

Tai Chi and Its Effect on Post-Traumatic Stress

Donnalea Van Vleet Goelz

A Dissertation Submitted to the Faculty of
The Chicago School of Professional Psychology
In Partial Fulfillment of the Requirements
For the Degree of Doctor of Philosophy
in Somatic Psychology

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2015

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Dedication

I dedicate this research to the individuals who suffer from PTSD. I acknowledge your courageous journey. I believe there is hope.

I recognize the many people who have helped me in this path called life. First and foremost my teacher, friend, and mentor, Emilie Conrad Da'oud, you were a true pioneer in the Somatics field. It was because of you that I developed a love of Somatics. You changed how I see this world in a most profound and beautiful way.

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Abstract

Despite the increasing use of mindfulness techniques in the treatment of PTSD, the clinical utility of mindfulness interventions in reducing PTSD symptomatology, especially among civilians, has not received extensive empirical attention. This quantitative pretest-posttest quasi-experimental research study addressed this gap in the empirical literature by evaluating the effectiveness of a mindfulness-based Tai Chi intervention in reducing PTSD symptomatology among a community-based cohort of adults with clinical levels of PTSD symptomatology, as indicated by a score of 40 or higher on the Post-Traumatic Stress Checklist (PCL-C). The hypothesis of the study was that participation in a mindfulness-based Tai Chi intervention would evince reduced levels of PTSD symptomatology. To test this hypothesis, 27 participants were randomly assigned to one of three conditions: (a) an Education Only intervention group ($n = 9$), (b) an Education and Tai Chi intervention group ($n = 9$), and (c) a control group ($n = 9$). Results from a one-way ANOVA, showed that individuals who participated in the Education and Tai Chi intervention group reported significantly reduced PTSD symptomatology in comparison to Education Only intervention and control participants. Results from a one-way ANCOVA, further demonstrated that participants in the Education and Tai Chi intervention group had a significantly lower posttest PCL-C mean score in comparison to participants in the Education Only Intervention and control groups. Results from this study show promise with regard to the efficacy of somatic mindfulness-based interventions in reducing PTSD symptomatology among individuals with PTSD.

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Chapter 1: Nature of the Study

Introduction

According to the National Center for Post-Traumatic Stress Disorder (PTSD), 70% of individuals living in the United States have experienced one or more traumatic events in their lifetime (Blake et al., 2000). PTSD is prevalent in approximately 8% of the population in the United States and is the third most common psychological disorder in the U.S., following depression and substance abuse (Blake et al., 2000). The highest rates of PTSD, according to the DSM IV (American Psychological Association, 2000), affecting from one third to more than one half of individuals with the disorder, occur in the “populations of survivors of rape, military combat, and captivity, and ethnically or politically motivated internment and genocide” (p. 466). The statistics cited above reflect studies done prior to the most recent military U.S. engagements in Iraq and Afghanistan. Both wars, initiated and continued since 2001, have exposed a significantly higher portion of the population to the rigors and danger of armed conflict (Sayer et al., 2011). There is a need for more research and treatment options that would “examine the utility of broad scale interventions” (Lapierre, Schwegler, & La Bauve, 2007, p. 993).

Background: Tai Chi

This research project proposed to examine Tai Chi as a possible method to help reduce PTSD symptoms. Tai Chi is an ancient Chinese healing and martial art characterized by slow, gentle, and rhythmic movement patterns. It was initially developed both as a martial art and as a spiritual practice (Jahnke, Larkey, Rodgers, Etnier, & Lin, 2010). It is still being practiced by some as a martial art, a spiritual art, a health benefit, or a combination of all three categories. One of the complications in researching Tai Chi is that there are many different forms, including the Yang form, Yang short form, Wu Form, Sun form, and Chen form. Each tends to accentuate

or focus on a different aspect such as the martial, spiritual, or health aspects. For example, the Chen form works with the martial art aspect, whereas the Yang short form accentuates the health benefits.

Due to its emphasis on health (Cheng, 1999; Parry, 2005), the Yang short form was used for the purpose of this research. There are several benefits for using this Tai Chi form. In practicing Tai Chi one goes through an entire cycle of postures which is referred to as a round of postures. The Yang short form is shorter version of the Yang long form. The short form has 37 postures and requires five to 10 minutes to complete; whereas the Yang long form has 108 postures and takes close to half an hour. Similarly, the shorter Form can be learned in a shorter period of time. The Yang short form is recognized as one of the main forms of Tai Chi for health purposes in the Tai Chi world (Cheng, 1999; Parry, 2005). It could be helpful for future research to look at the possibility of different health outcomes over the spectrum of the different Tai Chi forms.

In a recent systematic review and meta-analysis, Wang et al., (2009) concluded that Tai Chi is associated with improvements in psychological well-being, including reduced stress, anxiety, depression and mood disturbance, as well as increased self-esteem. Tai Chi practice has been associated with increased heart rate variability (a non-invasive marker of sympathetic modulation) and other favorable cardiovascular changes that represent psychophysiological markers associated with reductions in symptoms of PTSD (Figueroa, Demeersman, & Manning, 2012).

A leading argument for using Tai Chi as a possible method to reduce trauma levels is its broad appeal across the general population (Birdee, Wayne, Davis, Phillips, & Yeh, 2009). Birdee et al., found that the variables of age and gender were evenly distributed across the

demographic of Tai Chi practitioners, differentiating it from yoga, a similar somatic-based practice. It was found that the demographic of the yoga population was mostly female and younger in age. “Historically in India, yoga was practiced almost exclusively by men, while in the United States yoga has been feminized within contemporary popular culture. T’ai chi is perhaps perceived as more masculine, given its origin in martial arts” (Birdee et al., 2009, p. 971) and would therefore be more likely to appeal to men. It would be ideal to apply across a broad cross-section of trauma victims to demonstrate its effectiveness and overall generalizability.

Problem Statement

Identifying effective interventions to heal or release trauma is an important goal for today’s psychotherapists, social workers, and other health care professionals as they continue to treat more and more clients who have experienced traumatic events. There is a substantial need for such interventions for soldiers returning from war with PTSD. Veterans presently have an alarming rate of suicide (Kaplan et al., 2007; Valenstein, 2011). According to the department of Veterans Affairs in 2003, veterans accounted for 20% of all suicides in the US, or 18 deaths per day. According to that report, the US was losing more veterans who die by their own hands than on the battlefield by the ratio of twenty-five to one (VA Clinical Practice Guideline Working Group, 2003). The most recent report released by Kemp and Bossarte (2012) from the Veteran’s Affairs, estimated that 22 veterans have died from suicide each day in the calendar year of 2010 and it is estimated that they account for 23% of all suicides. The problem has been increasing even though much attention and effort has been focused on this issue. It is the hope of this researcher that this study will demonstrate how the mindfulness-based exercise of Tai Chi, a low-cost, non-invasive therapeutic option, may aid in symptom reduction for an ever-growing

population of people suffering from trauma and PTSD symptoms, whether they be active members of the military, veterans, or those in the general populations.

Significance of Research

There were several research questions this study examined. The dependent variable was symptoms of PTSD, using the PCL-C as a self-reported index of symptomatology. The independent variable had two levels. Education/cognitive learning was the first, and Tai Chi along with education/cognitive learning was the second.

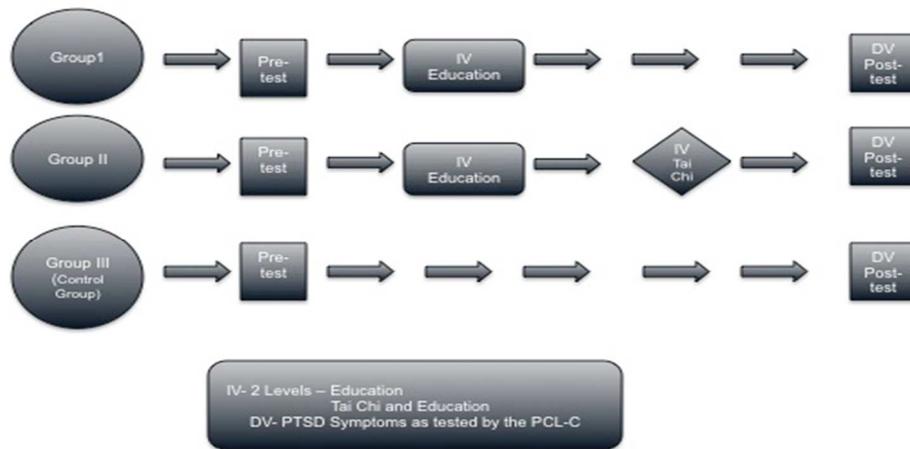


Figure 1. Diagram of theoretical framework of constructs.

The main question was whether PTSD symptoms could be reduced by the mindful exercise of Tai Chi and or education/cognitive learning. It was hypothesized that a reduction of symptoms would be seen as a result of both of the interventions but higher reduction would be seen with the Tai Chi. There were other questions within the project as well. Could education/cognitive learning be enough to connect and exert conscious control over PTSD symptoms? Would a somatic practice increase one's ability to connect and exert conscious control to a significant level? It was hypothesized that Tai Chi, a somatic intervention would increase one's ability to exert conscious control over PTSD.

A central premise of this paper argues that understanding the body's traumatic stress reaction, as well as identifying practical interventions that can help release traumatic stress, is an urgent mandate for today's medical and psychological communities. The basis for this statement is twofold. First, more effective interventions are needed for soldiers returning from war with a history of combat-related trauma, as well as civilians diagnosed with PTSD. Second, learning how to cope with trauma, and ultimately to potentially alleviate or resolve its psychological after effects is of utmost importance for us as individuals and as a society, especially because elevated stress reactions have medical costs (Perez, Abrams, Lopez-Martinez, & Gordon, 2012; Friedman, 2004) as well as social costs, including higher incidences of aggressive behavior (Shin, Rosen, Greenbaum, & Jain, 2012) and homelessness for returning US veterans (Tsai, Rosenheck, Decker, Desai, & Harpaz-Roten, 2012). Learning to control and reduce the body's traumatic stress reaction is paramount in order to reduce the financial and emotional burden of mental and medical interventions on our health care system and economy (Sayer et al., 2011) as well as to provide needed care to those suffering the effects of trauma.

Research findings by Porges (2001, 2011), van der Kolk (2002), and Ogden, Minton, and Pain (2006) have helped advance our understanding of what occurs in the body during and after the experience of trauma. In his work with clients diagnosed with PTSD, van der Kolk (2002) demonstrated a symptomatic trend of autonomic dysregulation in the participants and suggests that PTSD is characterized by elevated autonomic nervous system activity. This elevation results in clear physical changes such as an increase in heart rate and blood pressure. Another research project by Doussard-Roosevelt and Porges (1999) reported that prolonged episodes of traumatic stress can lead to elevated, chronic stress responses that become neurologically habitual. A somatic approach that by definition includes body and mind could possibly address the physical

body component of trauma as well as the psychological (Ogden, Minton, & Pain, 2006).

Preliminary research findings by Lan (2012) and van der Kolk (2006) support the need for the implementation of a somatic, mindfulness-based approach that results in the restoration of harmony of autonomic functioning.

Trauma is experienced first and foremost physiologically. In the past, researchers have argued that the “fight or flight” response represented the body’s natural reaction to fear. Today, thanks to researchers such as Dr. Stephen Porges and his polyvagal theory (2001, 2011), there is a more developed understanding of the neurophysiological manifestations of trauma. According to this theory, the first response to a frightful experience in a healthy individual is the activation of the social engagement system, known neurologically as the ventral vagal system.

Evolutionarily speaking, the ventral vagal system is the newest manifestation of the nervous system and is of particular importance in higher mammals. If this system fails to reduce the threat, or is ineffective given the circumstance (as in, for example, the threat of a lion attacking), then the autonomic system of flight/fight is activated. This system is activated in two ways, either by avoiding an impending threat—that is, fleeing the scene--or by preparing to face it.

There is a third system that includes the portion of the vagus nerve that originates in the dorsal motor nucleus of the vagus. The dorsal vagal system is an evolutionarily older system that may respond to a severe stressor by immobilization. Activation of the dorsal vagal system can result in freezing, fainting, or other energy-conserving response to perceived threat or other forms of intense challenge. If then bodily systems cannot return to homeostasis after an intense stressor, this may create the symptoms of depression or other forms of “shutting down”. All three of these systems are affected in individuals suffering from Post-Traumatic Stress Disorder (PTSD).

