2015

Take a Deep Breath: How Yoga Postures and Breathing Techniques Can Impact PTSD Symptoms

Sophia E. Armington
Scripps College

Symptoms

TAKE A DEEP BREATH: HOW YOGA POSTURES AND BREATHING TECHNIQUES CAN IMPACT PTSD SYMPTOMS

by

SOPHIA ARMINGTON

SUBMITTED TO SCRIPPS COLLEGE IN PARTIAL FULFILLMENT

OF THE DEGREE OF BACHELOR OF ARTS

PROFESSOR LEMASTER

PROFESSOR SPEZIO

DECEMBER 12, 2015

Take A Deep Breath: How Yoga Postures and Breathing Techniques Can Impact PTSD Symptoms

Sophia Armington
Scripps College

Abstract

Yoga postures (asana) and yoga breathing techniques (pranayama) could be an effective method of treating Post Traumatic Stress Disorder (PTSD). This study investigates the importance of the style of yoga treatment (pranayama, asana, or both) and the frequency with which these interventions are conducted (two or five times per week). The participants in this study will be military personnel with diagnosed PTSD who are currently receiving CBT and pharmaceutical treatment. All participants will have their PTSD symptoms assessed before the study begins, and then once a week each of the 12 weeks of the study. Structured interviews will be administered to both participants and loved ones of participants before and after the study in order to verify construct validity. It is proposed that all groups will show improvement in all three styles (asana, pranayama, and both) over the span of 12 weeks and the groups that practice five times a week will improve more than groups that practice twice a week. Therefore, participants who practice both pranayama and asana twice a week will have the most decrease in PTSD symptoms.

Keywords: Yoga, Pranayama, Asana, PTSD

Introduction

This study will demonstrate yoga's potential as a treatment for combat related Post Traumatic Stress Disorder. The results of this study will establish yoga's capacity to improve PTSD symptoms and determine the content of the yoga practice that will result in the greatest decrease in PTSD symptoms. The results of the study will also provide valuable information about the frequency with which people with PTSD should practice yoga in order to receive maximum benefits. Specifically, the study will investigate the differences between practicing yoga twice a week and practicing yoga five times a week. It will also provide information concerning the differences between practicing only breathing techniques, only physical postures, or both in combination. Finally, this study will provide information about the amount of time it takes to benefit from a yoga practice.

Hypotheses

1) Yoga breathing techniques individually will improve PTSD symptoms

2) Yoga posture practice individually will decrease symptoms of PTSD

3) Yoga posture practice and yoga breathing techniques together will be the most beneficial

4) Yoga practices will be more advantageous when practiced five times per week than two times per week.

Background of PTSD

Post Traumatic Stress Disorder (PTSD) did not appear in the Diagnostic and Statistical Manual (DSM) until the DSM III in 1980. The revolutionary element of the disorder was that it identified the origin of the symptoms (the traumatic event) as external, rather than an inherent weakness originating in the symptomatic person. However, the DSM III identified a traumatic

event as a catastrophic incident that was not commonly experienced by humans. The psychologists who originally created the PTSD diagnosis defined trauma as something along the lines of torture, rape, natural disasters, bombings, or something of that nature (Figley, 1985). More commonplace traumas such as divorce, serious illness, and financial reverses were not included until more recent editions. While a much higher percentage of people experience PTSD symptoms after traumatic events as defined by DSM III, psychologists have found that a much broader array of traumas can result in PTSD (Friedman, 2013).

In the DSM IV, the APA determined that the diagnostic criteria for PTSD could include a history of an exposure to a traumatic event that and symptoms from each of the following symptom clusters: intrusive recollections, avoidant symptoms, numbing symptoms, and hyper arousal symptoms. Researchers also included criteria concerning duration of symptoms and extent of distress or functional impairment (American Psychiatric Association, 1994).

In 2013, the APA made a number of noteworthy evidence-based revisions in order to better diagnose PTSD. These changes will have both conceptual and clinical impacts (Friedman, 2013). Notably, PTSD now includes anhedonic and dysphoric symptoms due to the fact that that it is not simply a fear based anxiety disorder (American Psychiatric Association, 2013). This change also means it is not longer categorized as an Anxiety Disorder. It is now classified as a Trauma and Stress Related Disorder, which is a new category consisting of disorders that have been heralded by exposure to a traumatic or otherwise unfavorable environmental occurrence (Friedman, 2013).

PTSD is unique in that it requires more than a set of symptoms in order to receive a diagnosis. One cannot be diagnosed without having experienced a traumatic event (Friedman,

2013). One new feature in the DSM V is that all of the symptoms must have begun after exposure to the traumatic event, or have been significantly exacerbated after the incident. It is possible to experience symptoms of PTSD after directly experiencing a traumatic event involving death, threatened death, injury, threat to personal physical integrity (for example sexual violence), or threat of physical integrity of others. It is also possible to experience PTSD symptoms after witnessing a traumatic event in person, learning that a traumatic event occurred to a loved one (if the traumatic threat is either violent or accidental), or experiencing extreme exposure to distressing details of the traumatic event (not through media, pictures, television or movies unless work related) (American Psychiatric Association 2013).

The intrusive recollection criteria are comprised of the most easily identifiable and distinct symptoms of PTSD. Events that trigger PTSD can leave emotional scarring that can manifest as intrusive conscious images, traumatic subconscious images during sleep, and flashbacks of the event, which are also referred to as dissociative episodes. PTSD allows the traumatic event to remain an overshadowing psychological occurrence that that maintains its ability to induce panic, terror, dread, grief, or despair in individuals for years, decades or a lifetime after the event. The stimuli related to the trauma that can spark recollections of the original event have the power to trigger mental images, emotional reactions, and physiological responses associated with the trauma (American Psychiatric Association 2013).

The avoidance criteria include the behavioral tactics that people with PTSD use in an attempt to avoid any triggering stimuli. These avoidance tactics can also be used to try to diminish the potency of their psychological reaction if they come into contact with such stimuli. Behavioral modifications involve preventing any thought or condition that could potentially

trigger upsetting traumatic memories. In severe cases, avoidant behavior may appear to mimic agoraphobia because the traumatized individual is fearful of encountering reminders of the traumatic event if he or she exits the house (American Psychiatric Association 2013). For example, someone with PTSD might be inclined to spend inordinate amounts of time playing a computer game instead of engaging in more social activities because the person with PTSD consciously or subconsciously desires the safety granted by the lack of stimuli.

The negative mood symptoms and negative cognitions symptoms cause persistent variations in attitudes or mood that have set in since the traumatic incident. Those who suffer from PTSD often have misguided, inaccurate theories about the origins and consequences of the trauma which lead them to blame themselves or others in spite of any lack of fault. Furthermore, PTSD can lead to inaccurate perceptions about the endless nature of the symptoms while causing people to feel inadequate and weak. People can feel responsibility, shame, and fury, and have negative judgments about the past, present and future. Negative mood symptoms and negative cognitions symptoms includes dissociative psychogenic amnesia, which involves blocking out cognizant occurrences of trauma-based recollections and feelings. These symptoms also involve the inability to feel positive feelings such as love, pleasure, and happiness. These hardships make meaningful interpersonal relationships extremely difficult (American Psychiatric Association 2013).

