2017

Tai Chi/Qi Gong in Mental Health Treatment and Prevention: A review of Meta-Analytic Evidence and an Analysis of Evidence Congruence with Training Practices

Colin A. Price

Tai Chi/Qi Gong in Mental Health Treatment and Prevention: A review of Meta-Analytic Evidence and an Analysis of Evidence Congruence with Training Practices

A Thesis Presented

By

Colin A. Price

to

The Faculty of the Honors College

of

The University of Vermont

In Partial Fulfillment of the Requirements
for the Degree of Bachelor of Science
Specializing in Psychological Science
with the Distinction of Honors College Scholar

May 2017

Defense Date: May 2, 2017
Thesis Examination Committee:
Antonio Cepeda-Benito, Ph.D., Advisor
John Franklin, Ph.D., Chairperson
Shamila Lekka, Ph.D.
William Falls, Ph.D., Dean of the College of Arts and Science

Abstract

In a review of the literature, Abbot and Lavretsky (2013) concluded that Tai Chi and Qi Gong, two complementary and alternative therapies, improved mental and behavioral health-related outcomes. Their review inspired a number of meta-analytical reviews and follow up randomized controlled trials (RCT) that focused on specific outcome categories defined in their paper. My thesis expands Abbot and Lavretsky's review by examining the results of these posterior meta-analyses and RCT studies. In addition, I replicate the methodological searches provided by each included meta-analysis to bolster their findings with more recent publications. Creating an updated meta-analysis of my own to support or refute Abbot and Lavretsky's claims, I add to the argument on Tai Chi and Qi Gong's therapeutic effect on treating mental illness. Tai Chi and Qi Gong appear to be therapeutically beneficial across a range of mental health issues, and are indicated as a safe alternative of treatment. Future studies should include more methodological rigor (blinding, randomization, and reporting) and study these complementary and alternative therapies effect on additional disorders.

Table of Contents

Introduction

Our reliance on drugs to treat ailments is so pervasive that we have grown impassive to medications' potential side effects. It is routine to see pharmaceutical advertisements on television that offer wonder drugs that warn us about a myriad of unwanted, dangerous side effects. Yet, we live in a society that is dominated by medication. In 2014 alone, over 4.3 billion prescriptions were written in the U.S., amounting to $374 billion in medical fees (Sifferlin, 2015). In a Westernized, pill-popping world, where average number of side effects per prescription drug has climbed to 70, with some of the most common drugs reaching over 100, we continue to reach for the "quick fix" time and again, rarely considering other possible and safer alternatives. (HealthDay, 2011).

Non-Western healing practices that do not rely on drugs to treat ailments are collectively known as *complementary and alternative medicine* (CAM). Two well-known CAM practices that are gaining acceptance and possess evidence of their effectiveness are Tai Chi and Qi Gong (Abbot & Lavretsky, 2013). Tai Chi and Qi Gong are ancient practices that involve bodily and mental manipulations that consist of gentle movements while focusing on relaxation, breathing, and concentration ("Tai Chi and Qi Gong," 2016). Although there are clear differences between the two, both practices are frequently referenced together in part because Tai Chi stems from Qi Gong. Qi Gong is used purely for healing but Tai Chi also incorporates martial arts elements. Both practices require different movements, and use "chi", life's vital energy, differently (Frantzis, 2006).

While the East has been using alternative approaches for thousands of years, there has been a relatively recent influx of complementary and alternative medicine in the West both from a researcher and physician's point of view. A paper by Adrian Furnham in 2000 discussed how

public interest in CAM was rising, as well as the amount of research looking into its efficacy. It was estimated that 34% of the United States population visited CAM therapists in 1993, increasing to 47.3% in 1998. Both of these numbers outstrip the number of individuals who went to primary care physicians in either year (Furnham, 2000). The US was not the only Western country to see this increase in popularity either: France went from 16% to 36% of the population turning to homeopathy from 1982 to 1992, the Netherlands saw a rise from 1981 to 1990 of 6.4% to 15.7% of the population using CAM therapists, and at the time the study was published 25% of the United Kingdom had used some form of CAM (Furnham, 2000).

Other bodies of research identified this increase in CAM as well, one being the Institute of Medicine report in 2005. Tasked with improving the health of the nation, they took note of the increase in popularity of CAM approaches, focusing on the use of dietary supplements for chronic pain (The IOM report, 2005). Another national survey noticed the increased demand for CAM approaches across healthcare settings, and randomly sampled critical care nurses (Tracy et. al., 2005). Most of the participants reported using at least one CAM technique (most commonly dietary supplements, exercise, relaxation techniques, and prayer), viewed it positively overall, and judged it to be helpful in relieving a variety of symptoms.

As mentioned above, the average person typically chooses the “quick fix” of Western medicine when facing an ailment. If this is the case, why has there been such a shift in healthcare to CAM therapies? Adrian Furnham not only details this increase, but also suggests reasons why these approaches are becoming so popular. One reason provided is that people prefer the reduced chances of side effects. Many homeopathic options are low-to-zero risk, a definite selling point in their usage (Furnham, 2000). Secondly, many individuals feel that modern physicians spend too little time in consulting them, and are not in-depth enough with their assessments (Furnham,

2000). They desire the more hands-on approach associated with CAM treatments (Furnham, 2000). Next, the outlook CAM has on disease is found more favorable than Western approaches. While contemporary healthcare typically tries to "eliminate" the "illness", CAM has a more positive stance. They focus on "wellness" instead, emphasizing the natural healing processes of the body and bolstering the body's defenses homeopathically (Furnham, 2000). Finally, some patients simply seek out CAM therapy as a last resort. They may have tried many other approaches to their chronic conditions, and now turn to CAM to see if a change in tactics will be effectual (Furnham, 2000).

As mentioned, Tai Chi and Qi Gong are two such complementary and alternative medicines used in the past and present. It has been posited that both are effective as therapy approaches for two reasons: their use as an exercise, and their use as a meditative practice (Abbot & Lavretsky, 2013). Both can function as a low-impact, aerobic workout possible for a wide age and skill range. Much research has been completed demonstrating exercise's effectiveness in treating depressive-like symptoms, so Tai Chi and Qi Gong may be working via these means (Abbot & Lavretsky, 2013). Secondly, these techniques contain mindful (introspective thoughtfulness), meditative (calming and quieting) aspects to allow users to become more attuned to their thoughts, feelings, and bodies. Other CAM approaches such as meditation have been shown to have some efficacy in treating disorders such as anxiety, so it is believed this aspect of Tai Chi/Qi Gong could be adding to its effectiveness (Abbot & Lavretsky, 2013). These components combined help explain some of Tai Chi and Qi Gong's usefulness in treating mental illness.

In 2013, researchers Abbot and Lavretsky compiled a comprehensive but descriptive review of the literature on the health benefits of Tai Chi and Qi Gong. They searched English

and Chinese studies and gathered around 30 studies examining the use of Tai Chi and Qi Gong as CAM therapies. Their work included primarily randomized controlled trials, but also a handful of nonrandomized controlled trials and observational studies (Abbot & Lavretsky, 2013). They included all studies to date on the subject, regardless if they supported or refuted their ideas. As many studies made little distinction between Tai Chi and Qi Gong, and a variety of Tai Chi styles were used in each, they simply included both arts in their study. They then grouped studies by mental illness targeted, and summarized the accumulated findings for each section. The eight different sections included: Psychosocial Well-Being/Health-Related Quality of Life; Stress Management; Mood, Anxiety and Depression; Sleep Disturbance; Substance Abuse; Cognitive Functioning; Parkinson's Disease; and Traumatic Brain Injury (Abbot & Lavretsky, 2013).

The Psychosocial Well-Being portion drew information from a meta-analysis (comprised of 17 randomized controlled trials, 16 nonrandomized controlled trials, and seven observational studies) and a systematic review (containing 15 randomized controlled trials). 21 out of 33 of the randomized controlled studies and nonrandomized comparison studies found Tai Chi to have an increase in Psychosocial Well-Being. The systematic review stated that there appeared to be a correlation between Tai Chi and psychological well-being in 13 out of 15 of the studies, but that there needed to be longer trials with more control and higher quality (Abbot & Lavretsky, 2013).

The second category, Stress Management, looked at five different randomized controlled studies. Four out of five of these studies found Tai Chi and Qi Gong to have significant positive effects on stress. Two of the studies looked at elderly adults, one at middle-aged adults, and the fourth at adults with HIV. The fifth study that did not find positive effects consisted of patients with hip or knee osteoarthritis (Abbot & Lavretsky, 2013).

The next section was multi-faceted in that it contained studies looking at Mood, Anxiety, and Depression. They provided seven randomized controlled studies that demonstrated Tai Chi's ability to improve mood, and one that found no significant impact. Next, nine RCT's were described that showed an alleviating effect of Tai Chi on anxiety, and one that did not. Finally, 13 out of 14 of the randomized controlled trials suggested that Tai Chi and Qi Gong had positive effects on depressive symptoms. Abbot and Lavretsky also note that Tai Chi and Qi Gong appeared to be most effective when used to combat depressive symptoms in geriatric populations (Abbot & Lavretsky, 2013).

Following this section Abbot and Lavretsky discussed Sleep Disturbances and then Substance Abuse. They included four randomized controlled trials concerning Sleep Disturbances (three of four pertaining to older adults), all of which found Tai Chi to have a positive effect on sleeping (Abbot & Lavretsky, 2013). Two studies were included to look at Qi Gong's effect on Substance Abuse, one being a randomized controlled trial and the other a nonrandomized controlled trial. The RCT reported users experiencing fewer withdrawal symptoms compared to medicated and control groups, and the NRS found higher completion rates and reduced craving in the Qi Gong versus stress management group (Abbot & Lavretsky, 2013).