Symptoms of PTSD include flashbacks, numbing, intrusive images, intrusive sounds, intrusive smells, unpleasant body sensations, and nightmares. Under some conditions individuals suffering from PTSD no longer have a normal capacity for cognitive functions or to socially engage. Instead, more biologically ancient components of autonomic nervous system may be activated, as the body goes into states of hypo or hyper arousal. These changes can be associated with in a host of mental, physical, and psychological negative outcomes that inhibit the body's natural ability to self-regulate, self-sooth, and appropriately respond to the environment.

It is the intent of this paper to examine the latest neurobiological research on what occurs in the body during a traumatic response and to examine the hypothesis that a body-based, mindful exercise may be of benefit to help individuals suffering from PTSD to return to a more normal state of emotional regulation.

According to the guidelines from the Institute of Medicine (2008) and the Veterans Administration (2003), the current treatment recommendations for reducing PTSD are: medication, Cognitive Behavior Therapy (CBT), and Eye Movement Desensitization Reprocessing (EMDR). Medication can offer relief from some of the symptoms; however, the long-term effects of the treatment are less than satisfactory, and when treatment is discontinued, symptoms often return (Bernard, Lind, Alexander, & Freidman, 2012). The psychotherapy methods of CBT and EMDR have been found effective for some individuals suffering from PTSD, but are not suitable and effective for all, according to van der Kolk (2006) and Bryant (2011). Cognitive Behavioral intervention (CBT), Prolonged Exposure (PE), and Cognitive Restructuring (CR) have received a lot of attention and seemingly have positive results for Complex Post-Traumatic Stress Disorder (CPTSD) and or Disorders of Extreme Stress - not

otherwise specified (DESNOS). However, as discussed by Courtois (2004), these treatments typically rely on re-exposure to traumatic experience and if they occur too early in an individual's trauma history, can have negative consequences.

“Unfortunately, the wholesale application of CBT techniques to patients with CPTSD/DESNOS (even those who clearly meet the criteria for PTSD) may be problematic... In fact, it is not too strong to state that some patients may actually be harmed by the use of these techniques, especially if applied too early in the treatment process without attention to safety and the ability to regulate strong effect”. (p. 414)

Techniques such as CBT, ET, and EMDR are the major focus of research in the treatment of PTSD (Courtois, 2004; van der Kolk, 2002). Both CBT and EMDR are cognitive based practices which center on thoughts and feelings, however, as Porges (2001) and van der Kolk (2006) discussed, trauma has a physical basis and somatic-based interventions that also involve the physical body are warranted (Porges, 2001). Both yoga and mindful meditation address cognitive and somatic/autonomic systems, and may have value in the treatment of trauma (van der Kolk, 2006; Lazar et al., 2005).

Researchers such as Dr. Bessel van der Kolk and Dr. Sarah Lazar at the Trauma center in Boston have also begun examining mindfulness as a possible intervention for PTSD and trauma. Mindfulness can be defined as a capacity to be in the present moment without judgment and without cognitive elaboration (Lazar et al., 2005; Kabat-Zinn, 2011; Goldstein & Kornfield, 1987). Lazar et al., (2005) elaborated further on mindfulness, stating that the formal practice “involves sustained attention to internal and external stimuli” (p. 1893). Mindfulness research has shown significant evidence that certain techniques can aid in the reduction of PTSD symptoms (van der Kolk, 2002, 2006; Lazar et al., 2005).

Tai Chi is another promising somatic-based practice, which also incorporates mindfulness, and which holds potential for trauma reduction. Although it has received less research attention, Tai Chi is easily and inexpensively taught. In addition, because it was originally developed as a martial art, it may be more acceptable to individuals, especially men, with a military history. The current study designed to examine the hypothesis that the practice of Tai Chi may reduce symptoms associated with PTSD and contribute quantitative findings to the field of somatic psychology.

Tai Chi addresses the issue of tuning in and paying attention to one's sensations and physical patterns; Tai Chi focuses simultaneously on these internal awarenessess while also maintaining focus on the external world (Tai Chi Foundation, n.d.).

One key study has addressed the possibility of treating PTSD with Tai Chi (Grodin et al., 2008). The authors proposed that more research needs to be done in this area, as they only relied on preliminary observations from four case reports and thus their findings lack overall generalizability and reliability. More quantifiable research is necessary to substantiate the findings of this preliminary study. This study represents the first step in the expansion of research in this area.

Launching from the premise of this early study by Grodin et al., (2008), this paper lays the groundwork for the experimental research project that used Tai Chi, a mindfulness-based exercise, to help mitigate the symptoms of Post-Traumatic Stress Disorder (PTSD). Tai Chi has a similar theoretical foundation to other mindfulness practices that are gaining recognition for dealing with trauma and stress (Chu, 2004). Among the main strengths of this study is the chosen exercise intervention, which is easily performed and requires no equipment other than comfortable clothing for ease of movement. Thus, the intervention itself is a low-cost option.

The soft, flowing movements of Tai Chi can be practiced regardless of age, gender, and fitness level. Moreover, PTSD patients can safely begin Tai Chi training even when mobility is limited. In such situations, an experienced instructor will gradually incorporate the movements according to each participant's physical ability level, with appropriate adjustments of the Tai Chi form made on an individual basis. As interventions for people with PTSD are on the rise, the cost-effectiveness of engaging in alternative forms of mindfulness exercise or self-regulation activities has yet to be assessed and merits serious consideration given the current economy.

Limitations

There were several limitations to this study. The short term of the intervention—five weeks—could have presented a problem, as it takes a period of time to learn the Tai Chi form. A longer period of time to study and learn the Tai Chi form would be helpful as the participant could relax and concentrate on the mindful aspects of the form instead of trying to recall which step or move comes next. The size of this study was a concern. If the sample size was considered too small, the study would be under-powered and the external validity of its generalizability could be seen as reduced. A larger sample size would enable other variables to be looked at such as gender and the different causes (war, abuse, and rape) and be helpful in increasing the external validity. It is this researcher's hope that because significance was shown in this research project, a larger randomized trial with participants carrying a diagnosis of PTSD could be conducted in the near future.

Assumptions and Scope

The scope of this research project was not limiting as far as gender, cause of PTSD symptoms or how long the participant had experienced PTSD symptoms. Participants had a high level PTSD symptoms as demonstrated by their scores on the Post-Traumatic Checklist—civilian (PCL-C) and were over the age of 18 years and able to give informed consent. Since this was a

five-week training course the participants needed to be currently residing in the north Florida area. Due to the lack of ability to obtain a large enough sample size to power an analysis of a covariate ANCOVA (416 participants), issues of differences in gender, age, duration of PTSD and differences amongst causes of PTSD (war, natural disaster, and abuse) were not able to be fully analyzed but hopefully will be looked at in future research projects.

Definition of Terms

Somatic or Somatics- The origin of the word is from the Greek language and means related to the body (soma). Thomas Hanna (1970) brought the word into its modern usage, which is the experiential study of the body. Serlin (2005) pointed to the difference between behavioral psychology that studies the body from the outside or as an object and somatic psychology that studies the body as a subject and believes in the intrinsic wisdom of the body to heal itself. This paper's research perspective takes its point of view from the somatic psychology viewpoint.

Neuroception- Is defined as the evaluation of safety and danger by the nervous system in the body and it can be and often is independent of conscious awareness (Porges, 2003, 2004, 2010).

Polyvagal theory

Developed by Dr. Stephen Porges, this theory describes the nervous system as hierarchical evolutionary developed system (2011, 2001). It postulates that the physiological state of the body helps to determine one's psychological experience. As a result, when one learns to connect and regulate the nervous system one can possibly help change psychological experience.

Summary

In summary, this paper's intent is to provide the latest neuroscience research on the body-mind connection as an argument for the use of a mindful, physical body exercise, Tai Chi to help

reduce PTSD symptoms. In the following literature review chapter, research on PTSD and complex trauma will be looked at first, followed by the current research into the neurobiology of trauma and the neurobiology of movement. The next sections will examine research that has been done on Tai Chi; its general health benefits, and current research on Tai Chi, PTSD and traumatic brain injuries. This research provides support for the argument that Tai Chi may have value as somatic mindful intervention for those suffering from PTSD.

Chapter 2: Literature Review

Introduction

This paper presents a review of the literature on Tai Chi as a therapeutic modality that has the potential to play a role in the treatment of Post-Traumatic Stress Disorder. The review will address recent research on the neurobiology of PTSD and lay down the conceptual groundwork for an experimental study of the effects of Tai Chi on the alleviation of PTSD symptoms. This paper first examines what is PTSD and recent research on this topic as well as its connection to complex trauma. Neurobiology and its relationship to movement and mindfulness is next presented. The last part of the literature review will focus on Tai Chi and its potential role as a mindful exercise to facilitate health.

Post-traumatic Stress Syndrome (PTSD)

As stated above PTSD is a serious psychological condition typically characterized by specific symptoms following exposure to a traumatic event or events such as war, car accidents or a history of abuse (American Psychiatric Association, 2000). Sayer et al., (2012) report that the U.S. Department of Veterans' highest compensable mental disorder is PTSD. This disability has increased steadily over the past decade (Hoge et al., 2004; 1993; Sutker, Uddo, Braidley, & Allain, 1993). To help inform policies and interventions to assist veterans, Sayer et al., examined why veterans apply for PTSD disability. This qualitative study allowed the participants' own words to state how PTSD affected them. Of particular interest to the proposed research of this dissertation was the below statement made by a male Vietnam veteran:

Because if they're (the government) not going to recognize what it is, then I'll never be cured for what it is A claim is for just getting better. I'll pay you; if you can make me better, I'll pay you; that's the way I feel about it, seriously. (p. 703)

This statement points to the need for interventions that can help veterans heal from the

trauma they encountered because of their military service. This article also pointed out that it was easier to “begin the PTSD claims process than it was to obtain PTSD services, even if they wanted both” (p. 705).

PTSD is a major challenge for the afflicted individuals as well as their families. The treatments have not proven sufficient, as witnessed by the high suicide rate of veterans returning from war (Kaplan et al., 2007; Valenstein, 2011). A wealth of evidence supports the use of non-pharmacologic treatments for anxiety disorders, as well as for the treatment of PTSD (Roman, 2010, p. 370). Cognitive Behavioral Therapy (CBT) is recognized by the Veterans Administration as the gold standard for PTSD treatment but does not work for the population as a whole. According to van der Kolk (2006), “Neither CBT protocols nor psychodynamic therapeutic techniques pay sufficient attention to the experience and interpretation of disturbed physical sensations and preprogrammed physical patterns” (p. 282). According to van der Kolk (2002), people who experience the most direct sensory exposure to traumatic events are at the highest risk of developing PTSD.

Prolonged episodes of stress can create an elevated level of chronic traumatic stress responses within the body, which over time becomes habitual for the nervous system (Doussard-Roosevelt & Porges, 1999). To make progress in our medical understanding of trauma, and PTSD in particular, it is essential to study what is occurring within the body when traumatic experiences become prolonged (by being re-experienced in one’s mind) and are thus accompanied by a chronically elevated stress response. Such understanding opens the door for somatic methods that improve self-regulation of the central nervous system and thus may serve as interventions for PTSD.

Figley (1978) examined the different aspects of combat stress for returning veterans from

the Vietnam War. A sample was selected from veterans who were receiving educational benefits (via the GI Bill) after returning from Vietnam. The study was designed to assess the past and present interpersonal adjustment of veterans who had seen combat (combatants) and matched to a group of veterans who had not seen combat (non-combatants). Interpersonal Adjustment (IPA) was defined as looking at the “emotional well-being, satisfaction and relative comfort with others in general and with family and immediate friends in particular” (p. 108).

The questions were designed to assess the veterans’ own perceptions of the various changes that took place in their lives in the eight to twelve years prior to military service and then after their service in the war. It predicted that there was a positive, linear relationship between interpersonal adjustment and the length of time since discharge for the Combatant group, but not for the Noncombatants. It also predicted that although there would not be a significant difference between the two groups prior to military service, the “subsequent life period would be associated with significantly lower Variance of Interpersonal Scores (VIA) for the combatants even to the present time, compared to noncombatants” (Figley, 1978, p. 108). The findings showed that while noncombatants varied little over the different time periods, the combatants’ scores dipped significantly during military service, and only during the present time of the research project (1979) did the scores go back to the pre-military levels. The report lent some support to the idea that there is some dispositional difference between veterans who were exposed to combat and veterans who were not, and that these differences continued after release from military service and up through the date of the study.