The symptoms that are encompassed by the alterations in arousal or reactivity are the symptoms that are the most similar to panic disorders and generalized anxiety disorder. This group of symptoms contains generic generalized anxiety disorder symptoms such as insomnia and cognitive impairment, but also symptoms more characteristic to PTSD such as hyper-

vigilance and a tendency to become alarmed easily. In some cases, these symptoms can resemble paranoia. Irresponsible and self-harming actions such as reckless acts, unprotected sex, dangerous driving, and suicidal behavior are all in this group as well. Finally, the symptoms must be persistent for a minimum of one month, create social, occupational, or other distress, and not be caused by medications, substance abuse, or other illnesses (American Psychiatric Association 2013).

It is challenging to ascertain a precise epidemiology because of the social stigmas and ulterior motives, therefore, there is a broad range of estimates (Ramchand et. al., 2010). In a 2010 meta-analysis of PTSD prevalence in the Journal of Traumatic Stress, researchers found that studies of non- treatment seeking veterans had rates raging from 5-20%. However, seven studies of treatment seeking veterans indicated that over 20% of participants have PTSD (Ramchand et. al., 2010).

An article in the American Journal of Public Health discussing trends in military and veteran stigma and utilization of mental health services indicated that, even with recent improvements, less than one half of soldiers with mental health issues choose to seek help (Quartana et al, 2011). Many people suffer because the traditional treatment options, such as medication and talk therapy, are not necessarily accessible, appropriate, or effective. Therefore, it could be beneficial to research the effectiveness of yoga techniques as a form of treatment for PTSD.

Yoga

This study will involve two elements of a yoga practice: pranayama and asana. Pranayama (meaning "to extend the vital life force") is a series of breath control techniques

(Iyengar, 1977). Pranayama is meant to help recognize the connection between breath, mind, and emotions. There are many breathing practices within pranayama, some "heating" and some "cooling". Yogis suggest that pranayama can serve to deactivate the stress response (sympathetic nervous system) and induce relaxation (parasympathetic nervous system)(Holcombe, 2012). Pranayama is frequently practiced before and after a yoga posture practice or a meditation, although it can also be treated as a practice within itself (Iyengar, 1977).

Yoga asana (meaning "manner of sitting") describes the physical practice of the yoga postures (Iyengar, 1977). While some yoga postures have been practiced for centuries, others were developed more recently by yoga practitioners who discovered body positions with beneficial results. Yoga asana has most recently been developed into a form of exercise, although in the past it has been used as a meditative tool among other things (Iyengar, 1977). There is a large range of difficulty in the yoga asanas, but for the purpose of this study, the researchers will limit the asanas to less complex, more accessible postures that are available to all able-bodied participants.

Theory

The idea that yoga postures and breathing techniques can be used as a form of treatment for PTSD is derived from the concept of mindfulness. Mindfulness can be a state of being, a quality or trait, a form of meditation, and a type of intervention. Originally, mindfulness was a practice developed by Buddhist monks focusing on awareness and detachment (Vago & Silbersweig, 2012).

More recently, mindfulness has been secularized and changed to incorporate the development of the ability to skillfully respond to mental processes that create or increase

emotional suffering (Vago & Silbersweig, 2012). Most modern approaches to mindfulness within the field of psychology include elements of both increased awareness and attitude (Thompson & Waltz, 2010). Mindfulness has been defined as "the self-regulation of attention so that it is maintained on immediate experience, thereby allowing for increased recognition of mental events in the present moment" and "an orientation towards one's experiences in the present moment, an orientation that is characterized by curiosity, openness, and acceptance (Bishop et. al, 2004). It has also been described as "a flexible state of mind in which we are actively engaged in the present, noticing new things and sensitive to context" (Langer & Moldoveanu, 2000).

The previous successful implementations of mindfulness within Mindfulness Based Cognitive Therapy (MBCT) suggest that yoga postures and breathing techniques could also facilitate mental health for people with PTSD. MBCT is a process combining Cognitive Behavioral Therapy with Mindfulness in which people practice mindfulness and use their newfound awareness to improve their cognitive patterns (Segal, Teasdale, & Williams, 2004). Segal's MBCT theorizes that mental health can often times be enhanced through the development of a greater awareness of thoughts, feelings and bodily sensations. More specifically, it can be beneficial to have the ability to view thoughts, feelings, and bodily sensations as temporary states as opposed to identifying with them and viewing them as permanent, unchangeable states. When people identify their dysfunctional cognitions as automatic and perpetual, it can become challenging to develop different, preferable cognitions that result in diminished suffering. The goal of MBCT is to help people to develop the skills required to disengage from the reflexive habitual cognitive routines. MBCT involves statements

such as, "I am not my thoughts" and "Thoughts are not facts" (Baer, 2003). By developing a more nuanced relationship with their current state of being, people practicing MBCT have access to improved cognitive patterns. The current study theorizes that the practice of yoga will facilitate a similar non-judgmental awareness of present state and approach to experiences. It is proposed that, in doing so, the participants will experience a decrease in PTSD symptoms.

Pranayama

Existing research indicates that pranayama practice, or the practice of yoga breathing exercises can drastically diminish PTSD symptoms when completed regularly (Brown & Gerbarg, 2005). Studies observing the effects of Sudarshan Kriya Yoga (SKY) on depression have found that pranayama can be a very effective form of treatment for depression, which is a symptom of PTSD. SKY involves four different pranayama techniques: Ujjayi (victorious breath), Bhastrika (bellow's breath), Om with prolonged expiration, and Sudarshan Kriya (proper vision by purifying action) (Brown & Gerbarg, 2005).

A study involving 15 participants with dysthymia and 15 participants with major depressive disorder, researchers found that a daily SKY practice lead to a decrease in Beck's Depression Inventory (BDI) scores as well as Hamilton Rating Scale of Depression (HRSD) after just three weeks. The study indicated that pranayama is an effective treatment for varying levels of depression. While this study revealed valuable information, it was limited in that it only monitored participants for the span of a month, so the researchers were not able to evaluate the longevity of the benefits granted by pranayama (Janakiramaiah, 1997).

In a larger (46 participant) three-month open study with outpatients diagnosed with dysthymia, researchers again found that pranayama improved depression symptoms. However,

this study involved patients practicing on their own. Although they were supposed to practice daily, only 75% of participants practiced three or more days per week. Mean depression scores significantly dropped on the Hamilton Rating Scale for Depression (HRSD). Excluding the 9 participants who did not complete the study and the twelve participants two practiced pranayama less than three times per week, all participants went into remission. Researchers defined remission as a Clinical Global Impression score of two or less after three months and an absence of criteria that initially lead to the dysthymia diagnosis after three months (Janakiramaiah et al., 1998).

In a month long study involving participants with severe melancholic depression, researchers compared SKY pranayama techniques (six days per week, a half an hour per session) to bilateral electroconvulsive therapy and medication (150 mg of imipramine). Beck's Depression Inventory and HRSD scores dropped significantly in all three groups. Results indicated that SKY pranayama decreased symptoms of depression more than bilateral electroconvulsive therapy to a statistically significant extent, but there was no statistically significant difference between SKY pranayama and imipramine. The participants with severe melancholic depression had a remission rate of 67%, with remission defined as the HRSD score dropping below 8.0. The psychiatrists assessing the participants post treatment were not involved in the assignment of the participant groups. Although participants in the other two groups strictly maintained their regimen, not all participants maintained a six-day per week pranayama practice. The mean number of pranayama sessions was 5 per week (Janakiramaiah et al., 2000). Due to the fact that there is significant overlap between depression symptoms and PTSD symptoms (specifically the anhedonic and dysphoric symptoms aka negative changes in

thinking and mood), the aforementioned research indicates that yoga would successfully diminish PTSD symptoms.

