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# Chronic Pain: A Systematic Review of Current Treatment Approaches and the Impact on Patient Outcomes

## ABSTRACT

### Introduction

Chronic musculoskeletal pain is a health problem that reached epidemic proportions in the United States and in many areas around the world. <sup>1</sup> According to the Institute of the National Academies of Medicine (IOM),<sup>2</sup> over 100,000 American adults suffer from chronic pain. Issues surrounding the use of opioid medication for chronic pain include, drug tolerance, abuse, and addiction as well as illegal procurement and excessive use of healthcare resources. <sup>3</sup>

Complementary therapies such as chiropractic, yoga, and meditation are being sought and utilized more and more frequently by patients for a variety of diseases and health concerns.<sup>4</sup> The purpose of the study was to explore the effectiveness of alternative treatment modalities to opioid medication for non-malignant chronic pain.

### Method

A systematic review of the literature was performed using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Guidelines. Seven treatment modalities were studied including cognitive behavioral therapy, physical therapy, yoga, meditation, chiropractic, acupuncture, and opioid therapy. Search databases included CINHALL, ProQuest, OVID, and Google Scholar. Search terms included *chronic pain* as well as each of the seven treatment modalities. The exclusion criteria were studies published before 2009 or not peer reviewed, pilot studies, dissertations, studies including children and diagnoses such as fibromyalgia and rheumatoid arthritis. Study validity was determined using the United States Preventive Services Task Force (USPSTF) scoring system.

### Results

A total of 3799 articles were identified in the initial search. After applying the exclusion criteria, 35 studies were deemed appropriate for analysis. Mean effect sizes were obtained from the data representing the efficacy of each of the seven modalities, and a meta-analysis was performed. The meta-analysis result was expressed as an overall medium effect size of  $r = -0.427$ . This result indicated that alternative modalities on the whole had a moderate impact on lowering pain scores. Yoga had the largest individual effect size and, apart from opioids, was the modality deemed to have the greatest impact on lowering pain scores. Meditation and cognitive behavioral therapy were also shown to have a significant impact on reducing anxiety and depression, and improved quality of life.

### Discussion

Throughout the literature, multidisciplinary pain programs that utilize a variety of treatment modalities have a positive effect on patient outcomes related to chronic pain. <sup>5</sup> Results of this study support the use of alternative pain treatment modalities, especially yoga, for chronic pain as they can have a significant effect on pain outcomes and may help to reduce the use of opioids. The recommendation for practice is to consider the widespread use of multidisciplinary pain programs.

## **Introduction**

Chronic musculoskeletal pain is a health problem that reached epidemic proportions in the United States and in many areas around the world.<sup>1</sup> According to the Institute of the National Academies of Medicine (IOM),<sup>2</sup> over 100,000 American adults suffer from chronic pain. Further, pain costs the United States over \$635 billion annually for pain treatment and loss of individual productivity. Opioid therapy is a mainstay of treatment for cancer related or “malignant”, and non-cancer related or “non-malignant” chronic pain for the last several decades.<sup>6</sup> At the same time, issues surrounding opioid treatment such as overuse, abuse, addiction, and illegal procurement have catalyzed a variety of process and practice changes to ensure patient safety. These proactive measures include use of narcotic agreements, urine drug screening, and limitations on opioid prescription refills.<sup>7</sup> Various alternative treatment modalities for chronic pain were also noted in the literature and utilized in individual studies as well as in multidisciplinary pain programs often providing good results for patients.<sup>5</sup> According to the National Institute of Health (NIH),<sup>4</sup> between 2007 and 2012, 9.5% of American Adults (21 million) reported using Yoga, 8.4% reported using chiropractic or other manipulative therapy, 8.0% reported using meditation, and 6.9% reported using massage therapy. Further, it is estimated that Americans spend \$9 Billion annually on complementary therapies, representing 3% of all ambulatory health care costs.<sup>8</sup> The objective for this study was to explore the effectiveness of several treatment modalities considered alternative to opioid medication for non-malignant chronic pain. The results of the study may be used by providers and other healthcare professionals when considering treatment options for patients with chronic pain.