The researchers stated that though it is tempting to think that time heals all wounds, their research indicated additional important factors to take into consideration other than just time and patience. The first is that the data suggests post-combatants have a lower level of interpersonal

adjustment than non-combatants at each period of their lifetime. It also recognizes that the amount of time required to accommodate stress associated with combat experience is much longer than previously assumed. The data revealed that years after the war the combatants got into more verbal fights and had a higher frequency of violent fantasies and violent dreams than non-combatants. Combatants also used drugs more, had lower morale, and fewer close friends than the noncombatants. The time heals all wounds theory underestimates the profound psychological impact of combat, “both immediately, delayed, overt and covert” (Figley, 1978, p. 109). It also may underestimate pre-existing differences in combatant and noncombatants, which may leave those who later were exposed to combat especially vulnerable to psychological trauma.

Researchers are working to understand the mental health issues of soldiers returning from Iraq and Afghanistan and the potential barriers that arise as they attempt to seek care (Hoge et al., 2008; Hoge et al., 2004). A study conducted in 2004, Hoge et al., analyzed the mental health of soldiers before being deployed to Iraq and Afghanistan and after their tours of duty were completed. The study aimed to evaluate ways to implement policies to better serve the mental health needs of soldiers upon their return. “Many gaps exist in the understanding of the full psychosocial effect of combat” (Hoge et al., p. 9). In the past, most studies have been conducted on veterans returning from war with minimal data gathered before they deploy. Gathering data both pre- and post-combat allowed for a unique perspective on this issue as a clearer understanding may develop about the effect of combat.

This study looked at members of four U. S. combat units, three from the Army and one from the Marine Corps. An anonymous survey method using the 17-item National Center for PTSD Checklist of the Department of Veterans Affairs was performed. In order for a participant

to meet the criteria consistent with a PTSD diagnosis using this instrument, he or she had to have demonstrated a minimum of one intrusive symptom (flashbacks or nightmares), three avoidance symptoms (avoidance of stimuli that is associated with trauma), and two hyper-arousal symptoms (anger, hyper vigilance, and trouble sleeping).

The findings demonstrated that those soldiers who were exposed to significantly greater combat were more likely to meet the criteria of the DSM for major depression, generalized anxiety, and PTSD. The largest difference in the mental disorders mentioned above was the increase in PTSD. The finding also concluded that within the group that tested positive for a mental health disorder, only 23 to 40 percent sought mental health care. The predominant factor self-reported by the participants that inhibited them from seeking treatment was the possible stigmatization that might occur. It is interesting to note that this study also found that, “those whose responses were positive for a mental disorder were twice as likely as those whose responses were negative to report a concern about possible stigmatization and other barriers to seeking mental health care” (p. 13). This quote illustrates that those soldiers exhibiting symptoms consistent with a diagnosis seem to find it even more difficult to seek the help that is needed because of fear of stigmatization.

Alternative methods of treatment, such as Tai Chi, could be helpful for a soldier who has apprehensions about seeking treatment out of fear of being judged by his or her peers. As a recognized martial art, Tai Chi is already used throughout the world in training soldiers, and it would therefore not be unusual for a soldier to be participating in a Tai Chi class (Jahnke et al., 2010).

Currier, Holland, and Allen’s (2012) research on mental health symptoms pointed out that attachment theory has become a primary framework in helping understand an individual’s

adjustment to traumatic events. Attachment-related anxiety and avoidance were two of the highest rated associations with posttraumatic stress symptoms (PTSS). “The risk for posttraumatic stress symptoms (PTSS) and related problems will be lessened when a service member can mobilize positive mental representations and interpersonal resources” (p. 633).

They found strong support for positive mental health benefits to help increase positive attachment security in post deployment. Tai Chi classes could be a method to help increase positive attachment by increasing the participant’s connection and feeling of belonging to a group as well as helping teach the interpersonal ability to relax and connect to others through the ventral vagal system.

Continuing the understanding of the need for social support after a trauma, a recently published article, titled “Social Support Moderates Posttraumatic Stress and General Distress After Disaster” (Arnsberg, Hultman, Michel, &Lundin, 2012), examined the positive outcome of perceived social support from peers and family members available to survivors following a traumatic event. The article describes a study that was conducted using a sample of 4,600 Swedish tourists who visited the area affected by the Indian Ocean Tsunami in 2004. Data were retrieved from Swedish authorities following the catastrophic event to determine which individuals were impacted. There were 10,051 individuals who were originally contacted via a mailed survey requesting their participation in the study. Participants were asked to complete preliminary questionnaires that were used to then separate out participants into one of two groups based on their exposure to the tsunami as either high or moderate, and one additional group that had no exposure that was used as the comparison group. Participants were then administered various tests, such as The Crisis Support Scale, to test for how the participants perceived their

available social support, as well as The Impact of Event Scale-Revised, which assessed for the prevalence of posttraumatic stress.

The findings of the above study demonstrated a significant effect of social support acting “as a buffer against various forms of distress” for the study group that contained individuals who were highly exposed to the original traumatic event (p. 475). Social support did not, however, play a large role in mitigating the distress for those study groups moderately exposed to the trauma. This finding is valuable to note as it highlights how varying levels of trauma exposure may result in the individual responding differently to varying stress-reducing interventions. The study provides a strong argument for the importance of interpersonal relationships and connection when addressing treatment for a severe trauma. A Tai Chi class has the potential to provide both some social support and physical rehabilitation.

In their article, “Criminal Justice Involvement, Trauma, and Negative Affect in Iraq and Afghanistan War Era Veterans”, Elbogen et al., (2012) provided insight into the growing issue surrounding the correlation between trauma and criminal-related behaviors. In the article, the authors postulate that people who have been exposed to stressful environments or traumatic events, and who report negative effects such as anger and irritability are at a higher risk of antisocial conduct” (p. 1097). Due to the repeated exposure to traumatic events that took place while overseas, soldiers are returning home with unresolved emotional issues, which may be the cause of disruptive and oftentimes illegal behaviors, according to the authors of this research.

The study examined survey data obtained from 1,388 veterans who had returned home from Iraq and Afghanistan who presented with a diagnosis of PTSD or traumatic brain injury (TBI). The 1,388 study participants were randomly selected from a sample of over one million veterans who were active and served during or following the events of September, 2001. The

authors paid particular attention to the gender of their study sample in order to evenly represent both women and men.

Their findings (2012) supported the original hypothesis and demonstrated a significant relationship between PTSD and TBI and an increase in criminal activity; the data tables provided evidence that “veterans with TBI or PTSD reporting concurrent anger/irritability were more likely to be arrested” (p. 1099).

The authors acknowledge some limitations within their study surrounding the reliability of self-reported data. In addition, the above study looks at correlation relationships and therefore making any claims of causality is not possible. As the conclusion demonstrates that veterans with PTSD, anger, and irritability are at an increased risk for criminal activity and arrest, far more research needs to be conducted in this area to gain a deeper understanding of this continually rising problem in our society.

Another article by Shin et al., (2012) addressed the fact that one of the common problems faced by veterans who suffer from PTSD is aggressive behavior. They studied the longitudinal effects of clinical and treatment utilization factors that may affect the veteran’s aggressive behavior. Factors that increase a veteran’s PTSD level were a pre-disposition towards aggression at baseline, changes in alcohol intake, as well as intake of prescribed medications, such as benzodiazepines. Contrary to what the study had hypothesized, they did not find a reduction in aggressive behavior that related to the veteran’s mental health treatment visits or psychotropic medication, which are both currently the first line treatments prescribed by the medical community. The authors point to the importance of studying the nature of treatment options that veterans currently receive rather than the frequency of their visits. Important for these researchers’ proposed study is their assertion, “targeting reduction in PTSD symptoms may

have the additional benefit of reducing aggressive behavior among veterans with PTSD” (p. 655).

Alongside soldiers and veterans, victims of abuse have a reported vulnerability toward PTSD. A study conducted by Dale et al., (2009) investigated the potential impact of abuse history on an adult’s ability to regulate the autonomic nervous system. This research also examined abuse history in relation to psychological well-being in later life. The main findings demonstrated that abuse history was associated with less vagal regulation of the heart, as well as an inability to readily re-engage vagal regulation following a stressor. As the investigators stated, “these findings underscore the importance of evaluating both the psychological and physiological effects of trauma” (p. 299). This study suggests that the physiological processes underlying vagal tone may be directly related to early life trauma, based on using as a model of the polyvagal theory (Porges, 2001).

PTSD and Complex Trauma

The term trauma can be used to refer to many different forms of traumatic experiences. The term, complex trauma, which will be used here synonymously with PTSD, can refer to prolonged situations, such as acute/chronic illness that require intensive medical intervention, or a single, calamitous traumatic event. As trauma affects each person in different ways, a given event may be traumatic for one person and have little to no impact on another. Thus, it is important not to reduce the effect of trauma in a single way. Rather, it is necessary to take into account individual differences in the causes, consequences or perceptions of a particular experience.

In this context, the term, complex Post-Traumatic Stress Syndrome, has emerged, in an attempt to incorporate an understanding that certain forms of trauma are more complicated and

occur more frequently than others. Child abuse and domestic violence were two of the most frequently occurring incidences of trauma, with subsequent symptoms consistent with PTSD (Courtois, 2004). In these cases, the common denominator is that the victim's abuse occurs repeatedly over time, and that he or she is trapped in the situation in which the trauma transpires. Of significance for this paper is an expanded understanding of trauma which incorporates events involving armed conflict and combat (Courtois, 2004). PTSD was first included in the third edition of the DSM mainly because of the need for a diagnosis for the soldiers returning from Vietnam. The wars in Iraq and Afghanistan have occurred since 2001 and many soldiers have been involved in combat, some for multiple tours of duty; it has been argued that these conflicts have increased the occurrence of PTSD and complex post-traumatic stress disorder (CPTSD) in the population (van der Kolk, 2006).

A valuable article investigating the issue of complex trauma and its treatments is Courtois's work, "Complex Trauma, Complex Reactions: Assessment and Treatment" (2004). There, she discussed how the assessment of trauma should not be over-emphasized when conducting a psychological assessment; instead, questions that assess for trauma should be interwoven within the psychological interview or instrument so that they do not overtly stand out because it is paramount to avoid the risk of causing more harm by overtly drawing the client back into his or her original trauma. Courtois discussed the complications of treatments that are "exposing these patients too directly to their trauma history in the absence of their ability to maintain safety in their lives can lead to retraumatization" (p. 415).

The article goes on to point out that PTSD is often a component of why people seek mental health services, whether or not the awareness of internalized trauma is present. As is often the case for early treatment, disclosure is not always easy, particularly for individuals who

are suffering from trauma and have a heightened sense of social anxiety or fear. “Complex trauma occurs repeatedly and escalates over its duration. In families, it is exemplified by domestic violence and child abuse and in other situations by war, prisoner of war or refugee status, and human trafficking” (Courtois, 2004, p. 412). For this population, the disclosure of traumatic events may not emerge until the client develops a sense of safety.

Another important point made is that the clinician should also assess and work with the individual’s strengths and resources (Courtois, 2004). It recommends empowering the individual in ways such as helping create a more positive viewpoint of self, which will increase growth rather than regression. The clinician should also help the patient develop “a source of secure attachment for the traumatized individual as a base upon which the therapeutic work is conducted” (p. 417).

As previously mentioned, Tai Chi offers one method to help promote emotional regulation. In this research project, classes were conducted with two instructors. The instructors taught not only through their words but with their bodies, which were relaxed and emotionally regulated in a calm state. As such, students were able to witness and engage with the instructors, which may have helped them learn to self-regulate, whereas also developing a positive secure attachment in an environment in which they felt safe. As Courtois stated, “PTSD has a biopsychosocial and spiritual component that requires an array of linked biopsychosocial treatment approaches” (p. 417). Hobfoll et al., (2007) discussed the importance of creating safety and a calming atmosphere to help those suffering from PTSD. Other important ingredients mentioned by this report were having a sense of connectiveness, creating hope as well as a “sense of self and community efficacy” (p. 283). Tai Chi classes with fellow students would provide for community, where one could relax and develop a sense of calm. Tai Chi taps into

this spiritual and psychosocial piece that is imperative for growth and healing.

Neurobiology of Trauma

Neurobiology as a field of study, as mentioned earlier in this paper has made great advancements in its understanding of what occurs in the body during and after trauma. For many years it was thought that people regulated their emotions and feelings through the autonomic system (Porges, 2011). In this model, when an individual encountered danger, a fight or flight response would be triggered, caused by the activation of the sympathetic nervous system. Neurotransmitters of epinephrine and nor-epinephrine were released to activate this response. After the danger passed, the parasympathetic system, sometimes referred to as a “brake”, would come on line by releasing inhibitory neurotransmitters such as acetylcholine.