Yoga Asana

Research has indicated that yoga asana, or the practice of yoga postures, can also provide relief for people suffering from PTSD. A study involving Vietnam veterans indicated that practicing yoga asana twice a week for a span of 6 weeks decreases symptoms of hyper-arousal for veterans with PTSD (Staples, Hamilton, & Uddo, 2013). The age range of the participants in the study (58-64) indicates that that yoga can be useful to a broad spectrum of people with PTSD. While many people are intimidated by yoga because they envision complicated, difficult postures involving copious amounts of strength, balance and flexibility, in reality yoga asana practices do not need to be complex in order to be beneficial. This study suggests that simple postures that are accessible to an older population can be an effective treatment for PTSD.

A meta-analysis involving ten studies investigating the efficacy of yoga as a treatment for anxiety, depression, and PTSD demonstrated that yoga asana is a viable adjunct treatment, with a pooled mean effect size of -3.25 (95% CI, -5.36 to -1.14; P=0.002) (Cabral, Meyer, & Ames, 2011). This effect is large enough to indicate that publication bias may have been involved despite the researchers took precautions against it. It is likely that if every study measuring the impact of yoga on PTSD were published (including studies that did not find significant results), the meta-analysis would not provide such a significant mean effect size. Unfortunately, studies that do not find significant results are rarely if ever published, therefore the meta-analyses are skewed. Never the less, it suggests that that yoga asana is at least somewhat helpful when treating anxiety, depression, and PTSD.

Yoga Asana and Pranayama in Tandem

While pranayama and yoga asana can be beneficial on their own, many people have found that they are most impactful when they are practiced in tandem. In a study conducted with 646 Tsunami survivors in the Andaman Islands, researchers again found the combination of yoga asana and pranayama to be helpful (Telles, Naveen, and Manoj, 2007). After practicing every day for eight days in a row, participants had significantly less fear, anxiety, sadness and disturbed sleep. Furthermore, their breath rate decreased after each yoga session, indicating that the parasympathetic nervous system was activated during the yoga session. This study also indicated that the benefits of yoga asana and pranayama are not culturally specific. The study split participants into "endogenous people and "settlers from the main land" (i.e., India).

Yoga asana and breathing techniques can also be a useful tool as a preventative measure for military personnel in active duty. While participants were experiencing trauma regularly, researchers studied the impact of yoga on deployed military personnel in Kirkuk, Iraq (Stoller, Greuel, Cimini, Fowler, & Koomar, 2012). 35 participants practiced yoga twice a week for three weeks, while another 35 did not receive any treatment. The treatment group experienced a mean decrease of 8.23 on the Anxiety scale, while the control group had an average increase of 1.38. This study suggests that yoga asana and pranayama together could be used as a preventative measure for PTSD as well as a treatment.

Importance In Spite of Alternative Treatments

It was immeasurably helpful when the DSM finally labeled PTSD for a multitude of reasons. It gave a name to a set of symptoms that were bewildering, terrifying, and disabling, it facilitated research into sources and treatments, and it allowed insurance coverage and disability

payment to name a few. It also paved the way to a community that could offer collaboration among those who study or treat the condition and support networks for those afflicted with PTSD. Unfortunately, identifying the condition as a "disorder" has lead to a stigmatization that has prevented many people with PTSD from seeking a traditional treatment. Psychotherapy, cognitive behavioral therapy, and medications all have dramatic social stigma and consequences within the military. Consequently, many military personnel with PTSD diagnoses choose not to seek treatment. Despite the fact that 75% of combat veterans who screened positive for PTSD, generalized anxiety disorder, and depression recognized that they currently had psychological distresses, only 40% reported interest in receiving treatment (Brown et. al, 2011). Research has indicated that the reluctance to seek out help is reflective of the stigma surrounding mental health in the military (Blais, & Renshaw, 2013).

If nothing is done to decrease their reluctance to receive treatment, soldiers will continue to suffer. Although some members of the military are taking action to lessen the severity of the stigma, no end is in sight. In an interview on PBS News Hour, General Chiarelli, the Vice Chief of Staff of the United States Army, asked the American Psychological Association to change the name of Post Traumatic Stress Disorder to Post Traumatic Stress Injury, but his attempts were in vain. It is possible that yoga treatments would be less objectionable to veterans with PTSD because it has the potential for discretion, it does not involve negative side-effects, and it can be much less expensive than more traditional treatments.

Yoga, especially pranayama, can be very subtle and discreet. After someone with PTSD learns how to practice a beneficial breathing technique, they can simply use the technique in a private place whenever they choose to do so. Theoretically, after the person received training, no

one else need know that they were treating their PTSD symptoms. Ideally veterans and soldiers in active duty would continuously visit a mental health professional trained in yoga therapy. However, if that concept were simply unacceptable to someone with PTSD, then yoga practices could improve upon suffering in silence. Anything to prevent suffering, such as a breathing exercise workshops, should be available to people with PTSD. Furthermore, yoga asana and pranayama might be more appealing to people with PTSD who are not comfortable with verbalizing their experiences or emotions. Yoga asana and pranayama practices offer a form of treatment that does not involve long periods of talking that might be difficult or repellant to some people.

Yoga asana and pranayama could also be less disagreeable than medications for military personnel (Cabral, Meyer, Ames, 2011). Yoga does not have any of the markedly unpleasant mental and physical side effects that can occur while taking antidepressants and anti-anxiety medications. In fact, the side effects of yoga practice treatments, such as the improvement of physical fitness, flexibility, and agility or an increase in energy levels, might increase a one's likelihood of seeking treatment.

Additionally, yoga treatments could be more appealing than traditional forms of treatment because they are inexpensive by comparison. While some yoga studios cost $100 plus per month for membership, there are many gyms, studios, and community centers that offer yoga classes for less money than the average insurance copay for psychotherapy or medications. Furthermore, there are outreach programs such as Yoga Activist that strive to provide therapeutic yoga for those to whom it could be beneficial.

The Importance of Frequency

Surprisingly, there is not a single study that involves people with PTSD practicing yoga asana more than twice a week for a prolonged period of time. There is only one study involving pranayama more than once a week. In the Yoga Sutras of Patanjali, it is taught that yoga must be practiced "frequently, over the span of a lifetime, and with devotion" (Bryant, 2009). While the level of devotion to yoga is difficult to study, frequency and longevity are essential elements of a yoga practice, and investigating their impact on yoga for PTSD is an important element of the treatment (Chehrazi, 2014).

Treatments such as anti-depressants and anti-anxiety medications that are frequently administered to people suffering from PTSD are tested using many different dosages over long periods of time in order to determine how to maximize benefits. The administering of yoga as a treatment is no different. Researchers must establish a general guideline for what the ideal yoga treatment for the PTSD population should be in order to establish a maximally beneficial treatment. From there, every person looking to decrease their PTSD symptoms using yoga can modify the sequence that is ideal for their own individual situation.

Methods Overview

This study will take place in a military medical center in Bethesda, Maryland. The participants will be military personnel with diagnosed PTSD. The participants will be split into seven groups. Group one will practice yoga asana two times a week, group two will practice pranayama two times a week, group three will practice both yoga asana and pranayama two times per week, group four will practice yoga asana five times a week, group five will practice pranayama five times a week, group six will practice pranayama and yoga asana five times a week, and group seven will not receive any yoga intervention. All participants will be given the

Mississippi Scale, an established measure of PTSD in military personnel before the study begins, and then once a week each of the twelve weeks of the study. Additionally, each participant will complete a Clinician Administered PTSD Scale (CAPS) interview before and after treatment. Finally, a loved one of each participant will also complete two modified CAPS interviews indicating their perception of the participant.

