–302. [PubMed: 12115160]
27. Williams DA. Psychological and behavioural therapies in fibromyalgia and related syndromes. *Best Practice & Research Clinical Rheumatology*. 2003; 17(4):649–65. [PubMed: 12849717]
28. Buckelew SP, Conway R, Parker JC, Deuser WE, Read J, Witty TE, et al. Biofeedback/relaxation training and exercise interventions for fibromyalgia: A prospective trial. *Arthritis Care and Research*. 1998; 11(3):196–209. [PubMed: 9782811]
29. Nielson WR, Walker C, McCain GA. Cognitive behavioral treatment of fibromyalgia syndrome: preliminary findings. *The Journal of rheumatology*. 1992; 19:98–103. [PubMed: 1556709]

30. Singh BB, Berman BM, Hadhazy V, Creamer P. A pilot study of cognitive behavioral therapy in fibromyalgia. *Alternative therapies in health and medicine*. 1998; 4(2):67–70. [PubMed: 9682514]
31. Soares JJE, Grossi G. A randomized, controlled comparison of educational and behavioral interventions for woman with fibromyalgia. *Scandinavian Journal Occupational Therapy*. 2002; 9:35–45.
32. Vlaeyen JW, Teeken-Gruben NJ, Goossens ME, Rutten-van Molken MP, Pelt RA, van Eek H, et al. Cognitive-educational treatment of fibromyalgia: a randomized clinical trial. I. Clinical effects. *The Journal of rheumatology*. 1996; 23(7):1237–45. [PubMed: 8823699]
33. Hoffman BM, Papas RK, Chatkoff DK, Kerns RD. Meta-analysis of psychological interventions for chronic low back pain. *Health Psychology*. 2007; 26(1):1–9. [PubMed: 17209691]
34. Walco GA, Varni JW, Illowite NT. Cognitive-behavioral pain management in children with juvenile rheumatoid arthritis. *Pediatrics*. 1992; 89:1075–9. [PubMed: 1594351]
35. Anthony KK, Schanberg L. Juvenile primary fibromyalgia syndrome. *Current rheumatology reports*. 2001; 3(2):165–71. [PubMed: 11286673]
36. Kashikar-Zuck S, Swain NF, Jones BA, Graham TB. Efficacy of cognitive-behavioral intervention for juvenile primary fibromyalgia syndrome. *The Journal of rheumatology*. 2005; 32(8):1594–602. [PubMed: 16078340]
- 37*. Kashikar-Zuck S, Ting TV, Arnold LM, Bean J, Powers SW, Graham TB, et al. Cognitive behavioral therapy for the treatment of juvenile fibromyalgia: A multisite, single-blind, randomized, controlled clinical trial. *Arthritis & Rheumatism*. 2012; 64(1):297–305. [PubMed: 22108765] This paper was the first RCT in a sample youth with juvenile FMS to demonstrate that CBT is a safe and effective treatment for reducing functional disability and depressive symptoms as compared to an education control.
38. McCracken LM, Eccleston C. A prospective study of acceptance of pain and patient functioning with chronic pain. *Pain*. 2005; 118:164–9. [PubMed: 16203093]
39. McCracken LM, Vowles KE, Eccleston C. Acceptance of chronic pain: Component analysis and a revised assessment method. *Pain*. 2004; 107(1-2):159–66. [PubMed: 14715402]
40. McCracken LM, Vowles KE, Eccleston C. Acceptance-based treatment for persons with complex, long standing chronic pain: a preliminary analysis of treatment outcome in comparison to a waiting phase. *Behaviour Research and Therapy*. 2005; 43(10):1335–46. [PubMed: 16086984]
41. Vowles KE, McCracken LM. Acceptance and values-based action in chronic pain: A study of treatment effectiveness and process. *Journal of consulting and clinical psychology*. 2008; 76(3):397–407. [PubMed: 18540733]
42. Wicksell RK, Olsson GL, Hayes SC. Mediators of change in Acceptance and Commitment Therapy for pediatric chronic pain. *Pain*. 2011; 152(12):2792–801. [PubMed: 21995881]
43. Simon, LS.; Lipman, AG.; Caudill-Slosberg, M.; Gill, LH.; Kerr, KL., editors. *Guidelines for the Management of Pain in Osteoarthritis, Rheumatoid Arthritis, and Juvenile Chronic Arthritis*. American Pain Society; Glenville, IL: 2002. al. e
44. Osteoarthritis ACoRSo. Recommendations for the medical management of osteoarthritis of the hip and knee: 2000 update. *Arthritis & Rheumatism*. 2000; 43(9):1905–15. [PubMed: 11014340]
45. American College of Rheumatology Subcommittee on Rheumatoid Arthritis G. Guidelines for the management of rheumatoid arthritis: 2002 Update. *Arthritis & Rheumatism*. 2002; 46(2):328–46. [PubMed: 11840435]
46. Liddle SD, Baxter GD, Gracey JH. Exercise and chronic low back pain: what works? *Pain*. 2004; 107(1-2):176–90. [PubMed: 14715404]
47. Jones KD, Burckhardt CS, Clark JE, Bennett RM, Potempa KM. A randomized controlled trial of muscle strengthening versus flexibility training in fibromyalgia. *The Journal of rheumatology*. 2002; 29(5):1041–8. [PubMed: 12022321]
48. Hauser W, Klose P, Langhorst J, Moradi B, Steinbach M, Schiltenswolf M, et al. Efficacy of different types of aerobic exercise in fibromyalgia syndrome: a systematic review and meta-analysis of randomised controlled trials. *Arthritis research & therapy*. 2010; 12(3):R79. [PubMed: 20459730]