The last three groupings included Cognitive Functioning, Parkinson's Disease, and Traumatic Brain Injury. Abbot and Lavretsky cited two RCTs that showed improved cognitive functioning in a geriatric as well as older adult population. Three RCTs were found using Tai Chi as a therapeutic measure for Parkinson's. All studies showed more improvement in functioning than compared to other resistance and stretching methods. Finally, two randomized controlled trials were included to demonstrate both Tai Chi and Qi Gong's effect on traumatic

brain injury recovery. The first showed improved self-esteem and mood but not physical functioning in Qi Gong users compared to a non-exercise group. The second showed increased mood, self-esteem, and health-related quality of life in TBI patients as a result of Tai Chi (Abbot & Lavretsky, 2013).

To sum up, the researchers found that the majority of the studies they included were efficacious in each of their respective categories (Psychosocial Well-Being, Stress Management, Mood/Anxiety/Depression, Sleep Disturbances, Substance Abuse, Cognitive Functioning, Parkinson's Disease, and Traumatic Brain Injury). However, they did acknowledge the lack of research into other areas of mental disorders (Abbot & Lavretsky, 2013). While Tai Chi and Qi Gong appear to be quite effective in aiding stress, anxiety, mood, depression, and well-being, more thorough work must be completed in their use as a primary and complementary approach to other disorders. Despite this, they feel these therapies are non-invasive and safe, and it would be appropriate to recommend these approaches to patients (Abbot & Lavretsky, 2013).

As previously stated, Abbot and Lavretsky completed a narrative review, which differs slightly from a meta-analysis, the goal of this thesis. The narrative, or literature, review is a collection of papers pertinent to a selected topic that the researcher organizes as they see fit. Data are summarized in an empirical fashion, and the most important points (as defined by the organizer) are pinpointed and included (Kühberger et al., 2016). Meta-analyses, or systematic reviews, differ in that they are more highly structured and have set criteria while searching for studies and which to include/exclude. This makes them more reproducible, and allows scholars to compare studies by looking at effect size (Kühberger et al., 2016). In a 2016 review article comparing narrative and systematic reviews, Kühberger et al. found that narrative reviews tend to over-emphasize the "good" in their attempt to hit the highlights of the topic. The element of

subjectiveness that guides narrative reviews allows for omission of studies that may refute what they are trying to prove. Systematic reviews are safeguarded from this bias by the pre-established rules and steps researchers put into place at the start of research gathering (Kühberger et al., 2016).

For these reasons, this thesis will seek to replicate Abbot and Lavretsky's 2013 study from a meta-analytic standpoint rather than in a narrative review. This project searches for meta-analyses attempting to determine the validity or ineffectiveness of Tai Chi and Qi Gong seeking to confirm or deny the findings of Abbot and Lavretsky's review. This thesis updates the paper with studies completed since the publication of their review until the present, and compares conclusions for an updated, structured overview of the topic.

Methodology

Meta-analyses on Tai Chi/Qi Gong will be identified using PsycINFO, an electronic database that contains vast amounts of peer-reviewed literature related to mental health and behavioral science. More precisely, I searched the PsycINFO database for meta-analyses by using the keywords, "meta-analysis" or "meta-analytic" and "Tai Chi" or "Qi Gong" in the title or abstract fields. In addition, I checked whether new RCTs exist that were not included in each of the original meta-analyses, I used the same search method for each respective meta-analysis used to detect its studies but including only the year of their most recent studies to the present. For example, if the most recent RCT in a meta-analysis published in 2014 dates back to 2012, my search will include all the RCT studies published between 2012 and 2017.

The new meta-analysis is organized based on the groupings proposed by Abbot and Lavretsky. For example, all studies related to Mood, Anxiety, and Depression will be together, all those on Substance Abuse will be together, and so on and so forth. For each meta-analysis and each randomized controlled study referenced in each meta-analysis, I will compare findings to the descriptive review put forth by Abbot and Lavretsky (2013) to see what topics studies agree on, and what is refuted. This will result in a contemporary, up-to-date compilation of the latest information available on research into the benefits of Tai Chi/Qi Gong on mental illness treatment.

Psychosocial Well-Being/Health-Related Quality of Life

A search for meta-analyses that investigated the efficacy of Tai Chi or Qi Gong in improving well-being and/or quality of life yielded one meta-analytical review of randomized-clinical trials (RCTs), "Tai chi for improving cardiopulmonary function and quality of life in patients with chronic obstructive pulmonary disease: A systematic review and meta-analysis" (Guo et al., 2016). Their meta-analysis included 15 RCTs addressing the effects of Tai Chi as compared to other treatments (either exercise, a control group, or both) on alleviating chronic obstructive pulmonary disease. The main outcomes examined by the studies included in the meta-analysis were exercise capacity, using a six-minute walk-distance test (6MWD), and pulmonary capacity, using forced vital capacity (FVC) and forced expiratory volume (FEV). Also, consistently evaluated were blood gas parameters, and health-related quality of life (H-QL), which the RCT studies assessed using either the Chronic Respiratory Disease Questionnaire (CRQ) or the St. George Respiratory Questionnaire (SGRQ).

In each of the studies, the participants were adults (age > 17 years) diagnosed with chronic obstructive pulmonary disease (COPD), but who did not have any pre-existing conditions that would interrupt Tai Chi training (e.g., cognitive or sensory impairments, musculoskeletal disease, or formal exercise training within the previous year). To reduce the risk of including biased studies in their meta-analysis, Guo et al. (2016) used the Cochrane Collaboration's Risk of Bias, which rates studies in terms of five common biases: Selection (symptom baseline differences between the groups being compared), Performance (differences in the exposure to factors other than the interventions of interest), Detection (differences on how outcomes are measured), Attrition (withdrawal rate differences), and Reporting (favoring the

reporting of statistically significant results). In addition, Guo et al. (2016) accounted for the heterogeneity of the overall effect size of their sample of studies by analyzing the data using a random-effects model. Heterogeneity is the inter-study variability in the size and/or direction of the outcomes reported by the studies. For example, although on the average a group of studies may find a particular new treatment more effective than a traditional intervention, studies often vary on how large or small the difference is between the groups. Finally, they grouped effect sizes by outcome type and by trial length: short-term (one to three months), mid-term (six months), and long-term (12 months) (Guo et al., 2016).

The meta-analysis found statistically significant benefits of Tai Chi in each of the five measured outcomes at the completion of the short- and mid-term intervention lengths, as well as for the 6MWD exercise capacity test for after the 12-month trial. The authors concluded that Tai Chi might be beneficial in improving exercise capacity in short, mid, and long-term situations, but that the gains for pulmonary function and quality of life were not replicated in the treatment lasting 12-months (Guo et al., 2016). With regards to heterogeneity, Guo et al. (2016) reported that effect size varied greatly, from near minimal heterogeneity for the 6MWD, FVC, FEV, blood gas parameters, and specific components of H-QL (dyspnea and fatigue) in the short-term trials, to moderate in overall H-QL, FEV, and 6MWD, in the mid-term category, to substantial for the mastery H-QL after the short-term trial. The absence of Tai Chi effectiveness in the 12-month long interventions seems counterintuitive, particularly because participants are more likely to become Tai Chi proficient after six months of practice (Guo et al., 2016). This finding suggests that Tai Chi's effectiveness might be limited to patients with mild or moderately advanced COPD, but as the disease worsens over time the benefits of Tai Chi may wane.

The meta-analysis by Guo et al. (2016) has several strengths, including using a broad initial search strategy, the assessment of the quality of their studies using a standardized method to evaluate risk bias, mapping all potential outcomes to various treatment lengths, and including in their review only RCT studies. On the other hand, their sample size of 15 studies was modest, the quality of the studies included in their sample was adequate but not excellent, and many of the effect sizes found were heterogeneous (which means that the positive outcomes were not consistent across studies).

Using the PubMed database, I replicated the search strategy employed by Guo et al., (2016) and found two recent Qi Gong, RCT studies (Zhang et al., 2016 and Xiao & Zhuang, 2015) that Guo et al. did not include in their meta-analytical review (most likely because these studies had not been published at the time Guo et al. conducted their literature search). Both studies test the efficacy of a six-month, Qi Gong trial on COPD patients, and both found that Qi Gong improved exercise capacity, lung function, and H-QL. That is, my update supports the findings of Guo et al. (2016).

None of the 15 studies included by Guo et al. (2016) overlapped with the sample of studies reviewed by Abbot and Lavretsky (2013), which suggests that Abbot and Lavretsky's literature search of studies that examined Tai Chi's impact on H-QL was incomplete. Nonetheless, both reviews reported that Tai Chi has a positive effect on H-QL, and it might be important to conduct a larger meta-analysis of the effects of Tai Chi on H-QL without restricting the study to specific populations of patients. Unfortunately, both reviews lamented the relatively short duration of most existing RCT trials and a dearth of very high quality studies, specifically the need for better reporting measures, use of randomization and blinding, and greater methodological consistency across studies (e.g., more trials on specific medical populations).