## **Background**

According to Rosenblum, Marsch, Herman, and Portenoy,<sup>9</sup> opioid substances have been used for pain relief for thousands of years and within various cultures. Throughout the 20<sup>th</sup> century, opioid drugs were deemed very effective in controlling malignant and non-malignant chronic pain. Within the last several decades, however, attitudes toward opioids have continually changed. In the 1990s, opioid prescriptions and subsequent use increased in response to the finding that pain was being undertreated especially in certain socio-economic groups.<sup>10</sup> This notable increase in opioid use may have contributed to the current and alarming incidence of opioid addiction and overdose. Thus, the most recent treatment protocols and policies call for thorough risk assessment by providers, narcotic agreements, urine drug screens, and stricter prescription renewal processes.<sup>11</sup>

Another contributing factor to issues in opioid medication management, as described in a study by Tkacz et al.,<sup>3</sup> is that patients in outpatient or ambulatory care settings often sell or abuse opioid medications making appropriate and effective symptom control difficult to impossible. With the emergence of new medical guidelines for pain management such as more frequent use of non-steroidal anti-inflammatory drugs (NSAIDs) and strict criteria for opioid use,<sup>12</sup> primary care doctors may be less willing to prescribe opioid and other narcotic pain medications to those patients who are identified as high risk for abuse or overdose.

Although healthcare facilities may be following the recommended guidelines for opioid treatment that include performing pre-opioid treatment assessments and signing of narcotic agreements,<sup>7</sup> clinical observations suggest that patients often break these narcotic agreements through dangerous lifestyle choices such as alcohol consumption, overuse and abuse of the medication, or illegal procurement and selling of opioid drugs. This set of circumstances results

in a critical issue in pain management as providers are still ethically responsible to treat patients, and patients are still seeking medical treatment under the above conditions.

Alternatives to opioid therapy for treatment of chronic pain are currently represented in the literature and include traditional treatments such as physical therapy and non- traditional modalities such as yoga and meditation. In the United States and other countries, multidisciplinary pain programs were created, utilizing both allopathic medicine and a variety of complementary therapies with effective results in pain reduction and in decreasing opioid use. For example, a major medical center in Central Florida created a multi-disciplinary, multimodal pain rehabilitation program where non- pharmacologic therapies include; cognitive behavioral therapy (CBT), physical therapy, meditation, massage, and kinesiology in addition to professional support from social work, nursing, pharmacy, occupational therapists, and vocational counselors. This pain program includes both inpatient and outpatient services and receives patients from around the country. In 2013, this inpatient program succeeded in weaning 100% of patients completely off of opioid medication by the end of the program. Reported patient outcomes included significant reduction in pain and increase in quality of life. In the outpatient program, 30% of patients stopped taking opioids and the patient outcomes were commensurate to those of the inpatient program .<sup>13</sup>