49. Sim J, Adams N. Systematic review of randomized controlled trials of nonpharmacological interventions for fibromyalgia. *The Clinical journal of pain*. 2002; 18(5):324–36. [PubMed: 12218504]
50. Sculco AD, Paup DC, Fernhall B, Sculco MJ. Effects of aerobic exercise on low back pain patients in treatment. *Spine J*. 2001; 1(2):95–101. [PubMed: 14588388]
51. Hurkmans E, van der Giesen FJ, Vliet Vlieland TP, Schoones J, Van den Ende C. Dynamic exercise programs (aerobic capacity and/or muscle strength training) in patients with rheumatoid arthritis. *Cochrane Database of Systematic Reviews*. 2009; (4)
52. Brosseau L, MacLeay L, Welch V, Tugwell P, Wells GA. Intensity of exercise for the treatment of osteoarthritis. *Cochrane Database of Systematic Reviews*. 2003; (2)
53. Bartels EM, Lund H, Hagen KB, Dagfinrud H, Christensen R, Danneskiold-Samoe B. Aquatic exercise for the treatment of knee and hip osteoarthritis (Review). *Cochrane Database of Systematic Reviews*. 2009; (4)
- 54*. Escalante Y, Saavedra JM, García-Hermoso A, Silva AJ, Barbosa TM. Physical exercise and reduction of pain in adults with lower limb osteoarthritis: A systematic review. *Journal of Back and Musculoskeletal Rehabilitation*. 2010; 23(4):175–86. [PubMed: 21079296] This review summarized the results of 33 research studies that evaluated the effect of exercise programs on pain in patients with hip and knee osteoarthritis.. Based on these studies, this article synthesizes evidence for the effectiveness of exercise programs on pain in individuals with OA.
55. Hooten WM, Qu W, Townsend CO, Judd JW. Effects of strength vs aerobic exercise on pain severity in adults with fibromyalgia: A randomized equivalence trial. *Pain*. 2012; 153(4):915. [PubMed: 22341565]
56. Busch, AJ.; Barber, KAR.; Overend, TJ.; Peloso, PMJ.; Schachter, CL., editors. Exercise for treating fibromyalgia syndrome. John Wiley & Sons, Ltd; 2007.
57. van Saten M, Bowlwijn P, Verstappen F. A randomized clinical trial comparing fitness and biofeedback training versus basic treatment in patients with fibromyalgia. *The Journal of rheumatology*. 2002; 29:575–81. al. e. [PubMed: 11908576]
58. Mannerkorpi K. Exercise in fibromyalgia. *Current opinion in rheumatology*. 2005; 17:190–4. [PubMed: 15711234]
59. Sherry DD. Pain syndromes in children. *Current rheumatology reports*. 2000; 2:337–42. [PubMed: 11123080]
60. Stephens S, Feldman BM, Bradley N, Schneiderman J, Wright V, Singh-Grewal D, et al. Feasibility and effectiveness of an aerobic exercise program in children with fibromyalgia: results of a randomized controlled pilot trial. *Arthritis and rheumatism*. 2008; 59(10):1399–406. [PubMed: 18821656]
61. Kimura Y, Walco GA. Treatment of chronic pain in pediatric rheumatic disease. *Nature clinical practice Rheumatology*. 2007; 3(4):210–8.
62. Gowans SE, deHueck A. Effectiveness of exercise in management of fibromyalgia. *Current opinion in rheumatology*. 2004; 16(2):138–42. [PubMed: 14770100]
63. Lorig K, Holman H. Arthritis self-management studies: A twelve-year review. *Health Education Quarterly*. 1993; 20(1):17–28. [PubMed: 8444622]
64. Warsi AWPSLMPAJSDH. Self-management education programs in chronic disease: A systematic review and methodological critique of the literature. *Archives of Internal Medicine*. 2004; 164(15): 1641–9. [PubMed: 15302634]
65. Superio-Cabuslay E, Ward MM, Lorig KR. Patient education interventions in osteoarthritis and rheumatoid arthritis: A meta-analytic comparison with nonsteroidal antiinflammatory drug treatment. *Arthritis Care and Research*. 1996; 9(4):292–301. [PubMed: 8997918]
- 66*. Riemsma RP, Kirwan JR, Taal E, Rasker JJH. Patient education for adults with rheumatoid arthritis. *Cochrane Database of Systematic Reviews*. 2010; (11) This Cochrane review examined the results of 31 research studies on patient education for individuals with RA. This review concluded significant effects of patient education at first follow-up for scores on disability, joint counts, patient global assessment, psychological status, and depression, with no effects on anxiety and disease activity.