This model described the action of the sympathetic and the parasympathetic systems working in balance with each other, moving back and forth like a seesaw. Porges (2011) stated “Specific physiological and neurological mechanisms underlying arousal are often associated with the sympathetic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis. An inferred connection between the sympathetic nervous system and the HPA axis has resulted in similar research methods being used to study both arousal and stress” (Porges, 2011, p. 1). As described by Porges, this classic model created a sympathetic-centric view of emotional regulation and has been the focus of public consciousness as well as in popular press coverage of stress.

Today many scientists and thinkers working in the field of neuroscience consider a more complex system to be at work, which goes beyond the fight/flight autonomic responses (Porges, 2001, 2011; van der Kolk, 2006). The polyvagal theory proposed by Porges (2001, 2011) has gained acceptance in the scientific world, as it seems to better explain the body’s functions in the face of a challenge. This theory proposes that instead of just the fight or flight reaction, a

polyvagal system response may be activated, with features that describe mechanisms for the shut-down responses which can be seen following trauma.

Porges (2001, 2011) maintained that the nervous system is more accurately described in terms of a hierarchy of autonomic nervous system responses, rather than as a balance of sympathetic and parasympathetic systems. The polyvagal system can best be described by understanding the evolution and development of the vertebrate autonomic nervous system (Porges, 2001, 2011). The oldest component of this system, located in the brainstem, is the unmyelinated dorsal vagal complex, and is common to all animals including fish. This system is responsible for the immobilization, or freeze reaction to stress and trauma. In the evolution of the mammalian body, the second system to develop was the sympathetic system, also described as the fight or flight system. The last system that has developed, evolutionarily speaking, is that of the ventral vagal system. The ventral vagal complex (VVC) is made up cranial nerves V, VII, and IX, X, XI, which connect to the facial muscles, heart and lungs. “The VVC is composed of somatomotor component consisting of the special visceral efferents and visceromotor component consisting of the myelinated vagal pathways from the nucleus ambiguus to the sinoatrial node to the heart and bronchi” (Porges, 2011, p. 169). The VVC is present in higher mammals and is sometimes referred to as a neural component of the social engagement system, since it controls mammalian facial muscles and eyes, which are essential to human social communication.

The polyvagal theory contains several assumptions that are important to understanding the development and evolution of our nervous system and our emotions. Communication between the autonomic nervous system and the brain is assumed to be essential for emotions; thus this communication permits the enhanced emotional experience and expression characteristic of human behavior (Porges, 2011). It is important to understand that mammals still

retain the older forms of their nervous system and one's range of social behavior and affective states are determined by the phylogenetic level of the nervous system. In the face of a challenge the response strategy will follow the phylogenetic hierarchy. The newest structures respond first and if that does not work then they will continue to revert back until reaching the oldest or more primitive structural system.

Trauma, according to Porges (2001, 2011), has different levels of manifestation in the body, often referred to clinically as levels of arousal or tolerance of the nervous system (Ogden, Minton, & Pain, 2006). There are three primary zones of tolerance: the hyper arousal zone, the optimal arousal zone, and the hypo arousal zone. In the hyper arousal state or zone, the sympathetic system (mobilization) is activated. According to Ogden's interpretation of the polyvagal theory, the body experiences increased sensations, emotional reactivity, hyper vigilance, intrusive imagery, and discognitive processing. The symptoms associated with chronic hyper arousal state are confusion, sleep disorders, feelings of being unsafe, inability to read the emotions of others, and a tendency to panic and anxiety. The hypo arousal zone may be connected to the dorsal parasympathetic system. In this zone, there is an absence of sensation, numbing of emotions, disabled cognitive processing, and reduced physical movement. Symptoms of the chronic hypo arousal state include depression, social withdrawal, avoidance, sensitivity to minor stressors, memory loss, dissociative symptoms, weakness, numbness, autoimmune problems, retarded emotional recognition, and delayed reactions (Ogden, et al., 2006). The symptoms of both hyper arousal and hypo arousal relate directly to the criteria in the DSM-IV and DSM-5 used for diagnosing PTSD (American Psychiatric Association, 2000, 2013).

The third zone, the optimal arousal state, is governed by pathways arising in the ventral vagus area of the brainstem, and is related to a person's ability to engage socially. This can be

said to be an individual's window of tolerance that is healthy and within a certain degree of balance: when a person is able to be relaxed and engaged with one's environment and one's relationships. Similarly, the effect of Tai Chi, which will be discussed later in this paper, is to develop a relaxed state of being that is balanced and in harmony with one's environment (Jahnke et al., 2010; Chu, 2004). This relaxed state of being that Tai Chi cultivates could also be described as the optimal arousal state.

A compromised ventral vagal system will lead to sympathetic system engagement without interpersonal modulation, i.e., deregulation. Deregulation of the nervous system causes it to take less time for the sympathetic system to be engaged and longer for it to shut down. Siegel (1999) stated, "Psychological trauma can overwhelm affect regulation mechanisms, and various forms of adaption may be required to maintain equilibrium" (p. 294).

In a healthy, regulated nervous system, the ventral vagal system (social engagement) comes on line first in the presence of stress and trauma. If the ventral vagal system fails to fire, this system will give way to the flight/fight response of the sympathetic nervous system. A third reaction is possible: if, in response to the threat, the person faints or becomes totally immobilized or disassociated, the dorsal vagal system has been activated. In animals, this is a common response to threat, as when a rabbit or a deer becomes frightened and freezes. For example, if a person is approached by a threatening stranger, he or she may try to talk to that person, to engage in behavior to de-activate the situation—the social engagement system. If this is not successful, running away or fighting might ensue - the sympathetic system. In a healthy, regulated system, reactions to threatening situations will follow this sequence, but if there is has been a trauma and stress an individual may live in a constant state of either the sympathetic or dorsal vagal system reaction. Evolutionarily speaking the ventral vagal system in more newly evolved in mammals.

Reptiles and lower level mammals freeze. Humans have more resources and can use the ventral system—unless they have been compromised and cannot access the ventral vagal, in which case they might go immediately into freezing, fighting or flight.

The ventral -vagal complex usually inhibits the more primitive, older dorsal vagal complex. The dorsal-vagal nerves are not myelinated, and thus respond more slowly than those of the ventral-vagal complex. The target organs for this complex are primarily located in the visceral area below diaphragm. This is the system that is responsible for the hypo range of arousal in the three-zone model.

In an ideal world, one would be able to modulate between the three zones of arousal, but always return to the optimal zone. Unfortunately, for a person living with a high level of nervous system activation, or an intense activation of the nervous system, then the overall system can be more quickly thrown into the above mentioned hyper activity range or hypo activity range. It is at this point that the organism becomes unhealthy and stressed. “Unresolved survival-related action tendencies include not only chronic postural and movement patterns related to defense, but also the rapid mobilization of the autonomic nervous system response to trauma related stimuli.” (Ogden et al., 2006, p. 26).

The ventral vagal complex (optimal arousal state) helps regulate and control our ability for social engagement. Human facial gestures, breathing, and heartbeat are all regulated within this system, and yet this system is often compromised after a traumatic event (Porges, 2001). Ogden and associates (2006) argued that under these conditions, “unresolved survival-related tendencies may emerge, such as chronic postural and movement patterns associated with defense or protection, as well as rapid mobilization of the autonomic nervous system in response to trauma-related stimuli” (p. 26).

The polyvagal theory offers a different perspective on compromised social behavior such as PTSD (Porges, 2001). The range of an individual's social behavior is constrained by the body's physiological state, rather than being exclusively constrained by social or emotional forces. Porges's theory emphasizes that mobilization (hyperactivity) and immobilization (hypoactivity) may be adaptive strategies to a challenged (i.e. frightened) individual (see figure 2). Thus, according to Porges (2001), creating states of calm and exercising the neural regulation of the brainstem structures may be helpful in regaining the ability to activate the social engagement system.

Physiological Effects**Neurological Sources****Hyper-arousal "Fight or Flight"**

(Increased sensations, emotional reactivity, hyper-vigilance, intrusive imagery)

Sympathetic Nervous System (SNS)

^

**Optimal Arousal Tolerance Zone
"Social Engagement"**

(The zone where a healthy, regulated organism resides)

Ventral Vagal - Parasympathetic Nervous System (PNS)**Hypo-arousal "Immobilization"
(Freeze)**

(An absence of sensation, numbing of emotions, disabled cognitive processing and reduced physical movement)

v

Dorsal Vagal - Parasympathetic Nervous System (PNS)

Figure 2. Polyvagal theory diagram based on the work of Porges (2001, 2010, 2010) and Ogden et al., (2006).

Porges (2004, 2011) is also credited with introducing the concept of *neuroception* to the study of neurobiology. He defined neuroception as the process of detecting information regarding safety or danger through the senses. Neural circuits are activated accordingly to decide “whether situations or people are safe, dangerous, or life-threatening” (Porges, 2011, p. 11). This function takes place in primitive parts of the brain, and an individual is often not

conscious or aware that it is occurring. The resulting reactions, either prosocial or defensive, also originate in primitive brain areas. It is possible that neuroception can become so heightened and adapted for situations, such as being in a war zone, that when an individual is later out of the war zone, the body's neuroception does not recognize that the situation has changed. It continues to misread the situation and keeps reacting in a defensive way. "From a clinical perspective, the defining features of psychopathology may include either a person's inability to inhibit defense systems in a safe environment or the inability to activate a defensive system in a risky environment or both" (Porges, 2011, p. 13).

Porges (2004) further discussed the possibility that faulty neuroception may "lie at the root of several psychiatric disorders, including autism, schizophrenia, anxiety disorders, depression, and reactive attachment disorder" (p. 19). Faulty neuroception thus may be a contributing factor, helping to explain maladaptive physiological reactivity as well as defensive behaviors that are connected to certain psychiatric disorders, including PTSD. Individuals take their cues from the way others neurally regulate the muscles of their faces and heads, according to Porges (2004). Eye contact, the prosodic tone in another's voice, facial expressions of smiling, frowning, etc. are all cues that one reads of the others emotional expression. It is important to understand these cues in treating and working with PTSD in two ways. The first is for the therapist to help create a better therapeutic relationship with individuals. The second is to help the individual suffering from PTSD to become aware of these cues in themselves and others in order to allow a return to the normal range of social engagement regulated by the ventral vagal system.

Neurobiology and Movement

Van der Kolk (2006) has been actively investigating the connection between neuroscience and movement as a method of treatment for PTSD and asserts that “effective treatment needs to involve the following three factors: (1) learning to tolerate feelings and sensations by raising the capacity for interoception; (2) learning to modulate or control arousal; and (3) learning that it is critical to engage in effective action after confrontation with physical helplessness” (p. 277). He asserts that these are the core principles for working with and treating individuals suffering from PTSD.

In a research project by Lazar et al. (2005), Functional Neurological Resonance Image (FNRI) was used to study 20 people who were engaged in meditation and mindfulness exercises. The practices attended specifically to internal and external sensory awareness. The data collected from the study show changes in the brain as a result of these activities. They found:

Brain regions associated with attention, interoception, and sensory processing were thicker in meditation participants than matched controls, including the prefrontal cortex and right anterior insula. The largest between-group difference was in the thickness of the right anterior insula. It has been proposed that by becoming increasingly more aware of sensory stimuli during formal practice, meditation practitioners gradually increase their capacity to navigate potentially stressful encounters that arise throughout the day. (p. 288)

FNRI show that traumatized victims have less gray matter in the insula and the prefrontal cortex (Lazar et al., 2005). According to Lazar, one is able to increase gray matter in these areas through practice of meditation and exercises in mindfulness.

A study done by Gard et al., (2012) examined the effects of a yoga program at the Kripalu Center, located in Lennox, Massachusetts, on not only the quality of life and perceived

stress but also self-compassion and mindfulness in young adults. They found an increase in the variables of quality of life, compassion, and mindfulness. They did find a decrease in self-reported stress which was predicted. One of their conclusions was that, “Mindfulness-based programs, therefore, have a great potential to foster resiliency against mental illness and promote psychological well-being” (p. 166).

The human brain has an ability to adapt and change, which is often referred to as plasticity (Leven & Vuckovich, 1987). The implications of plasticity hold much promise for those who suffer from chronic hyper- or hypo-arousal. The idea that a person’s brain chemistry can change through bodily experience is pivotal when one considers the field of Somatics. When working exclusively with cognitive patterns of “re-thinking” one’s situation, as occurs in CBT, the intervention only addresses one aspect of the body, mind, and spirit. By using an intervention that targets all of the levels, changing one’s experience in the body, as well as in the spirit and mind, the opportunity to effect favorable changes should increase.