Mood, Anxiety, and Depression

Wang et al. (2014) conducted a meta-analysis titled, "The effects of Tai Chi on depression, anxiety, and psychological well-being: A systematic review and meta-analysis." Wang, et al. (2014) limited their sample to RCT and quasi-experimental (Q-E) studies testing the effectiveness of Tai Chi to treat depression, anxiety and other psychological effects. Study heterogeneities were noted across two domains: clinical (sample characteristics or constructs measured), and methodological (waitlist or alternative intervention controls). Studies were grouped by clinical homogeneity into three groups of studies that respectively tested the effects of Tai Chi in depression, anxiety, and other psychological functioning.

After eliminating studies that did not use RCT or Q-E methods, did not include adequate comparison groups for Tai Chi, had sample sizes below 10 participants, or were deemed of poor quality, Wang et al. (2014) kept 42 studies that could potentially provide 25 effect sizes on depression, 11 on anxiety, and 32 on other psychological measures (groupings added up to more than 42 because some studies assessed more than one of the three grouped outcomes). However, after further examination of the studies, Wang et al. (2014) noted that the studies continued to be too different from each other to include them all in a single meta-analysis. Their final meta-analytic sample was reduced to only three RCT studies and two Q-E studies. The RCT studies allowed for testing of the effects of Tai Chi in both depression and general well-being, and the two Q-E studies only examined Tai Chi's effects on well-being (Wang et al., 2014).

Given that so very few studies allowed for a meta-analysis, Wang et al. conducted a "descriptive" review of the 42 quality studies that they had initially retained for potential inclusion in the meta-analysis. Wang et al. concluded that participants in most studies experienced positive effects as a result of the Tai Chi therapy in anxiety, depression, stress, well-

being, and mood. Using depressive symptoms as an outcome, 16 of 23 studies found significant improvement in depression as a result of Tai Chi (Wang et al., 2014). The meta-analysis of three studies that assessed depression exhibited statistically significant differences between the experimental and control groups as measured by the Center for Epidemiological Studies of Depression (CES-D) scale, with an absolute effect size *(ES)* = -5.97. Of the 32 studies (29 RCTs) that looked at Tai Chi and other psychological effects, 10 studies reported significant improvement in at least one category in overall quality of life. The more limited five-study meta-analysis did not find a statistical difference between Tai Chi and control groups (Wang et al., 2014). Finally, eight of the 11 studies that examined Tai Chi's impact on anxiety compared to control groups found positive outcomes compared to alternatives (Wang et al., 2014). No overall effect size was calculated for the anxiety measures.

Replicating the search strategy used by Wang et al. (2014), I only found one study posterior to the most recent study they included in their review. However, the study I found was just a protocol for a proposed RCT using Tai Chi to improve physical and psychological well-being. Therefore, as of this time, no additional papers can support or refute the findings put forth by Wang et al. (2014).

When comparing Wang et al. (2014) and Abbot and Lavretsky's (2013) sample of studies included in their respective literature reviews, only eight studies (all RCTs) were included in both reviews (Dechamps et al., 2009; Fransen et al., 2007; Galantino et al., 2005; Gemmell & Leathem, 2006; Hartman et al., 2000; Sattin et al., 2005; Tsai et al., 2003; Wang et al., 2010). Similarly to Wang et al. (2014), Abbot and Lavretsky also mentioned the difficulty of assessing the multiple modalities of Tai Chi, resolving the issue by combining results of various styles into one result per study. Both papers concluded that Tai Chi was beneficial in reducing depressive,

anxious, and mood symptoms, although "other psychological effects", such as mood, in the Wang et al. paper were not statistically significant, which curtails Abbot and Lavretsky's report.

Chi el al. (2013) also published a meta-analysis addressing mood, anxiety, and depression, "Tai chi and reduction of depressive symptoms for older adults: A meta-analysis of randomized trials." After a rigorous screening process, only four randomized controlled trials were used in their meta-analysis. Only RCTs and quasi-randomized trials were used in search criteria, including patients exhibiting depressive symptoms, and excluding trials that used Tai Chi as a co-intervention. The primary participants were older adults (55 years and older), and the studies focused on Tai Chi's effect on depressive symptoms measured most commonly with the CES-D (Chi et al., 2013). Two of the studies looked at sedentary adults, while the other two looked at adults with osteoarthritis. All studies were assessed for bias following the 2008 Cochrane Handbook, adhering to the same quality guidelines followed by Wang et al. (2014) (adequate sequence generation, blinding, completeness of outcome data, etc).

All four studies were different in that they used different comparative control groups, but were similar in other regards. Participant age and health conditions were similar, and intervention characteristics were comparable as well: all four used hour-long sessions, and most met twice per week (Study 2 met three times a week) for 12 weeks (Study 3 lasted 24 weeks) (Chi et al., 2013). All used the CES-D to measure depressive symptoms. Results were pooled to calculate an effect size, and it was determined that there was a small significant difference between Tai Chi and control groups (SMD = -0.27), and that there was no heterogeneity between studies. Subgroup analyses were completed to determine within study variations and if participant conditions influenced results (Chi et al., 2013).

"Study One" (Fransen et al., 2007) and "Study Four" (Wang et al., 2009) showed in their

analyses decreased depressive symptoms in older adults with osteoarthritis (SMD= -0.24), but not statistically significant ones. Similarly, "Study Two" (Frye et al., 2007) and "Study Three" (Li et al., 2001) showed improved depressive symptoms in sedentary adults (SMD= -0.31), but again without statistically significant results (Chi et al., 2013). These results were confusing, as the original full analysis demonstrated statistically significant differences in decreasing depression symptoms compared to control trials. When sensitivity analyses were run, removing "Study Four" from calculations significantly changed the overall effect size, which suggested that the effect size of Study Four was largely responsible for the overall effect size (Chi et al., 2013).

Using the same search strategy that Chi et al. (2013) employed yielded two potential new studies not included by Chi et al. (2013) (Irwin et al., 2014; Larkey et al., 2014). The first study used older adults with insomnia, receiving their respective interventions once a week for two hours over the course of four months; follow-ups took place seven and 16 months post-treatment. They determined that across all outcomes they were observing (improved sleep quality, fatigue, and depressive symptoms), cognitive behavioral therapy was statistically more effective than Tai Chi Chih (a style of Tai Chi) and sleep seminar education. They did note, too, that Tai Chi Chih was statistically more effective at improving these symptoms than sleep seminar education (Irwin et al., 2014). The second study (Larkey et al., 2014) included cancer survivors and the ability of Qi Gong and Tai Chi Easy to reduce fatigue, depression, and sleep disturbance. Measurements for each were taken initially, after 12 weeks (the conclusion of the trial), and three months post-intervention. While they discovered statistically significant differences between groups in reducing fatigue, results for depression and sleep disturbance were not statically significant from control groups. These two new studies are congruent with Chi et al.'s (2013)

finding of weak or no effects of Tai Chi on depression.

Chi et al.'s paper detailed many of the aforementioned shortcomings brought up in the above meta-analyses, such as researchers not looking at mental illness as the primary focus, poor quality current studies (not enough randomization, blinding, etc.), and a need for longer term trials in studies. Chi et al. (2013) included three of the studies used by Abbot and Lavretsky (Fransen et al., 2007; Frye et al., 2007; Li et al., 2001). Chi et al. (2013) concluded that compared to wait list controls, Tai Chi was more effective in minimizing depressive symptoms, but that while Tai Chi appeared more effective at decreasing symptoms of adults with osteoarthritis, this effect was not statistically significant. They also conceded that their results could not be conclusive due to the limited nature of their analysis (Chi et al., 2013). Chi et al.'s (2014) uncertainty contrasts with the 13 of 14 studies that Abbot and Lavretsky (2013) claimed supported Tai Chi's effectiveness in reducing depression, as well as their claim that geriatric populations benefited the most.

The final meta-analysis concerning Mood, Anxiety, and Depression was published by Yin and Dishman (2014), "The effect of Tai Chi and Qigong practice on depression and anxiety symptoms: A systematic review and meta-regression analysis of randomized controlled trials." Unlike Abbot and Lavretsky, Yin and Dishman elected to distinguish between Tai Chi and Qi Gong as some researchers categorize them as different mindfulness practices. As a result, after compiling 35 RCTs (20 on Tai Chi and 15 on Qi Gong), they separated results into distinct groups: Tai Chi's effect on depression, Tai Chi's effect on anxiety, Qi Gong's effect on depression, and Qi Gong's effect on anxiety. Eight of the studies focused specifically on depression and anxiety as the primary outcome, the rest were primarily focused on physical functions of disease (Yin & Dishman, 2014).

Inclusion criteria for this study required papers that were in English, employed random assignment, and measured depression or anxiety outcomes both as a baseline and after partaking in Tai Chi/Qi Gong. Effect sizes were determined by comparing mean changes between control and Tai Chi/Qi Gong groups, adjusting for small sample size bias. A random-effects model was employed as study heterogeneity was anticipated, and funnel plots were graphed to detect publication bias (Yin & Dishman, 2014). There was a wide range of treatment lengths, ranging from one to five sessions/week, for 30-120 minutes/session, and lasting eight-48 weeks. There were also a variety of scales used to determine depressive outcomes (CES-D [used in nine papers], Beck Depression Inventory, Geriatric Depression Scale, Profile of Mood States-Depression, Hamilton Rating Scale, etc.) and anxiety outcomes (State-Trait Anxiety Inventory [most often used, found in three studies], Profile of Mood States- Tension/Anxiety, Depression Anxiety Stress Scale-Anxiety, etc.) (Yin & Dishman, 2014).