67. Nicassio PM, Radojevic V, Weisman MH, Schuman C, Kim J, Schoenfeld-Smith K, et al. A comparison of behavioral and educational interventions for fibromyalgia. *Journal of Rheumatology*. 1997; 24(10):2000–7. [PubMed: 9330945]
68. Cherkin DC, Deyo RA, Battié M, Street J, Barlow W. A Comparison of Physical Therapy, Chiropractic Manipulation, and Provision of an Educational Booklet for the Treatment of Patients with Low Back Pain. *New England Journal of Medicine*. 1998; 339(15):1021–9. [PubMed: 9761803]
69. Eccleston C, Palermo TM, Williams AC, Lewandowski A, Morley S. Psychological therapies for the management of chronic and recurrent pain in children and adolescents. *Cochrane database of systematic reviews (Online)*. 2009; (2):CD003968. [PubMed: 19370592]
70. Ramos-Remus C. Complementary and alternative practices in rheumatology. *Best practice & research Clinical rheumatology*. 2008; 22:741–57. [PubMed: 18783748]
71. Chung W, Xu S, Eken A, He J. Current status of complementary and alternative medicine in the treatment of rheumatic disease pain. *Current Rheumatology Reviews*. 2009; 5(4):194–8.
72. Fiechtner J, Dinning D. Non-pharmacologic treatment options in rheumatologic disease. *Current Rheumatology Reviews*. 2009; 5:199–203.
73. Bronfort G, Haas M, Evans R, Kawchuk G, Dagenais S. Evidence-informed management of chronic low back pain with spinal manipulation and mobilization. *Spine J*. 2008; 8:213–25. al. e. [PubMed: 18164469]
74. Manheimer E, White A, Berman BM, Forsys KL, Ernst E. Meta-analysis: acupuncture for low back pain. *Annals of internal medicine*. 2005; 142(651-63)
75. Kwon YD, Pittler MH, Ernst E. Acupuncture of peripheral joint osteoarthritis: a systematic review and meta-analysis. *Rheumatology (Oxford, England)*. 2006; 45:1331–7.
76. Fouladbakhsh J. Complementary and alternative modalities to relieve osteoarthritis symptoms: a review of the evidence on several therapies often used for osteoarthritis management. *Orthop Nurs*. 2012; 31(2):115–21. [PubMed: 22446805]
77. Soeken KL. Selected CAM Therapies for Arthritis-Related Pain: The Evidence From Systematic Reviews. *Clinical Journal of Pain*. 2004; 20(1):13–8. [PubMed: 14668651]
78. Ernst E. Systematic review of systematic reviews of acupuncture. *Clinical medicine (London, England)*. 2006; 6(5):508–9.
79. Ernst E. Complementary or alternative therapies for osteoarthritis. *Nature clinical practice Rheumatology*. 2006; 2(2):74–80.
80. Sarzi-Putini P, Atzeni F, Lubrano E. [Complementary medicine in rheumatoid arthritis]. *La medicina complementare nell'artrite reumatoide*. *Reumatismo*. 2005; 57(4):226–31. [PubMed: 16380748]
81. Ernst E, Posadzki P. Complementary and alternative medicine for rheumatoid arthritis and osteoarthritis: an overview of systematic reviews. *Current pain and headache reports*. 2011; 15(6): 431–7. [PubMed: 21979101]
82. Lee H-J, Park H-J, Chae Y, Kim S-Y, Kim S-N, Kim S-T, et al. Tai Chi Qigong for the quality of life of patients with knee osteoarthritis: a pilot, randomized, waiting list controlled trial. *Clinical rehabilitation*. 2009; 23(6):504–11. [PubMed: 19389743]
83. Brismee J-M, Paige RL, Chyu M-C, Boatright JD, Hagar JM, McCaleb JA, et al. Group and home-based tai chi in elderly subjects with knee osteoarthritis: a randomized controlled trial. *Clinical rehabilitation*. 2007; 21(2):99–111. [PubMed: 17264104]
84. Terry R, Perry R, Ernst E. An overview of systematic reviews of complementary and alternative medicine for fibromyalgia. *Clinical rheumatology*. 2012; 31(1):55–66. [PubMed: 21614472]
85. Langhorst J, Klose P, Musial F, Irnich D, Hauser W. Efficacy of acupuncture in fibromyalgia syndrome--a systematic review with a meta-analysis of controlled clinical trials. *Rheumatology (Oxford, England)*. 2010; 49(4):778–88.
86. Verkamp EK, Flowers SR, Lynch-Jordan AM, Taylor J, Ting TV, Kashikar-Zuck S. A survey of conventional and complementary therapies used by youth with juvenile-onset fibromyalgia. *Pain management nursing: official journal of the American Society of Pain Management Nurses*. 2012