The Benefits of Tai Chi

This paper hypothesizes that using Tai Chi can help relax and regulate the nervous system in people with PTSD symptoms. Tai Chi is an exercise that enhances health and self-awareness through a series of gentle, flowing movements. There are three main aspects of Tai Chi that can be most helpful in learning to release the effects of trauma in the body.

According to Cheng (1981), an important principle is relaxation. During the practice of Tai Chi, the entire body must be relaxed, especially the face, chest, shoulders, waist, elbows, and hands. The body as a whole is neither tense nor limp, but erect and supple. The second principle of Tai Chi is slowness, the ability to slow down and be present, which is a key to mindful self-awareness. The third principle is based on Chinese medicine and the concept of “chi” in the body. *Chi* is the internal vital energy or life force in the body. Kaptchuk’s (2000) *The Web That*

Has No Weaver: Understanding Chinese Medicine identifies the obstruction of the natural flow of chi or energy as one of the causes of disease.

Larkey (2009) recently suggested classifying Tai Chi as a Meditative Movement, proposing it as a new category of exercise characterized by “(a) some form of movement or body positioning, (b) a focus on breathing, and (c) a cleared or calm state of mind with a goal of (d) deep states of relaxation” (p. 231). Other researchers have referred to Tai Chi as a mindfulness exercise, because the practitioner learns to be fully in the present, with full attention applied to posture, breathing, and other bodily aspects.

With respect to PTSD, such a practice could be helpful in activating the capacity for interoception, which is beneficial when working through a traumatic past and would correlate with Lazar’s FNRI study, as cited above. There, she suggested that in the treatment of PTSD, the practitioner needs to include tuning into the internal experience in a mindful way, “noticing whatever thoughts, feelings, body sensations, and impulses arise” (Lazar, et al., 2005, p. 288). The Tai Chi practitioner is taught to become attuned to internal experience as well as to develop the capacity to attend to one’s feelings and body sensations (Tai Chi Foundation, nd).

Tai Chi and Health

In Tai Chi, the breathing pattern synchronizes with the slow rhythm of body movements—the shifting of weight, sinking and rising, projecting and withdrawing. This synchronization helps to further relax the body. Brown and Gerbarg (2005) researched breath in relation to emotional health. Their paper, “SudarshanKriya Yogic Breathing in the Treatment of Stress, Anxiety, and Depression: Part I and Part II”, pointed to findings in current research of “associations between emotional disorders and vagal tone” (p. 189). Their study proposed using yogic breathing “to integrate research on yoga with the Polyvagal theory, vagal simulation, hyperventilation, and clinical observations” (p. 189). The project involved teaching different

breathing patterns to participants from several different groups, such as an addiction group, prison program group, and juvenile offenders. Measurements were then taken using instruments such as the Beck Depression Inventory, prison reports (which showed a decline in violent behavior), and self-report measures on anxiety, anger, and fighting. They concluded that although more controlled clinical trials are needed, there is now sufficient evidence to consider yogic breathing as a “potentially beneficial, low risk adjunct for the treatment of stress, anxiety, PTSD, depression, stress-related illness and substance abuse” (p. 715).

Research has been done to study Tai Chi’s effect on a multitude of health issues, such as chronic pain (Marone & Greco, 2007), arthritis (Hartman, Manos, Winter, Li, & Smith, 2000), as well as pain, muscle weakness, and osteoarthritis (Song, Lee, & Lam, 2003); all of these cases resulted in positive results. Building on present data surrounding the mind-body connection and the capacity to reduce stress, this research project hypothesizes that the release of body tension may be essential for the easing and treatment of trauma and PTSD.

An additional research study conducted by Hartman et al. (2000) measured quality of life and health satisfaction, as well as arthritis, using the independent variable of Tai Chi. The overall quality of life and health satisfaction scores were significantly improved for individuals in a group learning Tai Chi, in this case with a sample of 33 adults. This study did measure quality of life, but arthritis is not the same as PTSD and therefore the result’s applicability may be limited when thinking about the treatment of PTSD. A noted limitation of the study is the lack of overall generalizability due to the small sample size.

Another significant study that incorporates Tai Chi was written by Kerr et al., (2008), entitled “Tactile acuity in experienced Tai Chi practitioners: Evidence for use dependent plasticity as an effect of sensory-attentional training”. This longitudinal study was designed to

evaluate practitioners' spatial acuity and explored underlying cortical plasticity and learning in the participants. The study used Tai Chi participants to measure the increase in sensory-attentional ability and neuroplasticity. The article discussed the strong association of cortical plasticity with spatial acuity in the primary somatosensory cortex. In the Tai Chi group spatial acuity was superior to that of the matched control group. By focusing somatosensory attention on nearly undetectable feelings in the palms and fingertips (while the eyes are gazing in an unfocused, relaxed manner at a point several feet in front of the practitioner, not looking directly at the fingers or hands), practitioners report being able to sense how a feeling in the palm or fingertip may be related to feelings in the rest of the body; in this manner, the practice is said to cultivate a real-time relaxed sense of whole body awareness.

The authors address several limitations of this project, indicating that their small sample size of 14 participants, which reduces the overall generalizability of their findings, as well as concluding because theirs was a cross-sectional study, that no causal conclusions on the relationship of Tai Chi could be implied. Therefore, more research in this area with Tai Chi is warranted.

Feinstein and Church (2010) examined gene expression, psychotherapy, and the contribution of somatic interventions using acupoint therapy, a modality based on the same fundamental model of Chinese medicine as Tai Chi, namely the flow of chi in the body. The human body has 23,688 genes, yet not every gene is expressed. Environmental, psychological, as well as biochemical elements are all said to be factors that influence gene expression. The theory of their research project proposed that psychotherapies that use non-invasive somatic interventions may bring more "precision and power in bringing about therapeutic beneficial shifts in gene expression" (p. 283).

In the study, Feinstein and Church looked at acupoint therapy combined with other psychological interventions such as CBT, Exposure Therapy, and EMDR. Individual case studies were examined, as well as randomized controlled trials using acupoint protocol with exposure therapy. This study was conducted on 27 veterans with a PTSD diagnosis. The research found support for their theory, suggesting that combining somatic interventions with other clinical procedures could increase the speed and power of the psychotherapy treatment for psychiatric disorders.

Jin (1989) studied changes in heart rate, cortisol, noradrenaline, and mood during the practice of Tai Chi. Compared to baseline, the Tai Chi practitioners “reported less tension, depression, anger, fatigue, confusion and state anxiety, they felt more vigorous and in total had less mood disturbance” (p. 197). The practitioners’ heart rates and urinary noradrenaline levels became elevated, as would be expected with exercise. In contrast, salivary cortisol, a neurotransmitter marker for mobilization and stress, was reduced. However, it is now known that salivary cortisol normally varies on a circadian cycle throughout the day. The investigators did not explain whether such variability was taken into account when measuring salivary cortisol. In addition, immobilization is common and cortisol is not always elevated in PTSD. Thus, circadian and individual differences need to be taken into account in the analysis of endocrine changes. Further research using current and more sensitive assays could be beneficial in understanding the effect of Tai Chi at the neuroendocrine level, using for example measures of other hormones, such as oxytocin which can be detectable in saliva (White-Traut et al., 2009).

Another approach to documenting the consequences of Tai Chi looked at examining the effects on the level of cellular physiology. For example, Goon et al., (2009) studied Tai Chi’s impact on DNA damage, antioxidant enzymes, and oxidative stress in middle-aged adults. Sixty

participants were required for the study, all of whom were screened and selected based on the criteria that they did not participate in regular exercise. Thirty were assigned to the Tai Chi group and thirty to the control group that continued not to engage in any exercise regimen. A general physical examination was given along with serum lipid profile at the onset of the study, at six months, and then at 12 months. Heart rate, blood pressure, BMI, and food intake were also monitored. At the conclusion of the study, the Tai Chi group had significantly lowered heart rate and decreased systolic blood pressure as compared to sedentary participants. There was an increase in severely damaged DNA in the sedentary group but not the Tai Chi group. They concluded that long-term Tai Chi exercise might be effective in reducing stress on the cellular level (Goon et al., 2009). A reduction in cellular oxidative stress would be helpful to an organism's overall health and could moreover modulate the autonomic nervous system.

Tai Chi and Qigong Studies and Emotional Well-being

Tai Chi and Qigong come from the same root of movement exercises in Chinese Medicine to promote health. There are many similarities in the two exercises. Both are said to promote and help balance chi (Jahnke et al., 2010). The main difference is that Tai Chi consists of a series of postures practiced in a slow continuous movement that has a set sequence. Qigong uses individual postures that do not have a prescribed order and can be practiced singularly. Many of the postures of Qigong come from the Tai Chi sequence of movement. Therefore, in light of the limited number of studies, for the purposes of this paper, we are examining studies that have used Qigong as well as Tai Chi and related these to emotional well-being. Terjestam, Jouper, and Johansson's (2010) research examined the psychological problems that are increasing among students, such as difficulty sleeping, irritation, nervousness and increases in low mood. They were interested in studying how practicing Qigong could have an effect on the students' well-being at school, on psychological distress, self-image, and on overall general

stress. One group was assigned to practice Qigong and took classes twice a week for eight weeks while the other group was assigned to a control group that continued on with their normal activities. The results showed reduced levels of psychological distress and stress among the Qigong group, and students in that group had a tendency toward improved self-image while the control group had no changes in those areas.

According to Jahnke et al., (2010), there is an increase in research that examines the psychological as well as the physiological benefits of Tai Chi and Qigong. Often these two movement practices are examined separately and therefore examining the full impact of the benefits of these movement practices has not been demonstrated. This project is the only comprehensive review of the benefits of Qigong and Tai Chi done thus far in this area. This study looked at the broad range of health benefits of Tai Chi using only randomized controlled trials (RCT).

Arguing for a combination of both of these movement practices, the authors cite the similarity of the physical practice and philosophy. They point out that theoretical principles inherent in these traditions come from traditional Chinese medicine (TCM). The common emphasis is referred to as the three regulations in TCM, which are “body focus (posture and movement), breath focus, and mind focus (meditative components)” (p. 2).

The study looked at a broad range of benefits, including lowering hypertension, reducing the chances and effects of cardiovascular disease, and psychological benefits such as improved quality of life. “With a few exceptions, the preponderance of studies indicate that Qigong and Tai Chi hold great potential for improving quality of life in both healthy and chronically ill patients” (Jahnke et al., 2010, p. 11).

One of the points made was that often the psychological factor was a secondary goal of

the studies it examined. This stands in contradiction to the present paper's proposed study, in which the psychological aspect of PTSD symptoms is the goal. Several of these research projects reported a decrease in anxiety, depression, and an increase in mood state. Other projects that did not show significant changes with regard to markers of emotional well-being when compared to other interventions, such as relaxation techniques, other forms of exercise, or education controls. "This category of symptoms, particularly anxiety and depression, shows fairly consistent responses to both Tai Chi and Qigong, especially when the control intervention does not include active interventions such as exercise" (Jahnke et al., 2010, p. 13).

Conclusions of this study showed that there is a wide range of health benefits in response to both Tai chi and Qigong, "some consistently so, and some with limitations" (p. 16). There is a need for continued research for populations suffering from severe or chronic illnesses. "Tai Chi and Qigong (or more generally, meditative movement types of exercise) may provide attractive and effective exercise alternatives for the large populations of people at risk for preventable disease, sedentary, and lacking the motivation to engage in more conventional exercise" (Jahnke et al., 2010, p. 17).

In a systematic review aimed to critically evaluate published clinical trials designed to assess the effect of Tai Chi on psychosocial well-being, Wang et al., (2009) concluded that the Tai Chi intervention had a significant effect in 13 studies, particularly in the management of anxiety and depression. However, the methodological quality as assessed with a modified Jadad scale was high in only eight of the 13 studies. The Jadad scale took into consideration such factors as "randomization, blinding, withdrawals/dropouts, inclusions/exclusions, criteria, adverse effects, and statistical analysis" (p. 173). To score a high level on the modified Jadad scale, the research project had to score a 4 or above. One of the major issues for most of the

research was double blinding, or even blinding at any level. Wang et al., (2009) points out that even though “blinding is important to prevent performance and detection bias, when the intervention is a form of exercise it is very difficult to accomplish” (p. 179). Significant findings were demonstrated in six of the eight high-quality studies. The conclusion of this study calls for more well-designed research projects with specific Tai Chi instructional techniques, which would be instrumental in evaluating the effect of Tai Chi on mental health.