Method

Participants

The participants in the study will be veterans or active military members from a military medical center in a suburb of Washington DC. Participants will be over the age of 18 and of any gender or ethnicity. Every participant must have been diagnosed with PTSD prior to the experiment. Because of concerns regarding requesting that participants refrain from seeking out alternative forms of treatment, every participant must already be receiving treatment prior to the experiment. In order to maintain consistency, all participants must be taking prescribed pharmaceuticals and receiving cognitive behavioral therapy no more than twice a week.

The study will involve 280 participants (40 per group). Participants will be recruited through fliers, promotion tables, and doctors. Doctors within the facility will be welcome to inform patients whom they have diagnosed with PTSD about the study, but they will be required to inform patients that participation in the study is not mandatory.

No monetary compensation will be given for participation in the study. However, healthy foods and beverages will be provided before and after each session. It is likely that there will be a large attrition rate (an estimated 10%) because of the exceptionally time consuming nature of the study.

Materials

There will be three measures of PTSD used in the study. Two are self-report and one involves perceptions of loved ones. The most frequently used measure in the study will be the Mississippi Scale, which is the combat related PTSD scale used by the military (Hyer, Davis, Boudewyns, & Woods, 1991). The scale consists of 35 questions that can be answered using a scale of one to five, meaning scores can range from 35 to 175. For the purposes of the current study the Mississippi Scale be used to assess the severity of symptoms.

The scale samples the range of PTSD symptoms as they are outlined in the DSM 5 and also includes items for some of the frequently observed associated features. Previous research has indicated that the Mississippi Scale successfully and accurately measures PTSD (Keane, Caddell, & Taylor, 1988). The Mississippi Scale will be administered weekly throughout the 12 weeks of the study.

The second measure used will be the Clinician Administered PTSD Scale for DSM 5, which is a 30-item structured interview that takes between 40 minutes and an hour (Weathers et. al, 2013). The interview assesses the 20 DSM 5 PTSD symptoms in addition to establishing the initiation and duration of symptoms, individual distress, impact of symptoms on social and professional functioning, improvement in symptoms since a previous administration of the interview, and overall PTSD severity. This interview will be administered twice throughout the research process, once before the first session, and once after the last session.

The severity rating is reported on a scale of 0-4: 0 indicates that PTSD symptoms are absent in the interviewee, 1 indicates mild or sub-threshold PTSD, 2 indicates moderate or

threshold PTSD, 3 indicates severe or markedly elevated PTSD, 4 indicates extreme or incapacitating PTSD.

Clinicians must be trained before attempting to interpret the results of the CAPS Interview due to the complexity and nuance. However, in short the interviewer combines information about regularity and strength of an item into a single severity rating. The CAPS total symptom severity score is determined by summing severity scores for the 20 PTSD symptoms identified in the DSM 5. PTSD diagnostic status is determined by first identifying each symptom as "present" or "absent," then following the diagnostic information provided by the DSM 5. A symptom is only considered present if the corresponding item severity score is rated 2 ("moderate/threshold") or higher.

The final measure will be a structured interview for a family member or loved one who interacts with the participant on a regular basis. The loved one will be chosen by the participant. This person will participate twice; one interview before the experiment begins, and one interview after the experiment is completed. The interview will be structured using the questions from the Clinician Administered PTSD Scale, with modified questions reflecting the perspective of a loved one. For example, “Have you ever gotten emotionally upset when something reminded you of a traumatic event? What kinds of reminders make you upset? How often in the past month?” will be changed to “Has your loved one ever gotten emotionally upset when something reminded him/her of a traumatic event? What kinds of reminders make her/him upset? How often in the past month?”

Three yoga sequences will be used. One sequence will involve pranayama, another will involve yoga asana, and the third will combine both. These sequences will be trauma sensitive, meaning they are designed to avoid triggering any negative consequences for people with PTSD.

Procedure

The study will take place in a studio close to the medical facility where the participants were recruited so that the participants know in general how to get there. However, it will not be conducted on the campus of the medical center in order to ensure the privacy of the participants. There will be seven groups of participants:

Group 1 will practice yoga asana twice a week

Group 2 will practice pranayama twice a week

Group 3 will practice yoga asana and pranayama twice a week

Group 4 will practice yoga asana five times a week

Group 5 will practice pranayama five times a week

Group 6 will practice pranayama and yoga asana five times a week

Group 7 will be an active control group

Instead of practicing any form of yoga, the active control group will have a weekly card game when they meet to take the Mississippi scale so that the researchers can be sure that the benefits of the social element of yoga do not skew the results of the study. In this manner, the researcher can control for the benefits of socialization.

Participants will be randomly assigned to one of the seven groups, unless they are physically incapable of accessing basic yoga postures due to injuries. Physically handicapped participants will be assigned to group two, or group five (the groups involving only pranayama),

or the control group. Although this quasi-experimental design introduces a confound, it is the only manner in which it physically handicapped veterans can be included in the study.

On the first week of the study, participants will not practice yoga. Instead, participants will take the Mississippi Scale and the Clinician Administered PTSD Scale. The chosen relative or loved one of the participant will accompany them and complete their preliminary interview as well. The different groups will meet separately in order to use time efficiently and ensure that everyone gets sufficient attention. In the following weeks, the groups will meet and practice yoga, taking the Mississippi Scale questionnaire after the last yoga session of every week.

The yoga sessions of the study will continue for twelve consecutive weeks. Healthy snacks such as chia bars and herbal teas will be available before and after each session. After all of the yoga sessions are complete, researchers will repeat the process of the first session, administering the Clinician Administered PTSD Scale to the participants and interviewing the loved ones.

Ethics

This study poses very little risk for its participants while potentially offering many benefits to both participants and everybody suffering from PTSD. Additionally, there are steps that will be taken to reduce the already small risk involved in the study. Specifically, when practiced with uninformed instructors, yoga can trigger panic attacks or adverse responses in people with PTSD. There aren't any data revealing how frequently yoga triggers negative responses because of the unethical nature in which the answer to said question would be determined. However, the study would only involve yoga instructors who are certified in trauma sensitive yoga from a school registered with the Yoga Alliance. A part of trauma sensitive yoga trainings is teaching instructors how to avoid any poses and language that have a greater

potential to trigger panic attacks than every day movement, and teaching instructors how to respond when people do have panic attacks or adverse responses to yoga. Therefore, the potential harm caused by participating in the proposed study would be no greater than the potential harm of stretching up to reach something on a high shelf, bending over to pick something up off the ground, or other every day movements. Participants would be notified of the potential risk through a consent process in which they will be given extensive information about what to expect during the study, including a list of postures that will be in the yoga sequence. Furthermore, participants will be informed repeatedly that every single movement and breath is optional. Finally, they will be welcome to refrain from certain movements or leave at any point in time if they feel uncomfortable or do not want to continue participation for any reason.

Although the study itself poses little threat, participation in a study concerning PTSD could be problematic for veterans or military personnel. The privacy of the participants involved in the study would be considered and prioritized. While veterans and people with PTSD at the military medical center are not technically a protected population, there are potential social and professional ramifications for publicly participating in the proposed study. It is very possible that some people who would be interested in the study are not ready to publicize their PTSD for a multitude of reasons. Therefore, although recruitment will be done through the medical center, the actual yoga sessions will take place in a nearby location where the participants could avoid being seen by anyone not involved in the study. Furthermore, participants will not be asked to give their real names if they do not feel comfortable with the idea. All participants will be informed that using a consistent alias throughout the twelve weeks is a valid option. Through

this practice, participants will be granted as much anonymity as they find desirable. Furthermore, all data will be kept in a locked filing cabinet away from the medical center.