A total of 25 effects of Tai Chi on depression were gathered from the 20 studies on Tai Chi, 21 of which (84%) had effect sizes significantly larger than zero, the mean being 0.36. The studies were heterogeneous, there was a significant value for Egger's test for bias, and a "funnel plot" analysis exhibited potential publication bias (Yin & Dishman, 2014). A moderator analysis was conducted to determine sources of variation. Higher levels of baseline depression were found to increase effect size, and studies using blinded allocation appeared to have a smaller effect size. From the same studies, 8 out of 11 (72.7%) effects were found to have an effect size larger than zero when addressing anxiety, with an average of 0.34 (Yin & Dishman, 2014). These effect-sizes were also heterogeneous, Egger's bias test was also significant, but a funnel plot showed this was due to many of the studies having similar sample sizes rather than publication bias. An additional moderator analysis noted that age was inversely related to anxiety

reduction (the older one is, the less their anxiety was improved), and effect sizes increased among Asian participants. These two moderators explained the majority of the variance, ethnicity accounting for 69% of it (Yin & Dishman, 2014).

As for the 15 Qi Gong studies, Yin and Dishman (2014) calculated a mean effect size of 0.38 from the effects on depression, with 19 out of 21 (90%) having an effect size larger than zero. Effects were homogeneous across studies in this category, with an insignificant Egger's score and no evidence of publication biases found in the funnel plot. Due to insignificant variance, no moderator analysis was required for this effect. Finally, they found that all 12 effects of Qi Gong on anxiety (100%) had effect sizes larger than zero, with a mean effect size of 0.72 (Yin & Dishman, 2014). The effect size was heterogeneous once again, Egger's bias was insignificant, and the funnel plot didn't detect publication bias. Due to the heterogeneity, a moderator analysis was completed. Yin and Dishman (2014) determined that higher initial anxiety levels were associated with increased anxiety reduction, age was once again inversely related to reduction, and that anxiety reduction was larger with longer session lengths and more frequent practice, but smaller with the length of the trial (Yin & Dishman, 2014).

I replicated the methods Yin and Dishman (2014) provided in their meta-analysis and found two potential studies that could update their work, but one of them (Larkey et al., 2014) was also detected in my update of Chi et al.'s (2013) study and did not find statistically significant differences between groups. The second study used elderly participants in wheelchairs to determine seated Tai Chi's impact on depression and quality of life (Hsu et al., 2016). Sessions lasted for 40 minuntes, three times/week, for 26 weeks. Hsu et al. (2016) concluded that Tai Chi significantly decreased depressive symptoms (measured by the GDS-SF) and increased quality of life. My search also uncovered a proposed study to test the effects of Tai

Chi (12 weeks) on anxiety in stressed individuals compared to exercise; but it has yet to be published. The two novel RCT's offer mixed support for Yin and Dishman's (2014) meta-analysis, giving strong evidence for seated Tai Chi (Hsu et al., 2016) but not statistically significant effects for cancer survivors (Larkey et al., 2014).

When comparing studies used, eight of the 35 studies used by Yin and Dishman were included in Abbot and Lavretsky's review (Barrow et al., 2007; Brown et al., 1995; Fransen et al., 2007; Frye et al., 2007; Li et al, 2001; Li et al., 2002; Tsai et al., 2003; Wang et al., 2010). Like Abbot and Lavretsky, Yin and Dishman concluded that Tai Chi and Qi Gong had "small-to-moderately sized antidepressant and anxiolytic effects" (Yin & Dishman, 2014). Interestingly, Abbot and Lavretsky reported that geriatric populations benefited the most from Tai Chi/Qi Gong when it came to depressive symptom alleviation; however, Yin and Dishman noticed a smaller effect of anxiety reduction in older adults in both Tai Chi and Qi Gong studies compared to younger participants. Reasons for this were not discussed, although it may be a worthwhile avenue for future research. Despite this, Yin and Dishman reported a strong effect of Qi Gong on anxiety reduction (2014). They did also note that outcomes seemed to improve if sessions lasted 90 minutes or more, or practices took place six times a week. While Abbot and Lavretsky only mentioned using RCTs on Tai Chi while looking at anxiety, they did find that 90% of them were effective at reducing anxiety (2013).

As above, Yin and Dishman provided parallel pitfalls such as a need for more rigorous studies, with higher quality and better reporting. They also commented that practitioner or teacher skill level could not be determined from information included in the studies, information they deemed important for future studies. Finally, they pointed out that it was not feasible to conclude if it were the movements in Tai Chi and Qi Gong themselves or the combination of

them with mindfulness that made them so effective, requesting future brain scans to determine cerebral activity throughout these events (Yin & Dishman, 2014).

Sleep Disturbances

Moving from Mood, Anxiety and Depression, the next section dealt with meta-analyses on Tai Chi and Qi Gong's effect on Sleep Disturbances. Here I found a review titled, "The effect of a meditative movement intervention on quality of sleep in the elderly: A systematic review and meta-analysis," by Wu et al. (2015). The authors prefaced the topic by pointing out sleep disorders are typically associated with elderly individuals, with a prevalence of 25-60% in that population. They attributed this to limited slow-wave sleep, reduced REM sleep, reduced total sleep time, and other multifactorial risk factors (health status, psychiatric illness, cognitive dysfunction, etc.) when compared to younger individuals (Wu et al., 2015). Therefore, they limited their meta-analysis to geriatric samples, or studies that reported sample average ages of at least 60. They also excluded studies using participants with sleep disorders that require pharmacological treatments, such as sleep apnea (Wu et al., 2015).

After searching the literature, they selected 14 (RCT) studies to review, and 12 of those to include in a meta-analysis. Nine of their studies concerned Tai Chi, one on Qi Gong, one on Tai Chi and Qi Gong, and three on yoga (Wu et al., 2015). All studies were assessed for bias on the basis of the Cochrane Back Review Group, with similar to before domains such as selection bias, performance bias, attrition bias, reporting bias, and detection bias (Wu et al., 2015). Effect sizes were determined through a standardized mean difference (> 0.8 = large, 0.5-0.8 = moderate, 0.2-0.5 = small), and heterogeneity was determined with a chi-square and I^2 test (> 50% = significant). A fixed-effect model was employed in the case of insubstantial heterogeneity, and a random-effect model was used if there was heterogeneity. A funnel plot was

used to detect publication bias (Wu et al., 2015).

Treatment durations lasted anywhere from 12-24 weeks, with sessions lasting 20-70 minutes (usually 60 minutes) and taking place once a week to twice a day (most commonly three times per week). All studies included used various subjective sleep measures, such as the Pittsburgh Sleep Quality Index (PSQI), a sleep disturbance subscale of it, or the Sleep Rating Questionnaire. Following bias assessment, a mean score of 6.5 (low bias) was found, though a slightly asymmetrical funnel plot suggested potential publication bias. A total of 10 of the studies were determined to be low risk, while four were of moderate risk (Wu et al., 2015). Although 12 of 14 studies were used in a meta-analysis, the two excluded studies reported significant improvement in the experimental versus the control groups, but their results could not be pooled because of methodological differences between the studies.

Using a random-effects model, Wu et al. (2015) concluded that experimental groups showed better sleep quality than control groups (a SMD of -0.7, moderate effect, was calculated). After recalculating their findings myself to remove the two yoga studies that were included, a similar standard mean difference, -0.69, of Tai Chi alone compared to control groups was still procured, a value Wu et al. classified as a moderate effect size. Wu et al. (2015) noticed in a sensitivity analysis that frequency of any of the treatments was related to outcome, with fewer than three practices a week not positively impacting sleep quality. Further, they determined that those studies at risk of bias reported SMD's twice as high as those with low risk of bias (Wu et al., 2015). Finally, they concluded that Tai Chi (and yoga) seemed effective in improving self-reported sleep quality with results similar to reviews on both exercise and behavioral interventions on sleep quality. They took this to mean that these "meditative movement interventions" were just as effective as other intervention approaches (Wu et al., 2015).

My attempt to update Wu et al.'s pool of studies yielded one study. This study (Chan et al., 2016) included older adults suffering from cognitive impairments and related sleep disturbance. Data were collected at a baseline, after two months (the end of the treatments), and six months (post-treatment follow-up), using the Chinese Pittsburgh Sleep Quality Index to measure sleep quality and the Short-Form 12 to measure quality of life. The study ran for two months, with interventions lasting one hour twice a week. Chan et al. (2016) concluded that Tai Chi resulted in statistically significant improvements compared to control groups in both sleep quality and quality of life. These updated results support Chan et al.'s results.

Several issues were brought up in the discussion section, such as the sensitivity analysis finding that lower quality studies seemed to produce larger effect sizes when compared to higher quality ones. They hypothesized that this could be due to a selection bias in these papers, an attrition bias (unsatisfied participants left, leaving only subjects who were finding treatment to be effective), lack of assessor blinding, and lack of study power analysis (Wu et al., 2015). They noted the same issues as many of the above studies as well, such as lack of clear instruction, multiple styles of each treatment, and a wide variety of range and duration of treatments. As is becoming familiar, they requested additional thorough studies, this time with a focus on treatment style/duration (Wu et al., 2015). They commented that increased practice frequency would mirror the World Health Organization's recommendation for physical activity in the elderly population. Finally, they suggested that future studies use objective, rather than subjective, measures of sleep to obtain more reliable and accurate data (Wu et al., 2015).