A recently published article by Park (2013) on mind-body complimentary and alternative medicine (CAM) interventions and its efficacy in the mental health field discusses the need to research Tai Chi and other mind body treatments for mental health. It points to the recent data that suggests that CAM is being increasingly used to treat a number of different health conditions as well as a preventative method for health in the U.S. The article supports the idea that there are gaps in the knowledge in this field that is needed to inform health care practitioners and researchers (Park, 2013).

Knowledge about CAM modalities and their integration into clinical health psychology can be useful for researchers interested in taking a broader perspective on stress and coping processes, health maintenance and illness behaviors, and culture, and for practitioners seeking to incorporate CAM perspectives and techniques into their work. (p. 46)

Several different modalities were examined which included Tai Chi, qigong, yoga, hypnosis, progressive muscle relaxation, biofeedback, meditation, deep breathing, and guided imagery. The article looked at the characteristics of the users of CAM, finding that CAM use increases with higher levels of education, and that the users tend to be middle aged, and female. Those seeking CAM treatment were motivated by a wide range of psychological and physical

health issues, while others used CAM as a preventative measure for health and well-being. The authors, like others in this field (Jahnke et al., 2010; Larkey et al., 2007), discussed Tai Chi and Qigong as being very similar in their physical practice and that they are used similarly in traditional Chinese medicine. The section on the effectiveness of Tai Chi and Qigong as CAM treatments found that there has been mixed results. Many of the reports were considered inconclusive due to the poor quality of the different studies and the high risk of bias in the studies. The article also stated that most of the research had been done on older participants therefore its application to the wider population is not yet known. The areas where the greatest efficacy for using Tai Chi was found was for improving psychological health and general health for older people as well as for fall prevention. An important conclusion she pointed to is, “In general, systematic reviews of tai chi efficacy have concluded that the literature was weak and that more rigorous future research was necessary” (p. 54). This conclusion lends support for future research being proposed by my research project on Tai Chi and mental health.

Tai Chi and PTSD

A paper discussing treatment of survivors and refugees of torture by Grodin, Piwowarczyk, Fulker, Bazazi, and Saper (2008) suggests the possibility of treating PTSD with Tai Chi. “Self-regulation practices, such as exercise, relaxation, imagery, meditation, may be beneficial in regaining control and promoting the healing process” (p. 802). They proposed that more research needs to be done in this area, as they used only four case studies, and there were confounding variables, such as pharmacotherapy and psychotherapy.

The paper, “Physiologic Correlates of Tai Chi Chuan”, Iuliano, Grahn, Cao, Zhao, & Rose (2011) examined an advanced practitioner’s ability to change the energy flow through the hands, using infrared-thermography (IR), thermocoupled temperature measures, and laser Doppler flowmetry to evaluate the changes. The changes of blood flow and surface temperatures

appeared to be volitional. They go on to point out that blood flow through these areas of the body are considered autonomic and therefore not normally under voluntary responses. This research suggests that an individual may have the ability to connect to and control autonomic regulation through the practice of Tai Chi.

A multivariable regression model was used to analyze research in “Tai Chi and Qigong for Health: Patterns of use in the United States” (Birdee et al., 2009). This research used cross-sectional data from the 2002 National Health Interview Survey (NHIS) to explore who is practicing Tai Chi and the reasons for their use of this mindful exercise. It found that Tai Chi and Qigong were practiced in the United States by a wide range of participants for many health reasons. Interestingly, it compared this group to the population that practices yoga and found that, unlike yoga, the users were evenly distributed across age and gender. Yoga classes consisted of a majority of women participants, whereas Tai Chi had a more evenly distributed population among male and female. This balance of gender may make it helpful in attracting the male soldier population of sufferers of PTSD to participate. Being in a woman-dominated exercise class in yoga clothes might be viewed as untypical for a male soldier accustomed to a military viewpoint. In the conclusion of this research article the authors state:

As research agendas for the clinical application of mind-body techniques are developed, patterns of TCQ use should inform future studies. The practice of TCQ for muscular skeletal and pulmonary conditions as well as for preventative health and maintenance, should be explored. (p. 972)

In examining recent dissertations, two were found that relate to Tai Chi and trauma. Winsmann’s (2005) paper titled *The effect of Tai Chi Chuan meditation on dissociation in a group of veterans* examined meditation and dissociation. The research hypothesized that Tai Chi

would reduce distressing psychological symptoms and would have a positive effect on reducing dissociative experiences. The study was a randomized, controlled, pretest-posttest design, which taught veterans a Tai Chi class twice a week for four weeks. The results were that participants, overall, improved on all measures but no significant differential changes between the control group and treatment group were observed. The research pointed to methodological flaws that may suggest possible reasons for the lack of statistical significance between the two groups. All participants were undergoing group and individual therapy, which could have been a factor of improvement across both groups and would have been a confounding variable to show overall significance in the Tai Chi group.

The second paper by Hill (2012) examined *Tai Chi Chuan as an adjunct treatment of trauma: An integrative literature review*. This dissertation examined the state of the literature on the treatment of PTSD and Complex Posttraumatic Stress Disorder. It looked into four mindful interventions: meditation, yoga, Chi Gung, and Tai Chi. Like this paper, it proposed that Tai Chi would reduce autonomic arousal and aid in affect regulation. In Hill's discussion and directions for future research he states: "The field is wide open for research into Tai Chi as an adjunctive treatment for PTSD" (p. 73). He suggests in operationalizing a study one should pick a single style of form to study, which this research project does. He also points to the idea that a short form of Tai Chi would make an easier entry into practice and "would be considerable savings of time and money for clinics offering Tai Chi" (p. 73). The yang short form is the style this study proposes.

PTSD, Traumatic Brain Injury, and Tai Chi

PTSD may coexist with traumatic brain injury (TBI) because brain injuries are often sustained during traumatic experiences (Bryant et al., 2009; Bryant, 2011). The intersection

between PTSD and TBI has become a major research focus in recent years. TBI entails injury to the brain due to an external force, such as from a fall or explosion. A range of brain injuries may be involved, including brain laceration, intracranial hematoma, contusion, contrecoup injury, shearing of nerve fibers, intracranial hypertension, hypoxia, anemia, metabolic anomalies, hydrocephalus, and subarachnoid hemorrhage (Bryant, 2011). There is increasing evidence that PTSD can develop following mild traumatic brain injury, or mTBI (Bryant et al., 2009; Bryant & Harvey, 1998; Middelboe et al., 1992; Ohry et al., 1996; Hickling et al., 1998; Castro et al., 2008; Greenspan et al., 2006; Harvey & Bryant, 2000; Hoge et al., 2008; Levin et al., 2001). A survey of 2525 U.S. Army infantry soldiers found that mTBI was strongly associated with PTSD several months after their return from a year-long deployment to Iraq (Hoge et al., 2008). Two recent studies of U.S. Army soldiers returning from deployment to Iraq or Afghanistan found that postconcussive symptoms were strongly associated with PTSD (Wilk, Herrell, Wynn, Riviere&Hoge, 2012; Schneiderman, Braver & Kang, 2008).

Preliminary research suggests that Tai Chi interventions may have beneficial effects in individuals with TBI. Shapira and colleagues (2001) hypothesized that Tai Chi therapy could be used in rehabilitation of TBI because of the following characteristics: (1) its slow and gradual practice, enabling the safe and balanced development of muscle tone, control, and muscular strength; (2) falls may be prevented by Tai Chi's promotion of kinesthetic sense, balance, and coordination, attributes that may improve performance of daily tasks and expand the patient's range of activities; (3) the patient takes an active part in the rehabilitation process within a holistic framework that regards the individual as a whole, physical and mental being; (4) Tai Chi therapy is performed in a relaxed, quiet, and concentrated atmosphere that tends to have a mood-stabilizing effect and reduces mental stress and frustration; and (5) Tai Chi's complex

movements can accelerate neural reorganization, thus promoting recovery. Shapira's group presented the cases of three patients who had severe TBI and whose improvements in balance and muscle tone control appeared to be accelerated greatly after starting Tai Chi therapy, even in a patient whose original brain injury had occurred decades earlier. These improvements appeared to include increased physical and mental freedom, enhanced ability to perform daily activities, and reductions in psychological stress (Shapira et al., 2001). However, because this was only a small case series, the findings only provide grounds for further exploration of the hypothesis that Tai Chi may help reduce or prevent some of the physical and psychological sequelae of TBI.

Gemmell and Leathem (2006) explored the effects of a six-week course in Tai Chi on patients with traumatic brain injury (TBI) symptoms. Eighteen men and women (nine of each gender) with various degrees of TBI (mild, moderate, or severe) were randomly assigned to either the Tai Chi group or a control group. All participants completed the Medical Outcome Scale Short Form 36 (SF-36) and Rosenberg Self-Esteem Scale (RSES) before, during, immediately after, and 3 weeks after completion of the Tai Chi course. In addition, the Tai Chi group completed the Visual Analogue Mood Scales (VAMS) before and after each class. The Tai Chi course ran twice weekly for 45 minutes over six weeks; handouts showing the names and routines (forms) taught at each Tai Chi class were provided to enable more effective practice at home. The authors reported that Tai Chi was associated with significant improvement on nearly all VAMS scores, with increases in energy and happiness, and decreases in sadness, confusion, anger, tension, and fear. The Tai Chi group's usual role activities were significantly less impaired because of fewer emotional problems than the control group; otherwise, there were no significant between-group differences on the SF-36 or RSES. Nevertheless, the study was

underpowered, and the outcome measures chosen for the study may not have been specific enough to evaluate the constructs relevant to TBI (Gemmell&Leathem, 2006).

In a single-center randomized pilot trial, Blake and Batson (2009) examined the effects of a brief Tai Chi intervention on 20 individuals with TBI. Intervention participants attended a Tai Chi session for one hour per week over eight weeks at a charity day center in the community. Control subjects took part in non-exercise-based social and leisure activities during the same period. Outcomes (self-perceived mood, self-esteem, flexibility, coordination, physical activity and social support) were assessed at baseline and post intervention using the General Health Questionnaire-12, the Physical Self-Description Questionnaire and the Social Support for Exercise Habits Scale. The two groups were comparable at baseline. There was a small but significant improvement in mood in the Tai Chi group at the eight-week follow-up assessment. Secondary analyses also identified improvements in self-esteem and mood across the study period in the Tai Chi group only. No significant differences in physical functioning were found between groups. Although the small sample size of this study renders the findings inconclusive, they may suggest that a brief Tai Chi intervention could improve mood and self-esteem for individuals with TBI. This hypothesis remains to be tested with a large-scale randomized trial.

Aside from the underpowered nature of the two pilot trials just mentioned, several limitations are evident that may have implications for future study design. First, duration and intensity of the Tai Chi interventions were limited, and the effect of long-term participation (and/or possible attrition) may be of interest. It is possible that a longer intervention period and more frequent sessions may improve outcomes. Second, it may be useful to evaluate long-term effects of participation, possibly one to two years after completion of a Tai Chi intervention. Third, the two intervention studies were limited by the use of subjective self-report outcome

measures only. It would be helpful to supplement self-report measures with performance-based outcome measures in order to extend the findings to more objective ratings of physical and psychological functioning.

This research project hypothesized that a significant reduction of trauma symptoms in the body can be affected through Tai Chi. The null hypothesis of this research project was there will be no change in trauma symptoms in the body. The independent variable or intervention was Tai Chi and education on how trauma affects the body. The dependent variable is trauma and its level was measured by using the PTSD Checklist (PCL-C). Evidence has been presented that trauma has a physical component that can be addressed through mindful physical practice. Tai Chi fits this qualification well but needs more study across a broader cross-section of trauma victims to demonstrate its effectiveness.

In conclusion, Tai Chi may have some favorable short-term psychological benefits for individuals with trauma, although the studies to date are only preliminary and the findings inconclusive. Physical and psychological outcomes in both the short and long term need to be evaluated in a large-scale randomized trial with increased frequency and duration of exercise sessions, and with both subjective and objective outcome measures. A cost-benefit analysis could also be useful given the need for supervised group sessions with a qualified Tai Chi instructor (albeit without requiring expensive equipment or a gym membership). Finally, in the follow-up observations of individuals who have participated in a Tai Chi program, it would be logical to conduct assessments that are specific for PTSD in order to see if TBI sufferers overall experience alleviation of some of the severity of their PTSD as a result of this intervention. None of the studies to date have been designed to address this question.

Summary

In summary, there is a need for research that explores methods that are noninvasive, cost effective, and work to help reduce the effect of PTSD on soldiers and the general population. There is a growing level of evidence that the emotions and the body are connected (Porges, 2001, 2004, 2011; van der Kolk, 2002, 2006). This research hopes to add to the literature of understanding on the mind-body connection by using a mindful, physical body exercise Tai Chi to help reduce PTSD symptoms.