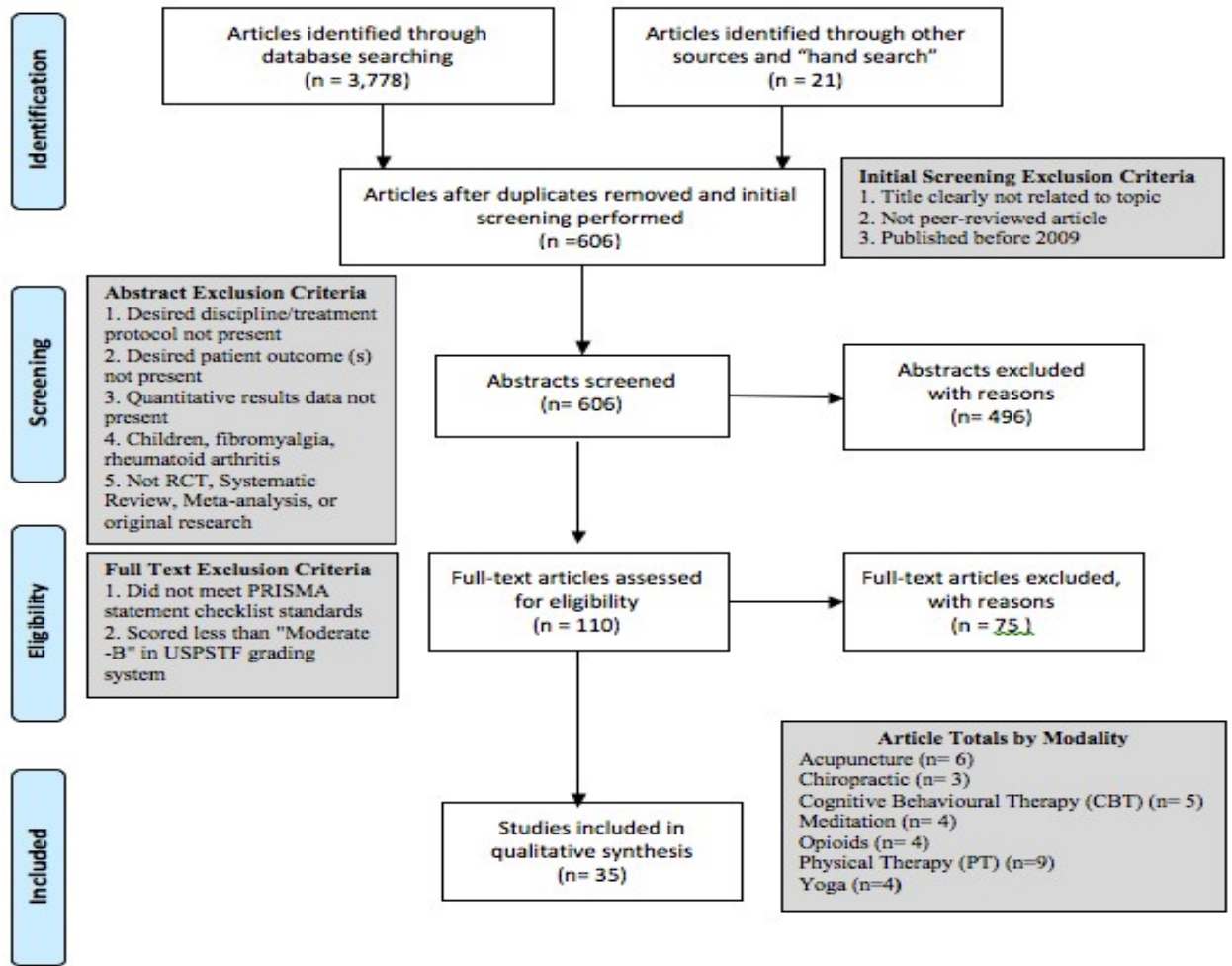
## **Methods**

A systematic review of the literature was performed using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Guidelines. The PRISMA guidelines include a 27 item criteria checklist and a four phase flowchart representing the review progression and results.<sup>14</sup> Seven pain treatment modalities were studied including; acupuncture, chiropractic, CBT, meditation, opioid therapy, physical therapy, and yoga. The main outcome

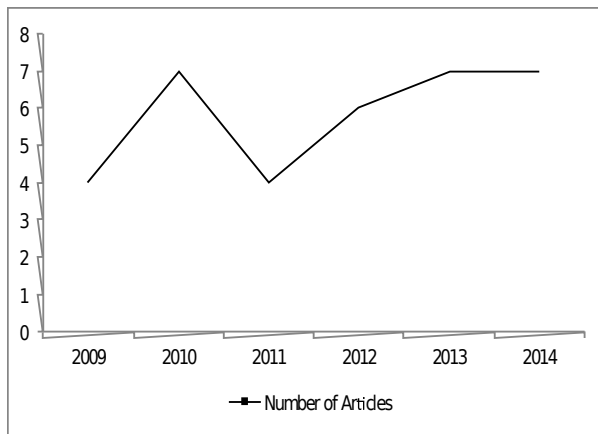
that was used for statistical analysis was reduction in pain scores, although other notable outcomes such as reduced anxiety and depression and improved quality of life are discussed in later sections.

The data search was performed using the following databases; CINHALL, ProQuest, OVID, and Google Scholar, then, an additional hand search of reference lists from the identified full text articles was completed. Search terms included “chronic pain” and the names of each of the seven treatment modalities. Randomized Controlled Trials (RCTs) and original research represented the majority of studies chosen as they are considered to have the highest scientific validity and significance. Exclusion criteria were studies published before 2009, studies that were not peer reviewed, pilot studies, dissertations, and studies including children. Diagnoses related to chronic pain including fibromyalgia and rheumatoid arthritis were also excluded since such disease processes are complex and have a variety of etiologies. Study validity was determined using the United States Preventive Services Task Force (USPSTF) scoring system. In this system, literature is given a two- part grade. First, the literature is assessed for net benefit as “high”, “moderate”, or “low” level. Second, the literature is given a grade of “A, B, C, D, or I (for insufficient) to serve as a recommendation for implementation into practice.<sup>15</sup> Only articles with a grade of moderate- B or higher were included in the study.