Five out of the 14 studies included were also referenced in Abbot and Lavretsky's work (Frye et al., 2007; Irwin et al., 2008; Li et al., 2004; Nguyen & Kruse, 2012; Wang et al., 2010), all five of which were also used in their meta-analysis. Abbot and Lavretsky similarly found

studies focused on older adults (three out of their four papers), and concluded that Tai Chi was effective in improving sleep quality. They made no reference to Qi Gong's usefulness, and Wu et al. did not mention any effect of Qi Gong either. Both papers alluded to the exercise component of Tai Chi as being potential reasons for their effectiveness. Unlike Abbot and Lavretsky, Wu et al. suggested that the frequency of treatment was crucial to effective outcomes, recommending a tri-weekly practice (Wu et al., 2015).

Cognitive Functioning

No recent studies on Tai Chi/Qi Gong and Substance Abuse were uncovered in this paper's search, so the next section of Abbot and Lavretsky's paper that is examined is Cognitive Functioning. Wayne et al. published a meta-analysis on this subject in 2014 titled "Effect of tai chi on cognitive performance in older adults: Systematic review and meta-analysis." Like the preceding section, declining Cognitive Function is typically an age-related phenomenon, and so the researchers found studies primarily covering older adults. Unlike the other sections described by Abbot and Lavretsky, Cognitive Functioning is not typically treated with pharmacological agents. Instead, physical activity has been looked into the most for this field, with one such approach being Tai Chi. It's believed to be a multi-faceted approach containing beneficial effects through moderate aerobic exercise, visuospatially and memory stimulating movements, and meditative thought to sharpen attentional resources (Wayne et al., 2014).

Due to the pioneering nature of this paper and lack of preexisting RCTs on Tai Chi and cognitive functioning, Wayne et al. (2014) elected to include RCTs, prospective nonrandomized controlled trials, prospective noncontrolled observational studies, and cross-sectional studies. Effect sizes were measured with Hedges' g, heterogeneity was monitored (25%= low, 50%= moderate, 75%= high), and a random-effects model was used (Wayne et al., 2014). Risk was assessed with the Cochrane Back Review Group, following the same dimensions as above. Outcomes from each study

were grouped into five separate categories: “Global cognition”, “Executive function”, “Language”, “Learning and Memory”, and “Spatial and Quantitative function.” The outcome most commonly associated with trials on cognitively typical individuals was executive function, and the most commonly observed outcome of those with cognitive impairments was global cognition (Wayne et al., 2014).

Wayne et al.’s paper gathered 20 studies on cognitive functioning, 11 of which looked at older adults without any cognitive impairment, the remaining nine with adults exhibiting some form of cognitive complication. Styles of Tai Chi varied by each trial (Yang, Sun, Tai Chi Chih, and multicomponent systems were used), as did treatment duration and frequency. They ranged from 20-60 minute sessions one to four times/week, lasting for 10 weeks to one year. Only four of the studies on non-cognitively impaired adults were RCTs, all of which reported a positive impact on executive functioning (Wayne et al., 2014). A meta-analysis using these RCTs was conducted, resulting in a statistically significant increase (Hedge’s g= 0.904) with high heterogeneity. Repeated without the study with the highest bias score, results were still significant (Hedges’ g= 0.394) with no heterogeneity.

Of the remaining seven studies, six provided evidence towards Tai Chi improving cognitive functioning across these domains (Wayne et al., 2014). Looking at the studies involving cognitively impaired adults, seven out of nine were randomized controlled studies and all but one used MMSE, the Mini-Mental State Examination, a cognitive function test to measure global functioning. A meta-analysis involving four of them that were compared to nonintervention groups found a small (Hedges’ g= 0.346) but statistically significant effect of Tai Chi on cognitive performance in regards to the MMSE (Wayne et al., 2014). In a similar meta-analysis looking at Tai Chi compared to active interventions, another small (Hedges’ g= 0.300) but significant effect was determined.

I was able to replicate the literature search employed by Wayne et al. by plugging their

search terms in PubMed and restricting results to those published after March 2013. A variety of study types were included (RCT, prospective nonrandomized controlled studies, prospective noncontrolled observational studies, and cross-sectional studies) but English was the only language included. After eliminating extraneous studies, no new papers were discovered.

Wayne et al. concluded that based on the meta-analysis on cognitively typical individuals, Tai Chi had a small but significant impact on functioning. Likewise, they determined that Tai Chi had a significant impact on improving cognitive functioning in cognitively impaired participants (Wayne et al., 2014). Once again, several of the same pitfalls were listed in this study: more studies on the topic need to be done completed, studies should be larger and have better designs, and more details on the Tai Chi style should be provided. As mentioned above, the relatively new area of research concerning Tai Chi and cognitive functioning didn't allow for many papers to be published as of yet. To accommodate this shortage they used several kinds of studies in their meta-analysis; however, for a more reliable study only RCTs should be included if possible.

When compared to Abbot and Lavretsky's study, two of the papers included in Wayne et al.'s paper were the same (Lam et al., 2011; Wang et al., 2010). Similar to the Sleep Disturbance section and as listed above, Cognitive Function complications are typically associated with older individuals. Therefore, both the papers included in Abbot and Lavretsky's and Wayne et al.'s analyses included older adults and geriatric individuals. Due to Tai Chi's low impact and lack of side effects, both analyses suggest that it is a viable treatment for improving Cognitive Functioning in those patients of advanced age.

Discussion

Each meta-analysis now individually described, all six may be compared to one another to determine similarities and differences, as seen in Table 1. The number of studies included in each meta-analysis ranged from four (Chi et al., 2013) to 42 (Wang et al., 2014), with an average of 20.8. Each meta-analysis included anywhere from 404 (Chi et al., 2013) to 3,017 participants (Wang et al., 2014), with an average of 1,886.3 members.

There was a wide variety of Tai Chi intervention lengths in each meta-analysis, as well as study duration lengths. Guo et al. (2016) saw Tai Chi sessions lasting 30-50 minutes, twice to seven days/week, for six weeks to 12 months. The most commonly seen duration and frequency were hour-long sessions every day of the week, for three months. Wang et al. (2014) did not provide information on how long Tai Chi sessions lasted, but participants frequented classes anywhere from once a week to twice a day for four weeks to five years, most typically being twice/week for 12 weeks. All of the studies used in Chi et al.'s (2013) meta-analysis lasted one hour, meeting twice/week on average (only one met three times/week) usually for 12 weeks (only one met for 24 weeks). Yin and Dishman (2014) did not provide individual study information, but rather ranges: Their included Tai Chi and Qi Gong studies lasted 30-120 minutes, one to five days/week, for eight-48 weeks. Wu et al. (2015) used studies with Tai Chi interventions of 20-70 minutes, once/week to twice daily, for 12-24 weeks. Their studies averaged 60-minute Tai Chi sessions that met three days/week for 12 weeks. Finally, Wayne et al. (2014) had a larger spread of 20-120 minutes, once a month to four days/week, lasting only one session to five years. Typical study frequency and durations they included were 60 minutes, three days/week over the course of a year. Compiled together, the most common session length appeared to be 60 minutes, meeting two-three days/week, and lasting for 12 weeks.

Looking at the quality of each study, nearly every researcher used some form of a Cochrane risk analysis guideline to assess biases, creating a relatively homogeneous comparison. The ranges in Table 1 were the result of incomplete study data. The lower range was determined by only interpreting "Yes" or "Bias Free" results in each meta-analysis, as many studies provided gaps in assessment (either by concluding the assessment was "unclear", marking the category with "?", or simply leaving it blank). The higher end of the range was figured assuming all of the uncertain values were indeed bias-free, creating a highest possible score for percentage of unbiased studies in each category of bias assessment for each respective meta-analysis. There was a wide array of differences in bias in each study, with Yin and Dishman (2014) not providing any bias information.

Guo et al. (2016) ranged from only 27% of studies describing analysis method to 60% describing their concealment. Wang et al. (2014) provided ranges for all aspects of the bias assessment, with selective reporting having both the lowest and highest potential bias (only 11.9% of studies being free of selective reporting to 100% being free of it). Chi et al. (2013) exhibited relatively low potential bias across the board, the most potential bias coming from blinded assessor and other sources of bias (50% of studies) and the least from randomization and selective reporting (100% of included studies described randomization and were free of selective reporting). The next available bias assessment information came from Wu et al. (2015), with a range of 0% of studies blinding assessors and participants to 100% of included studies describing randomization, concealment, having acceptable compliance, being free of selective reporting, and having similar timing of outcome assessment. Wayne et al. (2014) had data available for all included studies, and therefore did not have ranges of potential bias. Only 9.09% of their studies

reported participant blinding, and on the opposite end of the spectrum 100% of the studies used were free of selective reporting and had similar timing of outcome assessment.

As the majority of meta-analyses covered different topics of Abbot and Lavretsky's (2013) paper, it is difficult to compare across outcomes what measurements each had in common. There were definite overlaps in depression measurement tools, the most common scale being the CES-D (Center for Epidemiological Studies- Depression Scale [Wang et al., 2014; Chi et al., 2013; Yin & Dishman, 2014]), but some also had the GDS (Geriatric Depression Scale), SCL-90-RD (Symptom Checklist 90-revised), and GHQ (General Health Questionnaire) in common (Wang et al., 2014; Yin & Dishman, 2014). Similar anxiety measurements were used as well, such as versions of the STAI (State and Trait Anxiety Inventory), DASS (Depression, Anxiety, and Stress Scale), and SAS (Self-rating Anxiety Scale). These were used in Wang et al. (2014), Chi et al. (2013), or Yin and Dishman's (2014) meta-analyses. Chi et al. (2013) and Wu et al. (2015) also used the same measurement of sleep disturbance, the PSQI (Pittsburgh Sleep Quality Index) in both of their papers. All of these papers, with the exception of Wu et al. (2015), focused on depression and/or anxiety, so it follows they would have the most overlap in outcome measurement. The remaining studies focused on different outcomes (quality of life/ psychological well being [Guo et al., 2016] and cognitive functioning [Wayne et al., 2014]), and therefore had unique outcome measurement tools included in their studies.