Participation in the proposed study would not only pose minimal risk to participants, it also may offer relief from PTSD symptoms. Participants would have access to a mind body idiom that might offer a myriad of benefits. For society at large, psychologists working with people with PTSD would gain a better understanding of how to best use yoga asana and pranayama to help people that might benefit.

Recruitment through the military medical center will be through doctors, psychologists, and fliers in an ethical, private manner. Doctors and psychologists who see symptoms of PTSD in their patients can notify them of the study and give all of the relevant information to contact the researcher. Also, fliers will be up on boards and handed out to the general public notifying them of the study (it will be made clear that researchers are only looking for people with PTSD symptoms). Doctors and psychologists will make it clear that the study is completely optional.

Results

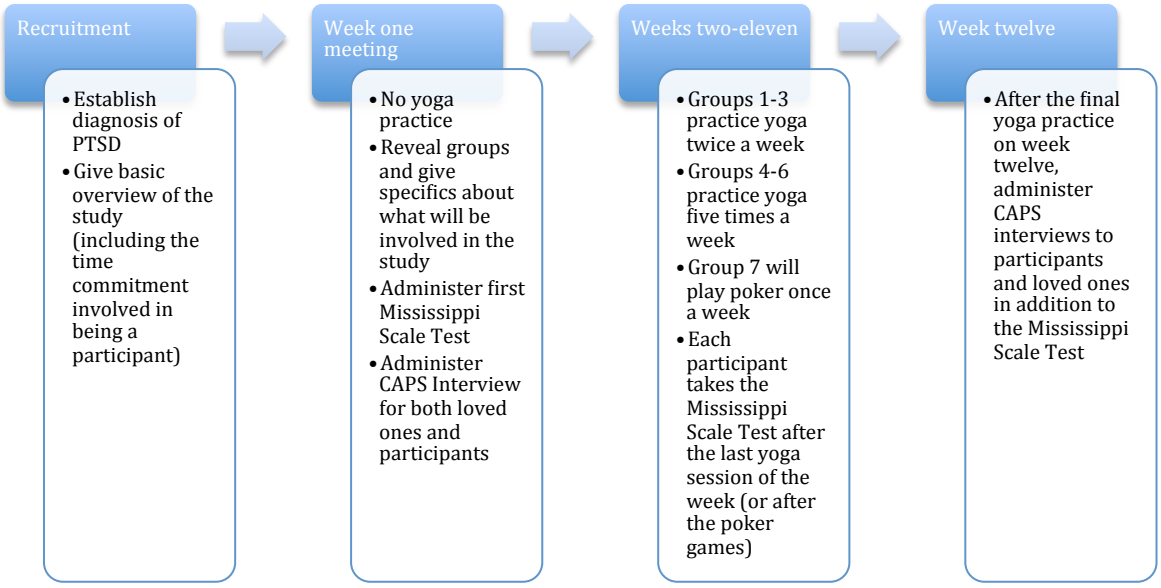

Figure 1. Sequence of procedure

Mississippi Scale

The week one scores of the Mississippi Scale will be compared to the week twelve scores for all active groups using the Wilcoxon signed rank, which is a non-parametric test that can be used to compare two repeated measurements on a single sample to assess whether their mean values differ. In this manner it will be established that practicing yoga results in a decrease in PTSD scores.

Next, differences between groups will be established using a series of Kruskal Wallis tests, which is a nonparametric test that does not assume normal distribution. The test will indicate whether the median values of the independent samples are shared. It is proposed that all seven groups will show improvement over time; however, some groups will decrease in Mississippi score more than others (as indicated in Figure 2).

The three groups that only practice twice a week will have a smaller decrease in Mississippi Scale scores than the three groups that practice five times per week. Participants from groups one and two will have a similar or identical change in score while participants from group three will improve slightly more.

The participants who practice five times per week will all improve more than participants who only practice twice a week. Participants from groups four and five will have similar decreases in Mississippi Scale scores. Participants from group six who practice both pranayama and yoga asana five times per week will have the greatest improvement in Mississippi Scale scores. Participants from the active control group will decrease their Mississippi Scale score the least. Overall, the most impactful predictor variable will be number of times a week that yoga is practiced.

A series of Kruskal Wallis tests will be used to establish when the changes in Mississippi Scale scores occur over the span of twelve weeks. It is proposed that the rate of change in Mississippi Scale scores will decrease after eight weeks and stop after ten weeks.

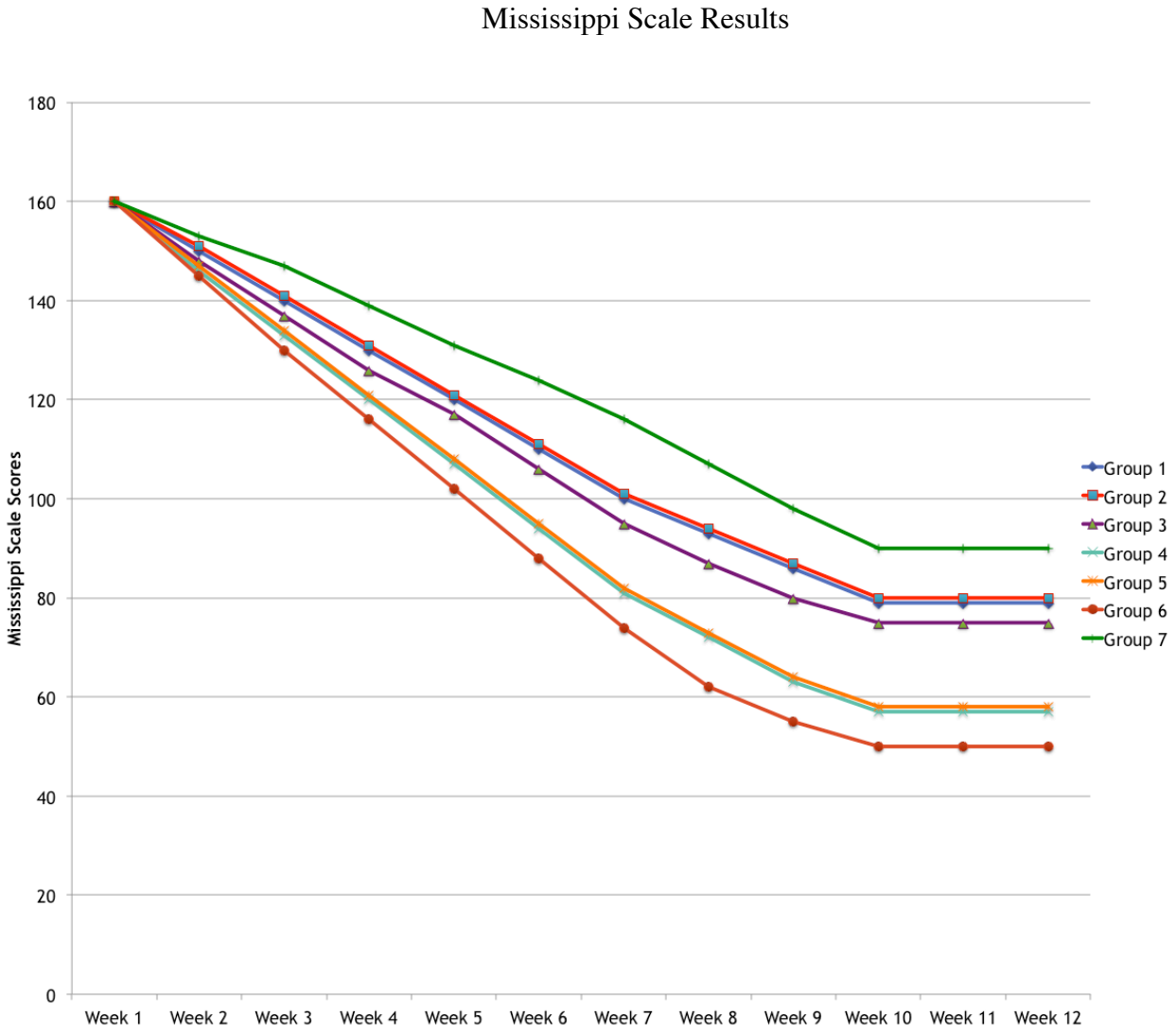

Figure 2. Progression of each group's mean Mississippi Scale scores over the span of the experiment.