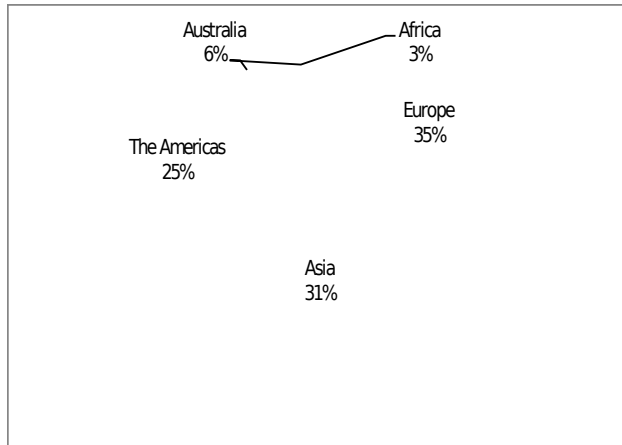
**Figure 1: PRISMA Flow Diagram**



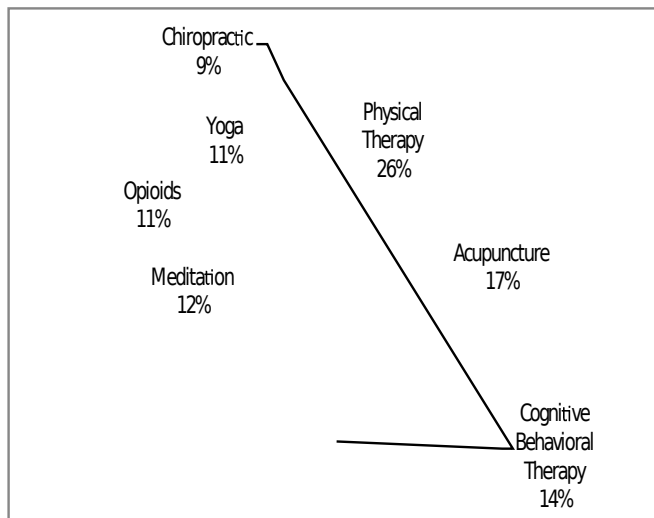
**Figure 2: Article Demographics: Articles over Time**