Most studies used a standard mean difference to calculate the effect sizes of Tai Chi compared to control groups, though some used the Hedge's g variation, which accounts for standard deviation. Although some measurements yielded negative values, all represent Tai Chi being favored to some degree over control groups (the negative or positive resulted from different studies assigning Tai Chi as "Group 1" or "Group 2" in their calculations). Values

closer to zero represent a smaller effect size of the preference for Tai Chi/Qi Gong, while larger values represent a greater effect of Tai Chi/Qi Gong on outcomes compared to controls. Health-related quality of life, blood gas parameters (Guo et al., 2016) and depressive symptoms in those with osteoarthritis had some of the smallest effect sizes, providing values of 1.92 (favoring control groups in one study), -0.26, and -0.24, respectively. Exercise capacity (Guo et al., 2016), the meta-analysis on depressive symptoms by Wang et al. (2014), and the meta-analysis on cognitively healthy individuals cognitive function by Wayne et al. (2015) had the largest differences in Tai Chi/Qi Gong preference, with effect sizes of 23.85, -5.97, and 0.904, respectively.

There were a range of p-values indicating significance as well in each meta-analysis, though all used a confidence interval of 95%, and therefore a p-value significance level of 0.05. Outcomes that yielded statistically significant averages included exercise capacity, some pulmonary function and health-related quality of life studies (Guo et al., 2016), the meta-analysis on depressive symptoms by Wang et al. (2014), depressive symptoms in Chi et al.'s (2013) paper, Tai Chi and Qi Gong on both anxiety and depression in Yin and Dishman's (2014) paper, sleep disturbance (Wu et al., 2015), and cognitive functioning in both cognitively healthy and impaired individuals (Wayne et al., 2014). Again, while all studies seemed to prefer Tai Chi/Qi Gong to varying degrees, some results were unable to cross the significance threshold. Such outcomes that provided statistically insignificant values were blood gas parameters (Guo et al., 2016), and depressive symptoms in sedentary adults and those with osteoarthritis (Chi et al., 2013).

Finally, the heterogeneity of each study was measured with a chi-square value and corresponding I^2 percentage. Heterogeneity between the studies used for each outcome had the

potential to vary quite a bit, though some were homogenous with an I^2 value of 0%. These included outcomes in blood gas parameters (Guo et al., 2016), depressive symptoms in sedentary and osteoarthritic adults (Chi et al., 2013), the meta-analysis on depressive symptoms by Wang et al. (2014), and the meta-analysis on cognitively impaired adults by Wayne et al. (2014). Other outcomes were high in heterogeneity, such as studies observing Tai Chi/Qi Gong and anxiety (I^2= 79% 83%, respectively; Yin & Dishman, 2014), the studies on sleep disturbance (I^2=70%; Wu et al., 2015), and the studies looking at cognitive functioning in cognitively health adults (I^2= 92.02%; Wayne et al., 2014).

Conclusion

This meta-analysis sought to update the findings published by Abbot and Lavretsky (2013) in a comprehensive, methodological manner. Six meta-analyses were included in my thesis, containing the data of 126 studies from over 11,000 participants. While not all domains of Abbot and Lavretsky's original paper were covered (Stress Management, Substance Abuse, Parkinson's disease, or Traumatic Brain Injury), the latest analyses spanned Psychosocial Well-Being, Mood, Anxiety, and Depression, Sleep Disturbance, and Cognitive Functioning. Across all meta-analyses, Tai Chi and Qi Gong seemed to help improve participant outcome to some extent over the course of treatment sessions. Although not all findings were statistically significant, these complementary and alternative approaches were indicated as acceptable potential therapeutic options in each paper. This is due to the successful outcomes of treatment via Tai Chi/Qi Gong, but also its lack of adverse effects on patients. A comparable treatment option, exercise, has had many more studies look into its effect on a variety of mental illnesses and been deemed satisfactory. However, even exercise seems to have adverse side effects on up

to 7% of those exposed to training (Yin & Dishman, 2014), mostly the elderly/geriatric community, while Tai Chi and Qi Gong remain "safe" for all thus far.

My paper had several strengths, the first being its meta-analytical nature rather than the systematic review completed by Abbot and Lavretsky (2013). As previously discussed, the meta-analysis is less affected by positive reporting bias and subjectivity, governed by an empirical approach and statistics. Though Abbot and Lavretsky's paper is a good starting point for future research to build upon, the systematic review format approach allows for too much uncertainty in their findings. Adding to their work by only including other meta-analyses into a single, contemporary meta-analysis works to eliminate some of the potential above bias. Compared to other meta-analyses, such as those used in my paper, this current project extends across a spectrum of mental illnesses rather than focusing on one particular disorder. Only including one mental illness is not in and of itself a negative aspect of a study, but having several different disorders creates a more diversified, useful tool for suggestions on Tai Chi/Qi Gong implementation in therapy.

A limitation of my paper is that it included two meta-analyses that used various other study types in addition to RCTs (Wang et al., 2014; Wayne et al., 2014). Due to the relatively small pool of available research on the topic of Tai Chi and Qi Gong as a therapeutic technique for mental illness thus far, I elected to include these two papers in my own study. However, RCTs are among the most rigorous and reliable methodologies, and are preferred when compiling a meta-analysis. Another restriction comes from the potential databases at my disposal. Due to access to only a number of archives, I only used PubMed and PsycINFO to search for meta-analyses and update the sources of said papers. Using more databases would presumably increase the number of sources included, thus strengthening findings.

Looking forwards, several suggestions can be made for future studies in this area. Nearly every meta-analysis I included spoke of the lack of methodological quality in each RCT. Typical points made were a need for better reporting, longer trial lengths, randomization and blinding. Table 1 shows the range in bias of studies in each meta-analysis, indicating room still for improvement in experiment design. Furthermore, several of the studies requested more information on the Tai Chi/Qi Gong training itself; who was teaching the class, what their qualifications were, what movements participants were practicing, what style of Tai Chi/Qi Gong they were being exposed to, and practitioner baseline experience. These are all variables that impact treatment outcome, and being able to distinguish what is more beneficial would aid in determining the most effective characteristics of treatment. For example, some meta-analyses mentioned treatment taking place individually, or in a group format. Noting this difference to decide if Tai Chi is more therapeutic alone or with others can help tailor future treatment plans.

As stated above, despite exact outcomes each meta-analysis considered Tai Chi and Qi Gong safe enough to recommend as a potential treatment plan. Tai Chi and Qi Gong can be modified to any age group or skill level, making it an adaptive, customizable experience for each unique individual. It doesn't require equipment, and can take place at home or in community, making it an inexpensive treatment option. The above meta-analyses speak to Tai Chi/ Qi Gong's effectiveness in treating and improving psychosocial well-being/quality of life, mood, anxiety, and depression, sleep disturbance, and cognitive functions, making it a versatile choice for a wide range of patients. Depression in old age has become a serious problem, with a prevalence rate of 13.5%, and often leads to other detrimental health conditions (Chi et al., 2013). Sleep disturbance is also described as a geriatric problem, too, afflicting 25-60% of that population (Wu et al., 2015). An intervention that is cost efficient, side effect-free, and effective

across a spectrum of disorders would be beneficial not only to this demographic, but anyone in need looking for an alternative form of therapy.

My inclusion of Tai Chi and Qi Gong's effect on several mental illnesses creates a single source for future scholars to turn to when determining appropriate treatment plans, or completing research in this field. My paper creates an updated, empirical source on the most recently available information on the subject, and compliments or refutes past systematic findings with the latest studies. My thesis offers support to a complementary and alternative therapy on which little research has been completed, and provides individuals with another option for treatment if they are unsatisfied with what is typically available. The two-pronged approach to therapy, an aerobic exercise with meditative components, creates a unique, multifaceted technique that can be accessible to every demographic, prescription-free. Moving forwards, I hope to examine if such treatments as Tai Chi and Qi Gong are appropriate in treating other mental illnesses, such as bipolar disorder and schizophrenia, and continue to determine the most effective styles, duration, and length of the art for the most effective results.