Chapter 3: Research Method

History of Research

The prevalence rate for PTSD is 7.8% in the general population of American adults, and PTSD rates average around 38% among individuals who have been exposed to a severe trauma (Blake et al., 2000; Santiago et al., 2012). Mind-body interventions that include Tai Chi and similar intervention modalities have been shown to significantly reduce PTSD-related symptoms among adults, (Hwan, Scheider, Kravitz, Mermier, & Burge, 2013). However, the majority of these intervention studies have examined the efficacy of mind-body interventions on the reduction of PTSD symptoms in individuals, most notably military veterans, who have experienced profound traumatic events (Hwan et al., 2013). Very few studies have examined whether mind-based interventions are effective in reducing PTSD symptomatology in non-clinical samples of individuals. The purpose of this quantitative quasi-experimental three-group pretest-posttest investigation is to evaluate the effectiveness of a Tai Chi intervention on the reduction of PTSD symptoms in a community-based sample of 30 adults, ages 18 years or older, residing in Florida. This study adds to the evaluation literature on PTSD intervention literature by testing the hypothesis that trauma symptoms can be reduced by the somatic mindfulness exercise of Tai Chi. The dependent variable (DV) is PTSD and was accounted for by the Post-Traumatic Checklist (PCL-C) instrument. The independent variable (IV) had two levels: Intervention X_1 consisted of education about PTSD; Intervention $X_{1,2}$ contained group education and a Tai Chi course. It was hypothesized that after the interventions, the average score on the PCL-C of the Tai Chi group and education will be less than the average score on the PCL-C of the education group which will be less than the average score on the PCL-C of control group. The null hypothesis was there would not be any differences in the PCL-C scores between the

control group and the two groups receiving interventions. The alternative hypothesis is a reduction of PTSD symptoms as witnessed by a reduction in the PCL-C scores would be seen in the group receiving education and even a greater reduction in PCL-C scores with the group receiving both the education and Tai Chi.

Notation:

There are two independent variables, X_I and X_{I-2}

Intervention X_I = Education group on PTSD

Intervention X_{I-2} = Education group and Tai Chi course

Control group = C

Null Hypothesis $H_0 = X_{I-2} \mu \text{ of PCL-C} = X_I \mu \text{ of PCL-C} = C \mu \text{ of PCL-C}$

Alternative Hypothesis $H_a = X_{I-2} \mu \text{ of PCL-C} \leq X_I \mu \text{ of PCL-C} < C \mu \text{ of PCL-C}$

Research Method and Design

This study utilized a quantitative quasi-experimental three-group pretest-posttest research design. For this research project, a quantitative method has been chosen for several reasons. By using a quantitative research method, the researcher takes a deductive and objective approach to the research questions by using the scientific method to answer research question (Creswell, 2009). In quantitative studies, information is gathered from objective numerical data and is gleaned statistically (Creswell, 2009). A quantitative predictive method is selected for this study due to its statistical rigor, as data in this study will consist of numerical data obtained from valid and reliable surveys (Muijs, 2010; Vogt, 2007). A quasi-experimental design was used, as it cannot be a true experiment since a random selection will not be possible to obtain. At this point a random assignment is being done in order to increase the internal validity of the study.

A pretest-posttest design was used for this study, as it is widely employed in behavioral research for comparing groups and for measuring change that is a result of an experimental treatment (Dimitrov&Rumrill, 2003). The basic pre-posttest experimental format was used where one of the groups will be exposed to treatment one, the other will be exposed to treatment two with group three receiving no intervention and functioning as a true control group.

In this study, a pretest-posttest two-group (i.e., intervention versus control) research design will be used. This design can be illustrated as:

O_1	X_1	O_2
O_1	X_{I-2}	O_2
O_1	X_C	O_2

Where:

O_1 is the pretest;

The Xs are the level of the independent variable, where

X_1 is the intervention of education and group work,

X_{I-2} is education and group work with a five week Tai Chi course, and

X_C is the control condition; and

O_2 is the posttest.

Population and Sample

Intended sample

Based on a power analysis using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007), for an analysis of variance (ANOVA) with three groups, with a small effect size, $f = .02$, significance (p-value) set at $p < .05$, and power established at .80, the required sample size was 36, or 12 participants per group (see Appendix A). The researcher tried to recruit this number but was unable to obtain this desired number. A total of 30 participants were recruited and a

decision was made to proceed with the research even though the desired number had not been reached. The 30 participants were recruited from the general population of adult men and women with no special or relevant characteristics. This community-based cohort design may help generalize the findings to the greater population, thereby helping to establishing external validity of the study. Using an online random number generator (up to 30), the participants were randomly assigned to three groups of 10 participants: (a) an intervention one group (education group), (b) intervention two group (education group, and Tai Chi training), and (c) a control group (no education or Tai Chi training).

The participants were individuals who have PTSD symptoms (a score of 40 or higher) according to the PTSD checklist (PCL-C). The principal investigator was present and oversaw and supported the different aspects of this research project. Dr. Bruce Kristol, a trained clinical psychologist who has worked with in the trauma field for many years (see CV) administered the PCL-C, for both the pre and post-test as well as presenting the group education and classes. Dr. Kristol also ran the debriefing sessions after the pre-test, posttest, and at the conclusion of the research project. Two certified teachers from the T'ai Chi Foundation provided the instruction and training for the intervention group receiving Tai Chi. The principal investigator has been a member and teacher within this organization for 25 years but will not participate in the instruction of the students in this research project.

Sampling procedure

The sampling procedure was a random, purposive sample as the research is examining participants having an elevated level of PTSD symptoms. An elevated level of PTSD symptoms according to the PCL-C was required to meet the standards of this project. The recruitment process included referrals from colleagues as well as posters, flyers, internet postings and a

newspaper advertisement. Snowball referrals came from fellow PTSD colleagues who have already made contact for this research project. Participants were assigned by a random number generator computer program to one of three groups of 10. The groups were as follows: an intervention group with education on PTSD, a second intervention group with education on PTSD and Tai Chi training and then a control group that will receive no Tai Chi training or education on PTSD. Names of participants were inputted into the computer and the program did the assignment of the participant to one of the three the groups. It is hoped that this random assignment will improve the validity of the research.

The external validity is the degree that the treatment can be generalized across different populations, different settings, and different periods of time to other periods of time (Coolican, 2009). In this research project, there were no limiting participant criteria with the exceptions of (a) participants must be adults, ages 18 years or over and (b) they must have PTSD symptomatology as evidenced by their PCL-C scores. It is hoped that the above-mentioned wide range recruitment process as well as its random selection will increase the research project's external validity. The PCL-C instrument has reported a high degree of external validity and test-retest reliability (Ventureya, Yao, Cottraux, Note, &Guillard, 2002).

Tai Chi has a wide range of forms and styles (Yang long, Yang short, Wu, Sun etc.), which could have an effect on the external validity, as they are quite different in speed, postures, and accentuating softness versus hardness. The method of Tai Chi that was taught in the research project, the Yang short style created by Professor Cheng has been formalized in order to teach in a direct and specific way by The Tai Chi Foundation. This organization has a specific method of teaching that is taught to its instructors and is very specific to what and how each hour

is taught. It could, therefore, easily be duplicated or repeated. This is hoped to increase the external validity as well.

Data Collection Methods

The interested participants who contacted the researcher were told this would be a research project on how possible integrative methods may be helpful to overall health. They were given three possible meeting times that will occur at the University of North Florida, 1 UNF Dr, Jacksonville FL 32224. At these meetings the research project was explained. The researcher explained that this project would examine the possible effect of using Tai Chi and education to help with the level of trauma symptoms in their body. An acknowledgment was made that recruitment will be based on the self-report measure of having a high level of trauma symptoms. If the potential participants did not meet the criteria for the project they were still able to take a course in Tai Chi provided by the researcher. Those that did meet the criteria and were interested in being part of the project were told that they would be randomly assigned to one of three groups by a computer program. All three groups were very important for information in this project. At the end of the five weeks study all participants were given the choice to participate in either of the other programs to which they had not originally been assigned.

Issues of ethics and confidentiality as well as possible times for future meetings (if they are selected to participate) were discussed. The ethical issues discussed will take into account the Belmont Report of 1979 on *Ethical principles and guidelines for the protection of human subjects of research* (retrieved from <http://www.hhs.gov/ohrp/humansubjects/guidance/belmont.html>). A detailed description of ethical issues that was discussed in meeting is in Ethical Protection of Participants section.

Data Management

The researcher and the chair of her committee, Dr. Sukal, are the only persons who have access to the data and information about this research project (including signed: confidential and consent forms). Using a list of numbers, the researcher assigned each participant an ID number to help with keeping confidentiality. This number is the identification of participants on all data. The researcher has this list in a locked safe separate from study data, which is in a locked file cabinet. The information will be kept for five years according to the APA guidelines.

Measures

Post-Traumatic Stress Checklist for Civilians (PCL-C; Weathers, 1993)

The Post-Traumatic Stress Checklist (PCL), developed by Weathers, Litz, Herman, Huska, and Keane (1993), was used to measure PTSD symptomatology pre- and post-intervention. The PCL-C is a 17-item self-report measure aligned with the DSM-IV symptoms that are used to diagnosis PTSD. Participants are asked to respond to the degree that they are experiencing post-trauma symptomatology by using a Likert-type response scale where 1 = not at all, 2 = a little bit, 3 = moderately, 4 = quite a bit, and 5 = extremely. The scale is computing by summing all items. Scale scores for the total PCL-C severity score range from 17 to 85 points, with a higher score denoting higher PTSD symptomatology. A score of 40 or higher indicates a significant degree of PTSD symptomatology. This study used the score of 40 for its cut off for qualification for this research project.

The initial psychometric data of the PCL was derived from a study by Norris and Hamblen (2003) with Vietnam veterans. In this study, the inter-item reliability was excellent, Cronbach's alpha = .97, and the three-day test-retest reliability was .96 (Norris & Hamblen, 2003). The strong inter-item and inter-rater reliability of the PCL-C has been documented in additional studies (Conybeare, Behar, Solomon, Newman, & Borkovec, 2012; Ventureya et al.,

2002). The PCL-C has demonstrated sound construct validity with the Clinician Administered PTSD Scale (CAPS), with $r = .93$ (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996) and with the Impact of Events scale, $r = .90$ (Conybeare et al., 2012).

Data Analysis Procedures

At the completion of the collection of the data, PCL-C data was manually entered into an SPSS 21.0 data file. Cases were reviewed for any missing data, and those cases with over 25% of the data missing removed. Data was imputed via linear interpolation for data missing at random. Items on the PCL-C (pretest and posttest) were analyzed as to their inter-item reliability, with an alpha of .70 or higher deemed to be good (Muijs, 2010). The scales were computed by summing items. Scale data will be examined for outliers as well as any violations of assumptions for analysis of variance (Mixed design ANOVA), including normal distribution of scale scores, independence of errors, and homogeneity of variance (Muijs, 2010). The sphericity assumption is important and Mauchly's test for sphericity will be used to see if the assumption has been met (Vogt, 1999).

To test the study research question, a between-groups within-groups ANOVA was conducted. An ANOVA is the analysis of two variances, or to be more specific, it is the ratio of two variances. The within-groups analysis of the between-groups within-groups ANOVA will determine statistical significant pretest to posttest for all groups (Vogt, 1999). The between-groups analysis will determine posttest differences in PCL-C scores across the two intervention groups and the control group. Significance will be determined by the ANOVA model F-value and corresponding significance (p) value, with significance set at $p < .05$. A partial η^2 will be used to assess effect size (i.e., proportion of variance in the dependent variable that is explained by the independent variable) (Muijs, 2010). The covariates of gender, duration of PTSD, age

and differences amongst causes of PTSD (war, natural disaster, abuse etc.) will hopefully be considered in a future project but because of the lack of ability to obtain a large enough sample size to power an analysis of a covariate ANCOVA (416 participants), it will not be able to be fully analyzed.

Ethical Protection of Participants

Tai Chi is a gentle, low-impact, and well-studied physical exercise; however, this research project endeavored to take many precautions to protect the participants from potential physical and emotional injury. A trained clinical psychologist, Dr. Bruce Kristol, who has worked with the trauma population for many years, was present during all aspects of this research project including: the first meeting, administering the pre and posttests, the educational classes and all Tai Chi classes as well as all the debriefing sessions.