**Figure 3: Article Demographics: Articles by Source Country**

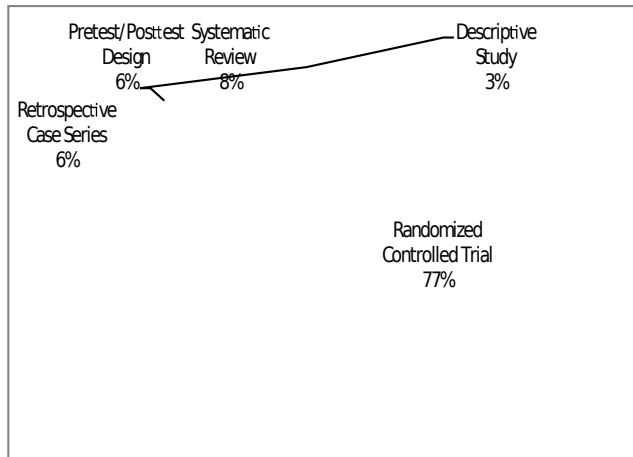


**Figure 4: Article Demographics: Articles by Modality**



**Figure 5: Article Demographics: Articles by Experimental Design**

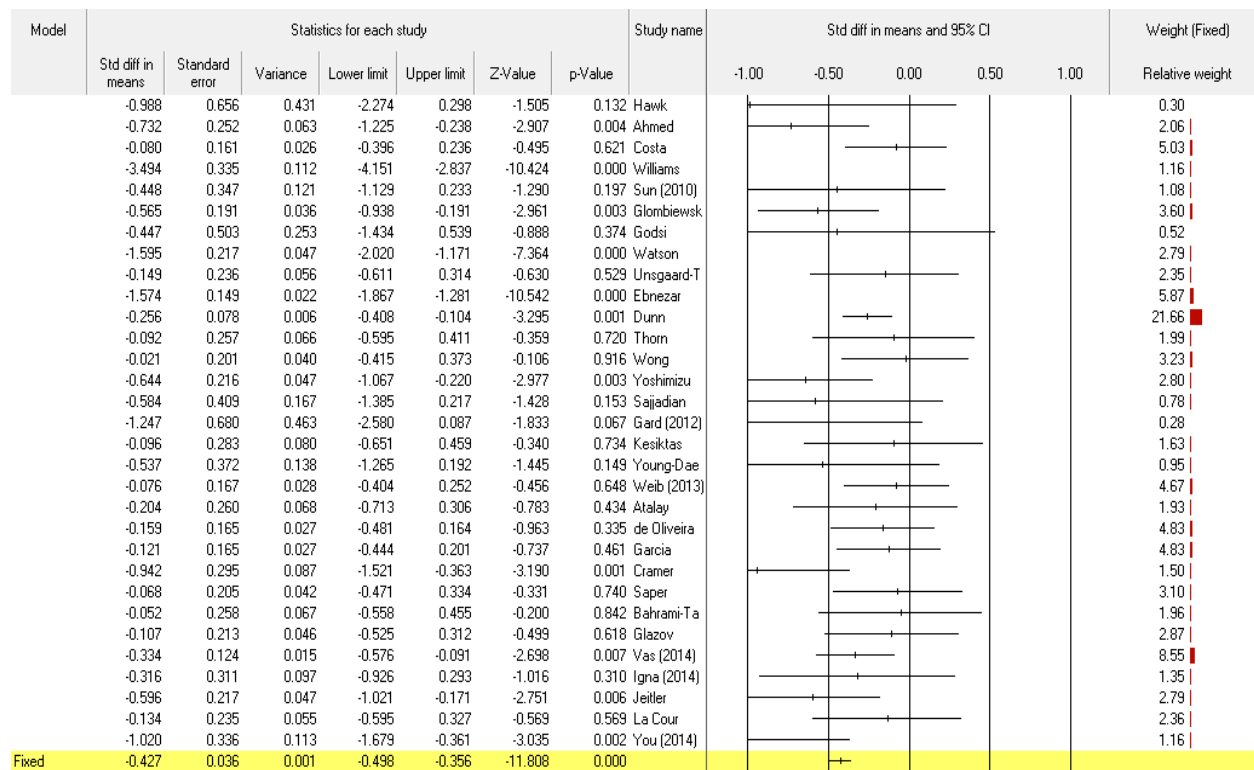




## Results

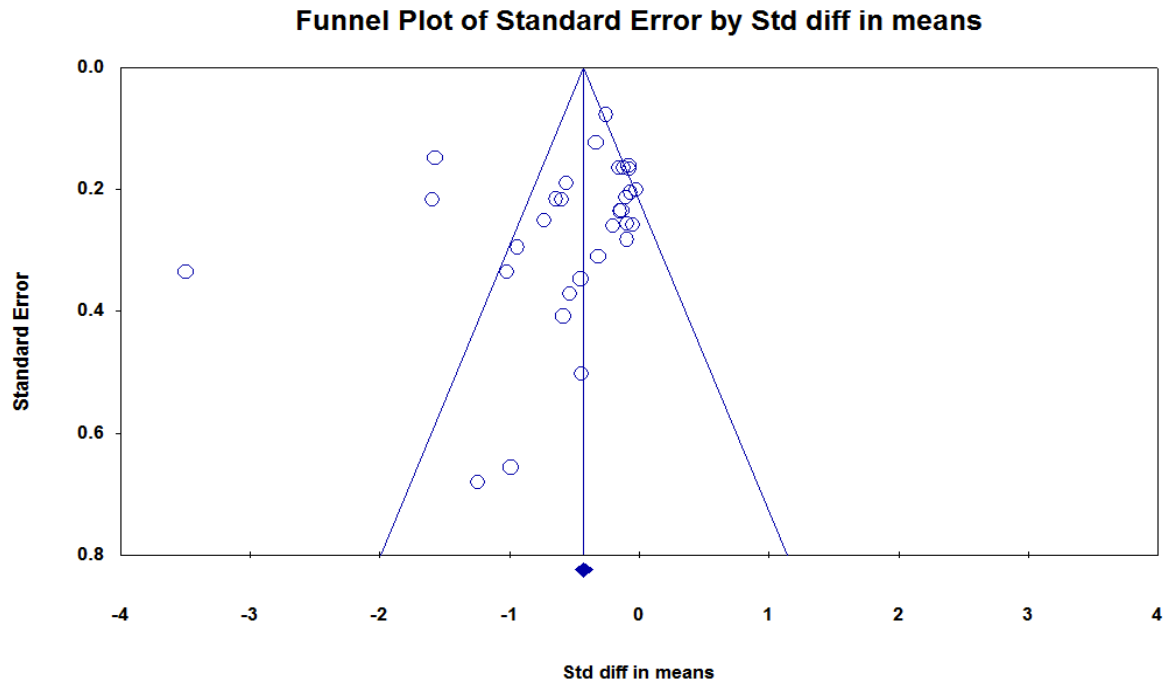
The initial search yielded 3799 articles of which a total of 35 were selected as appropriate for the statistical analysis. The two-part analysis included a meta-analysis, measuring overall effectiveness of non-pharmaceutical therapies using the weighted effect size results, and descriptive statistics, where effect sizes were computed for each treatment modality and the results were then synthesized in the overall study discussion. For the meta-analysis; effect sizes were determined using the Comprehensive Meta-Analysis (CMA) software computing standardized mean differences in pain scores between treatment and control groups. Small effect size was determined at  $r = < 0.2$ , medium effect size was  $r =$  between 0.2 and 0.8, and large effect size was  $r = > 0.8$ . Effect sizes in this study were expressed as negative integers signifying the average decrease in pain scores between study and control groups.

**Figure 6: Effect Size Forrest Plot (See References 16-46)**



The meta-analysis revealed an overall effect size of  $r = -0.427$  which is a medium effect size and thus signifies that all the treatment modalities moderately affect the decrease of pain scores. However, this may be an overestimation due to publication bias as reflected in the funnel plot (figure 7). The individual modality effect sizes are presented in Figure 8. Opioids and yoga had the highest effect sizes,  $r = -1.021$  and  $r = -1.519$  respectively, indicating that apart from opioid therapy, yoga had the greatest effect on reducing pain scores of all the studied modalities.

**Figure 7: Effect Size Funnel Plot**



**Figure 8: Individual Modality Results**

<b>Modality</b>	<b>Effect Size</b>	<b>Interpretation: Effectiveness in decreasing pain scores</b>
Acupuncture	-0.277	Not significantly effective
Chiropractic	-0.622	Moderately effective