Table 1: Summary of Posterior Meta-Analytical Findings

Authors, Year	Title (Summary)	# of Studies (total participants)	Length(# studies)/ Frequency of Intervention
Guo et al., 2016	Tai Chi for Improving Quality of Life in COPD Patients	15 (1,354)	30 (1), 50 (1), or 60 (13) mins 2 (5), 5 (1), or 7 (9) day per week
Wang F et al., 2014	Tai Chi's Effects on Depression, Anxiety, and Psychological Well-Being	42 (3,017)	Twice (4) daily 1 (4), 2 (16), 3 (11), 5 (2) days per week
Chi et al., 2013	Tai Chi and Depressive Symptom Reduction In Older Adults	4 (404)	60 (4) mins 2 (3) or 3 days per week
Yin and Dishman, 2014	Tai Chi and QiGong's Effect on Depression and Anxiety Symptoms	31 (2,765)	30-120 mins 1-5 days per week
Wu et al., 2015	Meditative Movement Intervention and Sleep Quality in the Elderly	14 (1,225)	20-25, 30 (3), 40, 50, 60 (7), or 70 mins 1,2,3 (8), 6, or 7 (2) days per week Twice daily
Wayne et al., 2015	Tai Chi's Effect on Cognitive Performance in Older Adults	20 (2,553)	20, 30 (4), 45, 50 (3), 60 (6), or 120 mins 1 (3), 2 (3), 3 (7), or 4 (2) days per week Once per month

Table 1: Summary of Posterior Meta-Analytical Findings

Duration of Intervention	Quality of Studies	Outcomes
6 or 8 weeks 4, 3 (8), 6 (2), or 12 (2) months	Randomization described (53%)	Exercise Capacity (6MWD)
	Concealment described (60%)	Pulmonary Function (FVC, FEV, FEV/FVC)
	Blinded assessors (40%)	HRQoL (SGRQ [Total, Symptoms, Activity, Impact], CRQ [Dyspnea, Fatigue, Emotional
	Attrition described (53%)	Function, Mastery, Total)
	Analysis method described (27%)	Blood Gas Parameters (SaO2)
4, 5, 6 (2), 8, 10 (2), 12 (16), 16 (2), 26, or 48 weeks 1, 2 (3), 3 (2), 6 (2), 10, or 12 (2) months 5 years	Randomization described (26.19-90.48%)	Depression (SDS, CES-D, BDI-SF, BDI. HAMD, SCL-90-RD, GDS)
	Concealment described (30.95-95.24%)	Anxiety (SAS, State and Trait Anxiety Invent.)
	Blinded assessors (38.10- 95.24%)	General Health Status (SF-12/ -36, MOS SF-36, 28-item HRQL scale, 60-item GHQ, SRHMS)
	Completeness of outcome data (71.43-100%)	HRQoL (MOS-HIV, AIMS II, Minnesota Living w/ Heart Failure Quest., WHOQOLBREF)
	Free of Selective Reporting (11.90-100%)	Psychological State (POMS, DASS)
	Free of other bias (42.86-69.05%)	Self-esteem (RSES, PSPP, Rosenberg Self-Esteem Scale)
12 (3) or 24 weeks	Randomization described (100%)	Depression (CES-D)
	Concealment described (50- 75%)	Anxiety (DASS-21, STAI)
	Blinded assessors (50%)	Pain (WOMAC, FAS)
	Completeness of outcome data (75%)	Sleep Disturbance (PSQI)
	Free of Selective Reporting (100%)	HRQoL (SF-36)
	Free of other bias (50%)	
8-48 weeks	Information unavailable	Depression (CES-D, Beck Depression Inventory, GDS, Profile of Mood States-Depression, HRS-D, DASS-D, SCL-90-RD, Q, QoLQ-D, 60-item GHQ-D, SFDS, CDI)
		Anxiety (STAI, PMST-A, DASS-A, 60-item GHQ-A, HRS-A, SCL-90-RA, SFAS, QoLQ-A)
12 (8), 16, or 24 (5) weeks	Randomization described (64.29- 100%)	Sleep Outcomes (PSQI [and Sleep Disturbance Subscale], Sleep rating questionnaire)
	Concealment described (50- 100%)	
	Similar baseline characteristics (57.14- 64.29%)	
	Blinded participants (0-78.57%)	
	Blinded assessors (0-78.57%)	
	Similar or no co-inverventions (92.86%)	
	Acceptable compliance (57.14- 100%)	
	Attrition described (57.14%)	
	Free of Selective Reporting (100%)	
	Similar timing of outcome assessment (100%)	
Once 10 (3), 12 (2), 15, 20 (2), 24, or 40 weeks 5 .7, or 6 months 1 (3), 3 (2), or 5 years	Randomization described (27.27%)	Executive Funct.: TMT A&B, DS, Stroop, WAIS-R Similarities, Rule Shift cards test, Digit
	Concealment described (36.36%)	Span, COWAT, CTT, Button Reaction, Single Primary/Secondary/ Dual Task
	Blinded participants (9.09%)	Global Funct.: Mattis DRS, MMSE, ADL, ADAS-Cog
	Blinded assessors (72.73%)	Language: BNT, Category Fluency, Animal naming, CVFT
	Similar or no co-intervention (81.82%)	Learning and Memory: AVLT, CVLT, RAVLT, LMI, LMII, HKLLT, RBMT, Delayed Recall,
	Acceptable compliance (36.36%)	Hopkins Verbal Learning Delayed Recall
	Attrition described (72.73%)	Spatial & Quantit.: Rey, CDT, Arithmetic word problems, Math computations
	Free of Selective Reporting (100%)	
	Similar timing of outcome assessment (100%)	

Table 1: Summary of Posterior Meta-Analytical Findings

Effect Size (Average/ Range)	Significance: p-values (Average/ Range)	Heterogeneity: I^2 (Average/ Range)
Ex. Cap. (23.85 / 16.02-30.90)	Ex. Cap. (0.02 / 0.01-0.03)	Ex. Cap. (44% / 0-82)
Pul. Func. (4.5 / 0.03-2.13)	Pul. Func. (0.303 / 0.01-0.66)	Pul. Func. (19% / 0-78)
HRQoL (-1.69 / -7.47-1.92)	HRQoL (0.220 / 0.00001- 0.73)	HRQoL (38.54% / 0-96)
Blood Gas Parameters (-0.26 / -0.28- -0.24)	Blood Gas Parameters (0.585 / 0.56-0.61)	Blood Gas Parameters (0% / 0-0)
Meta-Analysis (3 RCTs): -5.97	Meta-Analysis (3 RCTs): 0.00001 Overall: 38.10% found improvements signifiant 7.14% found improvements insignificant	Meta-Analysis (3 RCTs): 0%
Depressive Symptoms (-0.27)	Depressive Symptoms (0.03)	Depressive Symptoms (0%)
Dep. Symp. Sendentary (-0.31)	Dep. Symp. Sed. (0.1)	Dep. Symp. Sed. (0%)
Dep. Symp. Osteoarthritis (-0.24)	Dep. Symp. Osteo. (0.17)	Dep. Symp. Osteo. (0%)
Tai Chi- Depression (0.36)	Tai Chi- Dep. (0.001)	Tai Chi Dep. (55%)
Qi Gong- Depression (0.38)	Qi Gong- Dep. (0.0001)	Qi Gong- Dep. (29%)
Tai Chi- Anxiety (0.34)	Tai Chi- Anx. (0.0365)	Tai Chi- Anx. (79%)
Qi Gong- Anxiety (0.72)	Qi Gong- Anx. (0.0001)	Qi Gong- Anx. (83%)
Overall: (-0.70)	Overall: (0.0002)	Overall: (70%)
Cog. Healthy Meta-Analysis (4 RCT): 0.904	Cog. Healthy Meta-Analysis (4 RCT): 0.04	Cog. Healthy Meta-Analysis (4 RCT): 92.02%
Cog. Impaired Meta-Analysis (4 RCT): 0.346	Cog. Impaired Meta-Analysis (4 RCT): 0.004	Cog. Impaired Meta-Analysis (4 RCT): 0%

References

Abbott, R., & Lavretsky, H. (2013). Tai Chi and Qigong for the Treatment and Prevention of Mental Disorders. *The Psychiatric Clinics of North America*, *36*(1), 109–119. http://doi.org/10.1016/j.psc.2013.01.011

Barrow, D. E., Bedford, A., Ives, G., OToole, L., & Channer, K. S. (2007). An evaluation of the effects of tai chi chuan and chi kung training in patients with symptomatic heart failure: a randomized controlled pilot study. Postgraduate Medical Journal, 83(985), 717e721.

Brown, D. R., Wang, Y., Ward, A. N. N., Ebbeling, C. B., Fortlage, L., Puleo, E., et al. (1995). Chronic psychological effects of exercise and exercise plus cognitive strategies. Medicine and Science in Sports and Exercise, 27(5), 765e775.

Chan, A. W., Yu, D. S., Choi, K., Lee, D. T., Sit, J. W., & Chan, H. Y. (2016). Tai chi qigong as a means to improve night-time sleep quality among older adults with cognitive impairment: a pilot randomized controlled trial. *Clinical Interventions in Aging*, *11*, 1277–1286. http://doi.org.ezproxy.uvm.edu/10.2147/CIA.S111927

Chi, I., Jordan-Marsh, M., Guo, M., Xie, B., & Bai, Z. (2013). Tai chi and reduction of depressive symptoms for older adults: A meta-analysis of randomized trials. *Geriatrics & Gerontology International, 13*(1), 3-12. doi:http://dx.doi.org.ezproxy.uvm.edu/10.1111/j.1447-0594.2012.00882.x

Dechamps A, Gatta B, Bourdel-Marchasson I, Tabarin A, Roger P. Pilot study of a 10-week multidisciplinary tai chi intervention in sedentary obese women. Clin J Sport Med. 2009;19:49–53. doi:10.1097/JSM.0b013e318193428f.

Fransen M, Nairn L, Winstanley J, Lam P, Edmonds J. Physical activity for osteoarthritis management: a randomized controlled clinical trial evaluating hydrotherapy or tai chi classes. Arthritis Rheum. 2007;57:407–14. doi:10.1002/art.22621.

Frantzis, B. K. (2006). *Tai Chi: Health for Life : how and why it Works for Health, Stress Relief and Longevity*. Blue Snake Books.

Frye B, Scheinthal S, Kemarskaya T, Pruchno R. Tai chi and low impact exercise: effects on the physical functioning and psychological well-being of older people. *J Appl Gerontol* 2007; 26: 433–453.