CAPS SEVERITY PARTICIPANT INTERVIEW

A Wilcox signed rank analyses will be used to establish an overall pre-treatment post-treatment difference of the CAPS severity ratings when it is administered to the participant. It is proposed that the CAPS severity rating will decrease between the first and second interview in all seven groups, as shown in Figure 3.

Symptoms

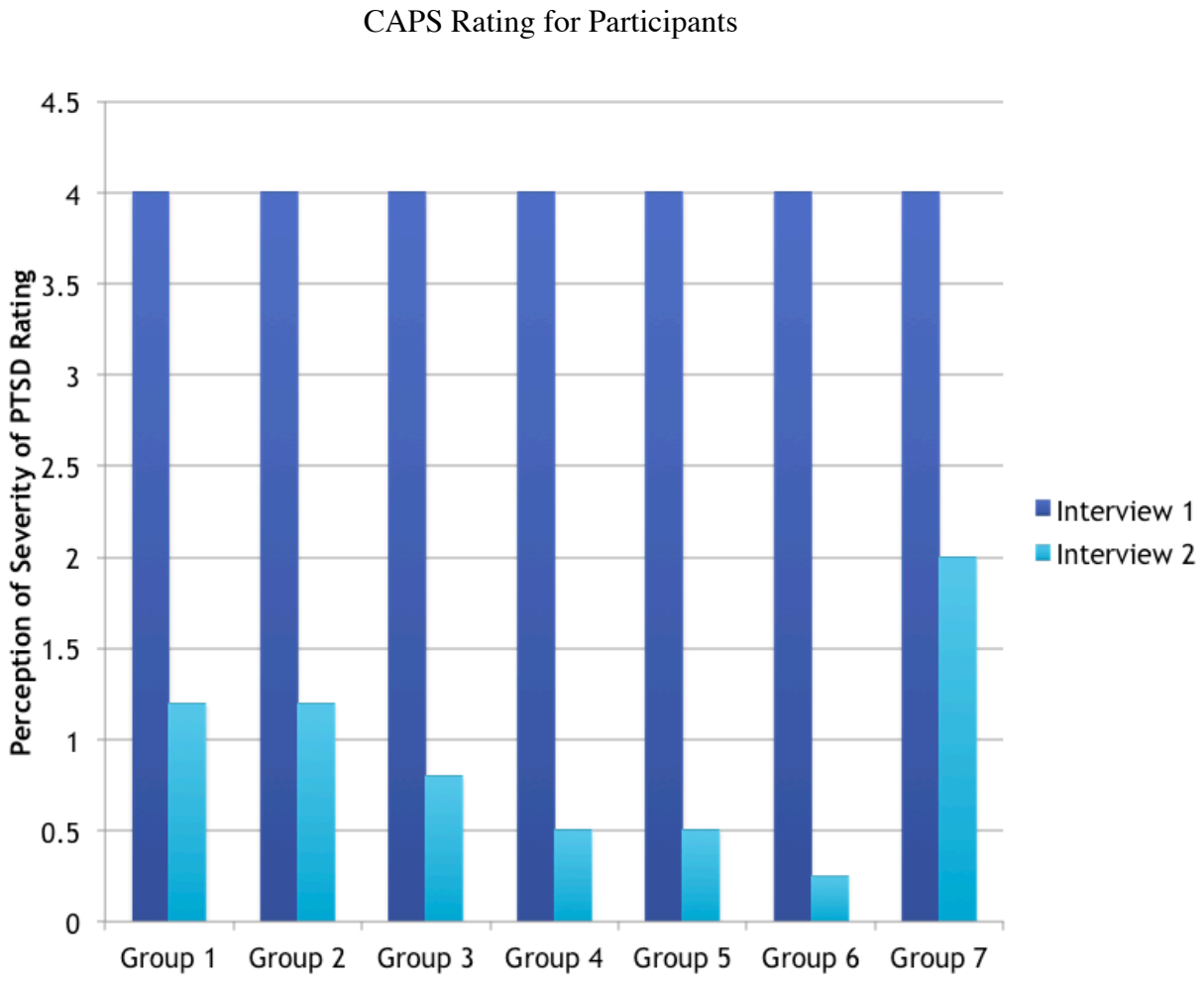

Figure 3, Mean CAPS severity rating before and after the intervention

Next, differences in CAPS severity rating between groups will be established using a series of Kruskal Wallis analyses. It is proposed that the change in the results of the CAPS severity rating for PTSD will be similar to the change in Mississippi Scale scores between week one and week twelve. The participants from the three groups practicing twice a week (1,2, and 3) will have a smaller decrease in scores than the participants in the groups practicing five times per week (4,5, and 6). The control group will have the smallest decrease in scores.

Groups one and two will have comparable scores, as will groups four and five. Group three will have a slightly larger decrease than groups one and two, and group six will have a

larger decrease than groups four and five. Finally, it is proposed that group six will have the greatest decrease in CAPS severity rating.

CAPS SEVERITY LOVED ONE INTERVIEW

A Wilcox signed rank analysis will be used to compare the pre-treatment and post-treatment results of the Clinician Administered PTSD Scale (CAPS) severity rating when it is administered to a loved one of the participant. It is proposed that the CAPS severity rating will change over all seven groups as indicated in Figure four. It is proposed that these results will replicate the results of the Mississippi Scale and the CAPS interviews conducted with the participants.

Next, differences between groups will be established using Kruskal Wallis analysis. Again, the three groups that only practice twice a week will have a smaller decrease in CAPS severity ratings than the three groups that practice five times per week. Participants from groups one and two who practice breathing or postures individually will have a similar or identical change in score while participants from group three who practice both breathing and postures will improve in CAPS severity ratings slightly more than one and two.

Participants from groups four and five will have similar decreases in CAPS severity ratings. Participants from group six will have a greater decrease. Again, the proposed results indicate that the greatest improvement in CAPS severity rating will be found in group 6. Participants from the active control group will decrease their CAPS severity rating the least. Overall, the most impactful predictor variable will be number of times a week that yoga is practiced.