Cognitive Behavioral Therapy	-0.389	Moderately effective
Meditation	-0.500	Moderately effective
Opioids	-1.021	Highly effective

Physical Therapy	-0.344	Moderately effective
Yoga	-1.519	Highly effective

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## Discussion

The individual modality statistical computations revealed that yoga had the highest effect size indicating that it was found to be the most effective non-pharmacologic treatment in the study. It is also important for the overall discussion to note the merits and results of the other modalities, some of which reported significant effects on related patient outcomes such as depression, anxiety, and quality of life. For example, acupuncture had a total of six studies included and had an average effect size of  $r = -0.277$  that would be considered low efficacy in pain reduction. In the study by Bahrami- Taghanaki, et al.,<sup>40</sup> patients in the acupuncture treatment group reported fewer days absent from work and fewer pain relapses. In the study by Weib, Quante, Xue, Muche, and, Reuss-Borst,<sup>34</sup> patients reported improvement in overall physical functioning, general health, and overall emotional state as compared to the control group. The chiropractic results derived from two studies showed an average effect size,  $r = -0.622$ , indicating a moderate effect on lowering pain scores. Other outcomes that were reported in this modality included some improvement in depression and dizziness in the chosen population.<sup>16</sup>

The CBT analysis included four studies. The results showed an average effect size,  $r = -0.389$  indicating moderate effectiveness in pain reduction. However, CBT was shown to be very effective in decreasing patients' reactions to pain, increase in pain acceptance<sup>43</sup> and overall improvement in functioning.<sup>30</sup> Meditation effect size results averaged  $r = -0.500$  from the four

studies included, showing a moderate effect on pain reduction. In addition to decrease in pain, patients practicing meditation reported less reaction to pain<sup>44</sup> lower anxiety and depression, increase in well-being, and feeling “in-control” of the pain.<sup>45</sup>