Furnham, A. (2002). Complementary and alternative medicine. *The Psychologist, 15*(5), 228-231. Retrieved from https://search.proquest.com/docview/619730782?accountid=14679

Galantino ML, Shepard K, Krafft L, LaPerriere A, Ducette J, Sorbello A, et al. The effect of group aerobic exercise and t'ai chi on functional outcomes and quality of life for persons living with acquired immunodeficiency syndrome. J Altern Complement Med. 2005;11:1085–92.doi:10.1089/acm.2005.11.1085.

Gemmell C, Leathem JM. A study investigating the effects of tai chi chuan: individuals with traumatic brain injury compared to controls. Brain Inj. 2006;20:151–6.doi:10.1080/02699050500442998.

Guo, J., Chen, B., Lu, Y., Zhang, W., Zhu, Z., Yang, Y., & Zhu, Y. (2016). Tai chi for improving cardiopulmonary function and quality of life in patients with chronic obstructive pulmonary disease: A systematic review and meta-analysis. *Clinical Rehabilitation, 30*(8), 750-764. Retrieved from https://search-proquest-com.ezproxy.uvm.edu/docview/1812926547?accountid=14679

Hartman CA, Manos TM, Winter C, Hartman DM, Li B, Smith JC. Effects of t'ai chi training on function and quality of life indicators in older adults with osteoarthritis. J Am Geriatr Soc. 2000;48:1553–9.

HealthDay. (2011, May 26). Lists of Prescription Meds' Side Effects Keep Growing. Retrieved March 20, 2016, from U.S. News Health website:http://health.usnews.com/health-news/managing-your-healthcare/healthcare/articles/2011/05/26/ lists-of-prescription-meds-side-effects-keep-growing-study

Hsu, C.-Y., Moyle, W., Cooke, M., & Jones, C. (2016). Seated Tai Chi versus usual activities in older people using wheelchairs: A randomized controlled trial. In *Complementary Therapies in Medicine* (pp. 1-6). Retrieved from PubMed database.

Irwin, M. R., Olmstead, R., Carrillo, C., Sadeghi, N., Breen, E. C., Witarama, T., . . . Nicassio, P. (2014). Cognitive behavioral therapy vs. tai chi for late life insomnia and inflammatory risk: A randomized controlled comparative efficacy trial. *Sleep: Journal of Sleep and Sleep Disorders Research, 37*(9), 1543-1555. Retrieved from https://search-proquest-com.ezproxy.uvm.edu/docview/1640006134?accountid=14679

Irwin MR, Olmstead R, Motivala S.J. Improving sleep quality in older adults with moderate sleep complaints: a randomized controlled trial of Tai Chi Chih. Sleep 2008; 31:1001–1008.

Kühberger, A., Scherndl, T., Ludwig, B., & Simon, D. M. (2016). Comparative evaluation of narrative reviews and meta-analyses: A case study. *Zeitschrift Für Psychologie/Journal of Psychology, 224*(3), 145-156. Retrieved from https://search-proquest-com.ezproxy.uvm.edu/docview/1837339104?accountid=14679

Lam LC, Chau RC, Wong BM et al. Interim follow-up of a randomized controlled trial comparing Chinese style mind body (Tai Chi) and stretching exercises on cognitive function in subjects at risk of progressive cognitive decline. Int J Geriatr Psychiatry 2011;26:733–740.

Larkey, L. K., Roe, D. J., Weihs, K. L., Jahnke, R., Lopez, A. M., Rogers, C. E., . . . Guillen-Rodriguez, J. (2014, August 15). *Randomized Controlled Trial of Qigong/Tai Chi Easy on Cancer-Related Fatigue in Breast Cancer Survivors* [PDF].

Li F, Duncan TE, Duncan SC, McAuley E, Chaumeton NR, Harmer P. Enhancing the psychological well-being of elderly individuals through tai chi exercise: a latent growth curve analysis. *Struct Equ Model* 2001; **8** (1): 53–83.

Li FZ, Fisher KJ, Harmer P, et al. Tai chi and self-rated quality of sleep and daytime sleepiness in older adults: a randomized controlled trial. J Am Geriatr Soc 2004;52:892–900.

Li, M., Chen, K., & Mo, Z. (2002). Use of qigong therapy in the detoxification of heroin addicts. Alternative Therapies in Health and Medicine, 8(1), 50e59.

Nguyen MH, Kruse A. A randomized controlled trial of Tai chi for balance, sleep quality and cognitive performance in elderly Vietnamese. Clin Interv Aging 2012;7: 185–190.

Rosenbaum, S., Tiedemann, A., Sherrington, C., Curtis, J., & Ward, P. B. (2014). Physical activity interventions for people with mental illness: A systematic review and meta-analysis. *The Journal of Clinical Psychiatry, 75*(9), 964-974. doi:http://dx.doi.org.ezproxy.uvm.edu/10.4088/JCP.13r08765

Sattin RW, Easley KA, Wolf SL, Chen Y, Kutner MH. Reduction in fear of falling through intense Tai Chi exercise training in older, transitionally frail adults. J Am Geriatr Soc. 2005;53:1168–78. doi: 10.1111/j.1532-5415.2005.53375.x.

Sifferlin, A. (2015, April 14). Americans Spent a Record Amount on Medicine in 2014. Retrieved March 20, 2016, from Time website: http://time.com/3819889/medicine-spending/

Tai Chi and Qi Gong: In depth. (2016, October). Retrieved October 20, 2016, from National Center for Complementary and Integrative Health website: https://nccih.nih.gov/health/taichi/introduction.htm#hed1

The complementary and alternative medicine controversy continues: The IOM report. (2005). *Journal of Pain & Palliative Care Pharmacotherapy, 19*(4), 5-9. Retrieved from https://search.proquest.com/docview/621161286?accountid=14679

Tracy, M. F., Lindquist, R., Savik, K., Watanuki, S., Sendelbach, S., Kreitzer, M. J., & Berman, B. (2005). Use of complementary and alternative therapies: A national survey of critical care nurses. *American Journal of Critical Care, 14*(5), 404-414. Retrieved from https://search.proquest.com/docview/620913596?accountid=14679

Tsai, J. C., Wang, W. H., Chan, P., Lin, L. J., Wang, C. H., Tomlinson, B., et al. (2003). The beneficial effects of tai chi chuan on blood pressure and lipid profile and anxiety status in a randomized controlled trial. The Journal of Alternative & Complementary Medicine, 9(5), 747e754.doi:10.1089/107555303322524599.

Vera-Garcia, E., Mayoral-Cleries, F., Vancampfort, D., Stubbs, B., & Cuesta-Vargas, A. (2015). A systematic review of the benefits of physical therapy within a multidisciplinary care approach for people with schizophrenia: An update. *Psychiatry Research, 229*(3), 828-839. doi:http://dx.doi.org.ezproxy.uvm.edu/10.1016/j.psychres.2015.07.083

Wang C, Schmid CH, Hibberd PL *et al*. Tai chi is effective in treating knee osteoarthritis: a randomized controlled trial. *Arthritis Care Res* 2009; 61: 1545–1553.

Wang, F., Lee, E. O., Wu, T., Benson, H., Fricchione, G., Wang, W., & Yeung, A. S. (2014). The effects of tai chi on depression, anxiety, and psychological well-being: A systematic review and meta-analysis. *International Journal of Behavioral Medicine, 21*(4), 605-617. doi:http://dx.doi.org.ezproxy.uvm.edu/10.1007/s12529-013-9351-9

Wang W, Sawada M, Noriyama Y, Arita K, Ota T, Sadamatsu M, et al. Tai chi exercise versus rehabilitation for the elderly with cerebral vascular disorder: a single-blinded randomized controlled trial. Psychogeriatrics. 2010;10:160–6. doi:10.1111/j.1479-8301. 2010.00334.x.

Wayne, P. M., Walsh, J. N., Taylor-Piliae, R. E., Wells, R. E., Papp, K. V., Donovan, N. J., & Yeh, G. Y. (2014). Effect of tai chi on cognitive performance in older adults: Systematic review and meta-analysis. *Journal of the American Geriatrics Society, 62*(1), 25-39.doi:http://dx.doi.org.ezproxy.uvm.edu/10.1111/jgs.12611

Wu, W., Kwong, E., Lan, X., & Jiang, X. (2015). The effect of a meditative movement intervention on quality of sleep in the elderly: A systematic review and meta-analysis. *The Journal of Alternative and Complementary Medicine, 21*(9), 509-519. doi:http://dx.doi.org.ezproxy.uvm.edu/10.1089/acm.2014.0251

Xiao, C., & Zhuang, Y. (2015). Efficacy of Liuzijue Qigong in Individuals with Chronic Obstructive Pulmonary Disease in Remission. *Journal of the American Geriatrics's Society*, *63*(7), 1420-1425. https://doi.org/10.1111/jgs.13478

Yin, J., & Dishman, R. K. (2014). The effect of tai chi and qigong practice on depression and anxiety symptoms: A systematic review and meta-regression analysis of randomized controlled trials. *Mental Health and Physical Activity, 7*(3), 135-146. doi:http://dx.doi.org.ezproxy.uvm.edu/10.1016/j.mhpa.2014.08.001

Zhang, M., Xv, G., Meng, D., & Ji, Y. (2016). Qigong Yi Jinjing Promotes Pulmonary Function, Physical Activity, Quality of Life and Emotion Regulation Self-Efficacy in Patients with Chronic Obstructive Pulmonary Disease: A Pilot Study. *Journal of Alternative and Complementary Medicine*, 810-817. https://doi.org/10.1089/acm.2015.0224