87. Barbour C. Use of complementary and alternative treatments by individuals with fibromyalgia syndrome. *Journal of the American Academy of Nurse Practitioners*. 2000; 12(8):311–6. [PubMed: 11930451]
88. Carson JW, Carson KM, Jones KD, Bennett RM, Wright CL, Mist SD. A pilot randomized controlled trial of the Yoga of Awareness program in the management of fibromyalgia. *Pain*. 2010; 151(2):530–9. [PubMed: 20946990]
89. van Koulil S, Effting M, Kraaijaat FW, van Lankveld W, van Helmond T, Cats H, et al. Cognitive-behavioural therapies and exercise programmes for patients with fibromyalgia: state of the art and future directions. *Ann Rheum Dis*. 2007; 66(5):571–81. [PubMed: 16916856]

Table 1**CBT and Exercise Recommendations**

	Common Elements Considerations	Diagnosis Specific		
		OA/RA	FMS	Back pain
CBT	Rationale for behavioral coping skills training	Realistic pacing and priority setting to prevent over-exertion	Pacing to increase participation in daily activities	Realistic pacing to prevent over/under exertion
	Cognitive techniques	Cognitive reframing related to coping and setting personal goals	Problem solving to anticipate barriers to active coping	Problem solving to address work-related function and disability
	<ul style="list-style-type: none"> - distraction - guided imagery - cognitive restructuring - problem solving 			
	Behavioral techniques		Cognitive reframing related to mood/fatigue management	
Exercise	<ul style="list-style-type: none"> - relaxation - activity pacing - pleasant activities 			
	Education in the importance of exercise and participation in regular physical activity	Joint protection using muscle strengthening exercises	Graded aerobic training to improve tolerance for moderate to vigorous activity	Stabilization and strengthening of back and abdominal muscles
	<ul style="list-style-type: none"> - aerobic exercise - muscle strengthening - stretching/flexibility 			
		Low impact aerobic exercise to improve endurance	Strength training to prevent deconditioning	Aerobic exercise to increase endurance
	Incorporating exercise into daily routine and the need for adherence to recommended program to maintain gains	Stretching exercises to reduce stiffness, improve gait	Use caution with stretching/flexibility exercises FM patients who may have co-morbid joint hypermobility	Stretching to improve gait and posture

Table 2

Summary of CAM Interventions with Preliminary Empirical Support

OA/RA	FMS	Back pain
Acupuncture for pain reduction	Acupuncture for pain reduction	Acupuncture for pain reduction
Massage (OA) for pain reduction	Massage for improving mobility	Chiropractic manipulation for pain reduction
	Yoga for pain, fatigue, and mood problems	