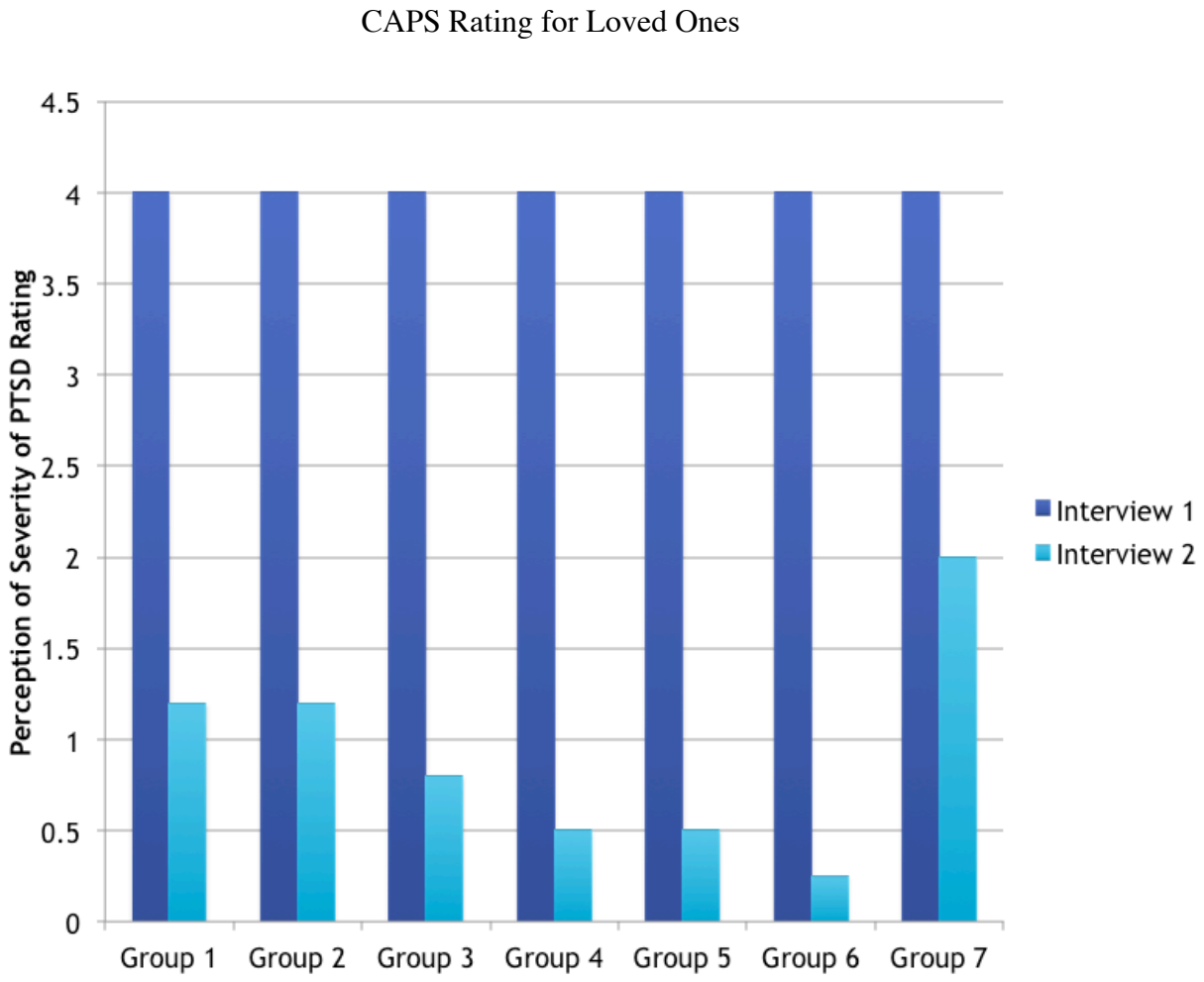

Figure 4. Mean CAPS severity rating from the perspective of loved ones before and after the intervention

Discussion

The proposed results of this study indicate that yoga breathing and yoga postures can both individually help PTSD symptoms, but it is more beneficial to practice breathing and postures together. The proposed results also indicate that yoga can be beneficial if it is practiced twice a week or five times a week. However, it is more beneficial to practice more frequently.

Symptoms

The proposed results indicate that the most important element of yoga as a treatment for PTSD is the frequency with which people practice instead of the content of the practice (i.e., breathing, postures, or both).

The significance of frequency of yoga practice indicates veterans with physical disabilities who cannot practice the yoga postures could still benefit from a yoga breathing practice. If someone cannot practice specific elements of yoga, he or she can hypothetically compensate through frequency of a pranayama practice. Yogic breathing exercises could be a valuable tool for temporarily or permanently physically injured people.

Although the proposed results are promising, the proposed study raises some concerns. First, recruiting enough participants will be challenging and most likely not possible within a single location. The stigma around both PTSD and yoga (or other forms of alternative treatment) is so great it will undoubtedly have a negative impact on participation. One proposed method of evading the feminine and fragile reputation that yoga sometimes has is simply avoiding the word "yoga". The study could be presented as breathing and exercise techniques for PTSD treatment instead.

Another likely challenge involved with the proposed study is attrition. The amount of time involved in practicing yoga five times a week for twelve weeks straight is considerable. It is a drastic time commitment even for participant practicing in the lighter twice per week groups. Three months is a very long time to keep participants consistently involved in a study. The drastic lifestyle change is simultaneously the greatest deterrent and the greatest asset that will lead to the most impactful improvement in participants.

Although this study will be useful in the development of knowledge about yoga as a treatment for PTSD, it is important to continue gathering more information. With previous research indicating that yoga practices can relive symptoms of depression, hyper-arousal, anxiety, insomnia, and more, it is clear that gaining a better understanding of the most effective implementations of yoga practices could vastly benefit people with PTSD. It will be important to expand upon the knowledge derived from this experiment.

In the future, it would be beneficial to study the impact of different styles of yoga on PTSD. In this study, the sequencing will based on vinyasa style yoga because it is a popular, physically demanding form of yoga. It is theorized that these attributes might keep the participants more engaged than other slower paced styles of yoga. However, there are vast differences between different styles of yoga, and others may be more impactful than vinyasa. Kripalu yoga, for example, has a focus on mental wellness. Coming to the conclusion that yoga is beneficial for people with PTSD after only experimenting with one style is comparable to deciding that movies are entertaining after only watching one film. There is variation between schools of yoga and also variation of postures within each school. Each practice offers a unique set of benefits.

Theoretically, it would be beneficial to conduct a similar study to this in the future with participants who are not receiving any other form of treatment outside of the yoga. Unfortunately, there are too many ethical problems with requesting participants to refrain from receiving outside treatment for such a study to be feasible. However, if it somehow were to become possible in the future, the information gathered would be valuable.

It would also be important to run similar studies with different or more diverse groups of participants with PTSD. For example, it is important to discover if the data gathered in this study is comparable to data gathered with groups of sexual assault survivors, people who were diagnosed with serious illness, or survivors of natural disasters.

Finally, a follow up study one year after this study could provide important information. Specifically, it would be valuable to learn whether or not participants continue to have relief from PTSD symptoms and if participants continued practicing yoga regularly.

The proposed results of the study indicate that two changes should be made in order to facilitate the benefits of yoga for PTSD symptoms. One is that yoga should be more easily accessible to veterans with PTSD. It is likely that many people with PTSD do not know that yoga is a potential resource that could improve their situation. With more visibility, more information, and easier access, yoga could be more commonplace for veterans with PTSD. Furthermore, insurance companies should cover the cost of yoga for people trying to use it as a form of treatment. It is a legitimate treatment that has been scientifically proven to be helpful in many studies.

References

American Psychiatric Association. (1980). *Diagnostic and statistical manual of mental disorders*, (3rd ed.). Washington, DC: Author.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders*, (4th ed.). Washington, DC: Author.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders*, (5th ed.). Washington, DC: Author.

Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical psychology: Science and practice*, *10*(2), 125-143.