Nine physical therapy studies were analyzed. The average effect size,  $r = -0.344$ , indicated a moderate effect on pain reduction. Physical therapy had the most literature of the modalities included in the search. It is interesting to note that physical therapy uses a variety of techniques such as slings, electro-stimulation, neural therapy and specialized treatment protocols such as Balneotherapy, McKenzie Exercises, and Back School. This adds to the richness and diversity of physical therapy research results. Yoga had the highest average effect size,  $r = -1.519$  indicating that this is a highly effective modality for reducing pain. Four studies on yoga were included in the analysis. Other notable outcomes for yoga included improvement in health related quality of life<sup>38</sup> decrease in joint swelling<sup>25</sup> and decrease in depression and pain medication usage.<sup>19</sup>

Although the literature search was comprehensive using the established exclusion criteria, publication bias was present as indicated by the asymmetry of the effect size funnel plot (figure 7). Heterogeneity or significant differences were also found in the analyzed studies, meaning that although the results showed an overall moderate effect size, these results cannot be predicted to be consistent in every case. Finally, the study had one reviewer, thus reducing scientific validity of the results.

## **Conclusion**

The issues surrounding opioid therapy for the treatment on non- malignant chronic pain is well documented. It is incumbent on healthcare professionals to address this complex health

problem using whatever treatments and resources that are deemed safe and effective for patients with chronic pain. The use of complementary therapies such as yoga and chiropractic has become more common even though patients pay out-of-pocket for such treatments. The results of the above study show that several non-pharmacologic modalities, especially yoga, can be effective in reducing pain, anxiety, depression and in improving quality of life.

Recommendations for further study include conducting RCTs with combinations of groups taking opioids compared with groups receiving a complementary therapy over a long period of time, studies involving ongoing evaluation of patients who participate in established multidisciplinary pain programs, and studies providing cost-benefit analyses of mandating multidisciplinary pain programs in both inpatient and outpatient settings. The recommendation for practice is to incorporate non-pharmaceutical treatments such as yoga or chiropractic whenever possible and appropriate. Finally, creating fully staffed, multidisciplinary pain programs may be the best way to make comprehensive pain care available and accessible for patients.

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## **APPENDIX A. STATEMENT OF ORIGINAL WORK**

### **Academic Honesty Policy**

**Capella University's Academic Honesty Policy (3.01.01) holds learners accountable for the integrity of work they submit, which includes but is not limited to discussion postings, assignments, comprehensive exams, and the dissertation or capstone project.**

**Established in the Policy are the expectations for original work, rationale for the policy, definition of terms that pertain to academic honesty and original work, and disciplinary consequences of academic dishonesty. Also stated in the Policy is the expectation that learners will follow APA rules for citing another person's ideas or works.**

**The following standards for original work and definition of *plagiarism* are discussed in the Policy:**

**Learners are expected to be the sole authors of their work and to acknowledge the authorship of others' work through proper citation and reference. Use of another person's ideas, including another learner's, without proper reference or citation constitutes plagiarism and academic dishonesty and is prohibited conduct. (p. 1)**

**Plagiarism is one example of academic dishonesty. Plagiarism is presenting someone else's ideas or work as your own. Plagiarism also includes copying verbatim or rephrasing ideas without properly acknowledging the source by author, date, and publication medium. (p. 2)**

**Capella University's Research Misconduct Policy ([3.03.06](#)) holds learners accountable for research integrity. What constitutes research misconduct is discussed in the Policy:**

**Research misconduct includes but is not limited to falsification, fabrication, plagiarism, misappropriation, or other practices that seriously deviate from those that are commonly accepted within the academic community for proposing, conducting, or reviewing research, or in reporting research results. (p. 1)**

**Learners failing to abide by these policies are subject to consequences, including but not limited to dismissal or revocation of the degree.**

## Statement of Original Work and Signature

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I attest that this dissertation or capstone project is my own work. Where I have used the ideas or words of others, I have paraphrased, summarized, or used direct quotes following the guidelines set forth in the *APA Publication Manual*.

Learner  
name  
and date

Anne M. O'Hare 5/25/2015

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Mentor  
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