Blais, R.K., & Renshaw, K.D. (2013). Stigma and Demographic Correlates of Help Seeking Intentions in Returing Service Members. *Journal of Traumatic Stress, 26*(1), 77-85. Doi: 10.1002/jts.21772

Bishop, S.R., Lau, M., Shapiro, S., Carlson, L., Anderson Carmody, N. D. J., Segal, Z.V. Abbey, S., Speca, M., & Velting Devins, D. G. (2004). Mindfulness: A Proposed Operational Definition. *Clinical Psychology: Science and Practice, 11*(3), 230-241.

Brown, M. C., Creel, A. H., Engel, C. C., Herrell, R. K., & Hoge, C. W. (2011). Factors associated with interest in receiving help for mental health problems in combat veterans returning from deployment to Iraq. *The Journal of nervous and mental disease*, *199*(10), 797-801.

Brown, R. P., & Gerbarg, P. L. (2005). Sudarshan kriya yogic breathing in the treatment of stress, anxiety, and depression: Part II-clinical applications and guidelines. *Journal of Alternative & Complementary Medicine*, *11*(4), 711-717.

Bryant, E.F., (2009). *The Yoga Sutras of Patanajali*. North Point Press: New York, New York.

Cabral, P., Meyer, H. B., & Ames, D. (2011). Effectiveness of yoga therapy as a complementary treatment for major psychiatric disorders: a meta-analysis. *The primary care companion to CNS disorders*, *13*(4).

Chehrazi, J. (2014). Yoga Activist. http://www.yogaactivist.org

Figley, C. (1985). *Trauma and its Wake: The Study and Treatment of Post Traumatic Stress Disorder*. Bristol, PA: Brunner Mazel.

Friedman, M. J. (2013). Finalizing PTSD in DSM-5: Getting Here From There and Where to Go Next. *Journal of Traumatic Stress*, *26*(5), 548-556.

Folette, V. M., Ruzek J. I., (2006). *Cognitive Behavioral Therapies for Trauma*. New York, NY: Guilford Publications

Holcombe, Kate. (2012). Breathe Easy: Relax with Pranayama. *Yoga Journal*. Retrieved from http://www.yogajournal.com/article/practice-section/healing-breath/

Hyer, L., Davis, H., Boudewyns, P., & Woods, M. G. (1991). *A short form of the Mississippi Scale for Combat-Related PTSD*. Journal of Clinical Psychology, 47, 510-518. (Shortened version: complete updated scale not available without permission)

Iyengar, B.K.S., (1977). *Light on Yoga: The Bible of Modern Yoga- Its Philosophy and Practice*. New York, NY: Schocken Books Inc.

Janakiramaiah, N., Gangadhar, B. N., Naga Venkatesha Murthy, P. J., Harish, M. G., Subbakrishna, D. K., & Vedamurthachar, A. (2000). Antidepressant efficacy of Sudarshan Kriya

Yoga (SKY) in melancholia: a randomized comparison with electroconvulsive therapy (ECT) and imipramine. *Journal of affective disorders*, *57*(1), 255-259.

Janakiramaiah, N., Gangadhar, B. N., Murthy, P. N. V., Harish, M. G., Shetty, K. T., Subbakrishna, D. K., & Vedamurthachar, A. (1998). Therapeutic efficacy of Sudarshan Kriya Yoga (SKY) in dysthymic disorder. *NIMHANS Journal*, *16*(1), 21-28.

Janakiramaiah, N., Naga Venkatesha Murthy, P. J., Gangadhar, B. N., & Subbakrishna, D. K. (1997). Normalization of P300 amplitude following treatment in dysthymia. *Biological Psychiatry*, *42*(8), 740-743.

Keane, T. M., Caddell, J. M., Taylor, K. L. (1988). Mississippi Scale for Combat-Related Posttraumatic Stress Disorder: Three studies in reliability and validity. *Journal of Consulting and Clinical Psychology*, Vol 56(1), 85-90.

Langer, E. J., & Moldoveanu, M. (2000). The construct of mindfulness. *Journal of Social Issues*, *56*(1), 1-9.

Ma, S. H., & Teasdale, J. D. (2004). Mindfulness-based cognitive therapy for depression: replication and exploration of differential relapse prevention effects. *Journal of consulting and clinical psychology*, *72*(1), 31.

Miggantz, E. L (2013) Stigma of Mental Health Care in the Military http://www.med.navy.mil/sites/nmcsd/nccosc/healthProfessionalsV2/reports/Documents/Stigma%20White%20Paper.pdf

Ramchand, R., Schell, T. L., Karney, B. R., Osilla, K. C., Burns, R. M., & Caldarone, L. B. (2010). Disparate prevalence estimates of PTSD among service members who served in Iraq and Afghanistan: possible explanations. *Journal of Traumatic Stress*, *23*(1), 59-68.

Reger, G. M., Durham, T. L., Tarantino, K. A., Luxton, D. D., Holloway, K. M., & Lee, J. A. (2013). Deployed soldiers' reactions to exposure and medication treatments for PTSD. *Psychological Trauma: Theory, Research, Practice, And Policy*, *5*(4), 309-316. doi:10.1037/a0028409

Staples, J. K., Hamilton, M. F., & Uddo, M. (2013). A yoga program for the symptoms of post-traumatic stress disorder in veterans. *Military Medicine*, *178*(8), 854-860.

Stoller, C. C., Greuel, J. H., Cimini, L. S., Fowler, M. S., & Koomar, J. A. (2012). Effects of sensory-enhanced yoga on symptoms of combat stress in deployed military personnel. *American Journal Of Occupational Therapy*, *66*(1), 59-68. doi:10.5014/ajot.2012.001230

Telles, S, Naveen, K.V., and Manoj, D. (2007). Yoga Reduces Smptoms of Distress in Tsunami Survivors in the Andaman Islands." *Evidence-based complementary and alternative medicine* 4.4 (2007): 503-509.

Thompson, B. L., & Waltz, J. (2010). Mindfulness and experiential avoidance as predictors of posttraumatic stress disorder avoidance symptom severity. *Journal of Anxiety Disorders*, *24*(4), 409-415.

Tick, E. (2005). *War and the Soul: Healing Our Nations Veterans from Post-Traumatic Stress Disorder*. Wheaton IL: Theosophical Publishing House

Shakespeare, W. (1597). *King Henry IV*. 2.3.38-44

Quartana, P, Wilk, J, Thomas, J., Bray, R., Olmsted, K., Brown, J., Williams, J., Kim, P., Clarke-Walper, K., and Hoge, C. (2014). Trends in Mental Health Services Utilization and Stigma in US Soldiers From 2002 to 2011. *American Journal of Public Health*, Vol. 104, No. 9, pp. 1671-1679.

doi: 10.2105/AJPH.2014.301971

Segal, Z. V., Teasdale, J. D., & Williams, J. M. G. (2004). Mindfulness-Based Cognitive Therapy: Theoretical Rationale and Empirical Status. New York, NY: Guilford Press.

Vago, D. R., & Silbersweig, D. A. (2012). Self-awareness, self-regulation, and self-transcendence (S-ART): a framework for understanding the neurobiological mechanisms of mindfulness. *Frontiers in human neuroscience*, *6*.

Weathers, F.W., Blake, D.D., Schnurr, P.P., Kaloupek, D.G., Marx, B.P., & Keane, T.M. (2013). *The Clinician-Administered PTSD Scale for DSM-5 (CAPS-5)*. Interview available from the National Center for PTSD at www.ptsd.va.gov.