A release form (see Appendix B and C) was signed by the participants and they were required to obtain a physician's approval to determine whether they were physically and mentally capable of participating in the class. The release form addressed confidentiality as well as psychological considerations. Having all test results assigned a number will help protect the privacy of the participants and maintain anonymity. Results and the reference number are secured in a locked safe, accessible only to the researcher.

The ethical issues that will be discussed at the preliminary meeting will that take into account the Belmont Report of 1979 on *Ethical principles and guidelines for the protection of human subjects of research* (retrieved from:

<http://www.hhs.gov/ohrp/humansubjects/guidance/belmont.html>).

Confidentiality

The participants were given a written form about confidentiality that they had to sign in order to participate in the study. The confidentiality form stated that all participants as well as instructors are required to keep confidential any information shared within the group. This was to ensure safety and trust within the group. At the end of each session, participants were reminded of confidentiality of the experience they have just participated in and the form they signed (see Appendix C for consent form). They were also informed that only the researcher will keep a record of the participants that took part in the project. The participants were assigned an anonymous number for all uses in the preparation and dissemination of materials based on the project. Anonymity of the participants was and is important. All participants were anonymized in all testing. Only the researcher has a record of the participants' real names for the purposes of evaluating pre-test and post-test change. A codebook matching the real names and numbers is being kept in a secure file, in line with data protection requirements. All electric files will be password protected.

Withdrawal

Participants had the right to withdraw at any time that they felt that they needed to do so. The participant also has the right to withdraw their data from the study as well.

Debriefing

Special attention and care was given to the debriefing of the participants. Dr. Kristol was in charge of the three scheduled de-briefing sessions. Cooligan (2009) defines debriefing as “informing participants about the full nature and rationale of the study they’ve experienced, and attempting to reverse any negative influence” (p. 612). McShane, Davey, Usher, and Sullivan (2014) discussed the importance of the debriefing process in imparting knowledge and in “creating awareness, educate, and even teach skills to participants” (p. 1).

The debriefing process for this research incorporated both of the above concepts of debriefing in an attempt to meet the ethical considerations of this research project, as well as using the opportunity to create more awareness while continuing to educate the participants.

There were three debriefing sessions scheduled. Dr. Bruce Kristol, a licensed psychologist with an expertise in the trauma field, conducted all three debriefing sessions along with the researcher.

The debriefing sessions:

I. Debriefing #1

This session was at the end of the first meeting after participants took the PCL-C test and just before they went home. The purpose of this debriefing was to make sure that the participants were comfortable and to answer any outstanding questions about the research project.

The debriefing was informal. Questions were open ended.

Questions asked:

Are there any questions?

How are you feeling right now?

Are there any concerns?

What would you like to know more about?

The participants were given the researcher's name and phone number along with Dr. Kristol's to call if they felt that they had more questions or need of support. A list of the mental health practitioners and agencies telephone numbers and or websites was provided for them to call, if needed. This debriefing did not concentrate as much on knowledge transfer about the

research project as the next two did, as this was only the beginning of study. The participants were thanked for their participation.

II. Debriefing # 2

This debriefing was after the final class/session – at the end of the five weeks. It was after the final test PCL-C had been taken.

Open-ended questions that were asked:

How do you feel right now?

Do you have any questions?

Are there any concerns?

What would you like to know more about?

What did you find the most difficult about classes?

What did you like the most?

Do you feel you have learned something from the classes?

Do you have any suggestions?

In the Tai Chi group, theater was implemented, as recommended by McShane et al. (2014). The researcher acted as a student and the participants acted as Tai Chi teachers. The participants instructed the researcher on ways to relax her body as she goes through the Tai Chi form. The idea was to reinforce what they have learned; the researcher exaggerated tenseness in body and then implemented their instructions of relaxation. Example: Shoulders were pulled up towards ears and very tense. Participant said to relax shoulders (often said in Tai Chi classes), researcher relaxed her shoulders. The idea was to be playful and have fun while reinforcing relaxation techniques. Print media of information about Tai Chi was given out (See Tai Chi booklet enclosed).

Participants were again given the researcher's name and phone number along with Dr. Kristol's to call if they feel that they have more questions or need of support. A list of the mental health practitioners and agencies telephone numbers and or websites was provided for them to call, if needed. The participants were thanked for their participation.

III. Debriefing #3

A third optional debriefing was offered to participants as an effort to promote more knowledge transfer (KT), education, and awareness. This session was scheduled approximately four months after the last class. This allowed for the participants of the different groups that did not receive the Tai Chi and education (and wanted to) to complete the courses. The data had been analyzed at this time. The full results of the research project data were presented to the participants.

Print media of the statistics from the research was given and explained in very simple non-academic style so that all could understand. Print media of information about Tai Chi was given out also (See Tai Chi booklet enclosed).

Open-ended questions were asked again.

Such as:

Are there any questions?

How are you feeling right now?

Are there any concerns?

What would you like to know more about?

What did you find the most difficult about classes?

What did you like the most?

Do you feel you have learned something from the classes?

Do you have any suggestions?

What would you like to know more about?

Theater was implemented again (see above).

The participants were given the researcher's name and phone number along with Dr. Kristol's to call if they felt that they had more questions or need of support. A list of the mental health practitioners and agencies telephone numbers and or websites was provided for them to call, if needed. The participants were thanked for their participation.

Safety and protection of participants

The safety and protection of the participants was very important for this research project; therefore, a list of mental health practitioners and agencies telephone numbers that they may call in case of need was provided. A clinical psychologist who has worked with trauma for many years was present at all meetings and classes. Participants that attended the introduction meeting were explained about the project and the informed consent form. Those that were comfortable with the research project including the meeting times were then asked to turn in their doctors permission slip. After turning in their medical permission slip they were given the informed consent (see Appendix A) informing them of their ethical rights as well as confidentiality form (see Appendix C) to sign. Once these forms were returned, the participants took the PCL-C with their assigned number instead of name being on the form so as to help keep confidentiality.

A debriefing session was held at the end of this session for extra protection of the participants. The researcher then evaluated the test to see if the participant has a high enough level of PTSD symptoms according to the guidelines of the PCL-C checklist. The participants who had a score of 40 or higher on the PCL-C were randomly assigned to study condition categories. If a participant scored a high score on the PCL(C) (above 75 points), where it may

have cause of concern for participant safety, a written clearance from the clinical psychologist was be required. One participant met this condition but was given written clearance by psychologist.

The two intervention groups had scheduled intervention meeting times. Intervention X_I (education, group experience) met for two hours on week 1 and then were asked to meet again in four weeks (week 5). On week 5, the X_I group had a one-hour discussion and debriefing time as well as taking the post-test of the PCL-C. Intervention $X_{I,2}$ (education, group experience, and Tai Chi course) also met for two hours (as above group) on week 1. They were given another meeting time of an hour and a half to meet later in the week for the beginning of the Tai Chi course. The intervention $X_{I,2}$ group 2 continued to meet twice a week for one and half hours through week 5. The week 5 meeting for this group was identical to group 1, and they were given the PCL-C post-test instrument and then debriefed. The control group was called and told that they have been selected to start the research project in five weeks. The control group was given the PCL-C test again in five weeks to access and evaluate their change with no intervention at all. They will also, like the last two groups, have time for debriefing any issues that could have come up for them. They were then given the option of taking the Tai Chi and education course. That started the following week. Some of the control group and education group did attend the Tai chi classes.

Internal validity is the degree to which the treatment makes a difference within the experimental setting. Things that can affect internal validity and that were examined such as history of participants during this time period were looked at. A control group was implemented to help account for this variable. The PCL-C has been selected as the instrument of measure because of it excellence in dealing with pretest effects (Ventureya et al., 2002). The openness of

the selection process as well as the random assignment of the groups hopefully helped account for the issue of differential selection participants. Mortality and maturation should not have been influencing factors due to the research being only a five-week intervention. The researcher kept notes on factors that occurred during the research project on the internal and external validity of the design.

There are many ethical issues to consider in trauma research. Becker-Blease's (2007) article on ethical trauma-focused research was used as a guide for accommodating participants with a PTSD diagnosis, as this guide addresses such topics as whether traumatized participants can provide a true informed consent and issues of reinjuring or reactivating the original trauma. As mentioned before, a list of mental health practitioners and agencies telephone numbers that they may call in case of need was provided. The researcher arranged ahead with these health practitioners and agencies to be on call in case of emergency. A trained clinical psychologist, whose specialty is trauma work, was hired to be present at all meetings and classes as well. The electronic data file is secured on a computer accessible only to the researcher. There is no identifying information about the participants included in the dataset, as the tests were coded numerically. IRB approval was obtained before any data was collected.

This research project had concerns over minimizing harm and maximizing benefits for its participants. Newman and Kaloupek (2004) looked at risk and benefits of trauma focused research studies and made several recommendations that this research project incorporated. According to the authors, it is important to devise protocols to minimize potential risks. They stated, "carefully enumerating the issues and clarifying potential risks and benefits makes it easier to generate options aimed at reducing risk and increasing benefit" (p. 385). The authors also point to the fact that one of the concerns that IRBs often have is the potential for emotional

harm due to the recall of a traumatic event. In researching this concern they found that in all studies a small subset of the individual that participated had “some degree of marked or unexpected upset” (p. 390). The questions that need to be addressed are how the upset compares to the distress that the individual normally feels in their daily life, and also the possibility that the research project itself is intensifying their typical symptoms or creating symptoms that are uncharacteristic for them. A clinical psychologist, whose specialty is trauma, was present at all of the classes and testing to be a resource for participants as precautionary protective measure. He also provided debriefing sessions at the end of the first meeting (after taking the PCL(C) instrument) and at the conclusion of the research project.

A content analysis done by Newman and Kaloupek revealed “remembering the past” was the main reason for becoming upset but conversely it was also identified as “the means identified for achieving insight, the most cited benefit” (p. 392). They recommend that the informed consent must acknowledge that one’s participation may result in distressing emotions during and after the protocol therefore the potential participants can make an informed decision. This research project’s consent form makes this acknowledgement.

Risks and Benefits

The list of possible risks reported by Newman and Kaloupek (2009) to help develop research protocol and its relevance to this research project are examined below.

1. Physical harm – Tai Chi is a gentle, low impact form of movement and has been well studied as a health oriented form of movement.
2. Legal action – no foreseen issues such as criminal/civil proceedings, research being subpoenaed, mandated reporting of abuse or deportation/immigration as this project does not

seek information during its course of time that would require such information from the participant.

3. Psychological/mental risk - Issues of how the body responds when stressed or traumatized will be discussed. No direct recall of the participant's traumatic events was asked for or solicited by researcher to help minimize this risk factor. A psychologist was present during testing and all classes as well as a list of mental health practitioners and agencies' telephone numbers was given in case of need by the participants if psychological or mental issues arise.
4. Social risk - privacy and confidentiality was strictly adhered to by researcher and teachers of Tai Chi as well as being asked by fellow participants as witnessed by their signed confidentiality form.

This research project has potential to maximize almost all of the possible benefits reported by Newman and Kaloupe (2009) as examined below.

1. Learning/insight – It is hoped that the learning of a mindful exercise tool such as Tai Chi helped in reducing trauma-related reactions.
2. Medical/ mental health services - A list of mental health practitioners and agencies' telephone numbers was given in case of need by the participants as well as having a trained psychologist present to be support during meetings, classes and testing.
3. Empowerment - The learning of a martial art as well as learning more information about one's body's reaction to trauma could be helpful in one's feeling of self-empowerment.
4. Altruism - Feeling worthwhile by participating - Participating in a research program that may offer a potential benefit to others with PTSD may support the participants' feelings of being of help to others.

5. Kinship with others - The bi-weekly classes in Tai Chi as well as the education about the body's reactions may create a sense of connection and kinship among the different groups.
6. Receiving favorable attention by Tai Chi teachers, psychologist, and researcher.
7. Scientific knowledge/outcomes were hopefully increased by this quantitative research project.
8. Foster valuable relationships – It was hoped that the participants would form a relationship to be of support for each other as well as having access to future classes in Tai Chi from teachers. This did seem to be the case for several of the participants as they are still talking classes and meet together after classes often.
9. Gain resources - Several resources were hoped to be gained by participants such as being able to do Tai Chi to help relax and regulate their body responses. Cognitively being able to understand more about their body's reaction through education. The list of mental health practitioners and agencies' telephone numbers will be a resource as well.
10. Gain recognition - It was hoped that by learning a method that can be helpful to relax and calm one's nervous system the participants can be leaders in their community and encourage and help others to receive the same training. If program is successful it will be offered free of cost over the next few years to other participants with high PTSD scores.

The assessment of the above risks and benefits of this research project demonstrates the possibility of creating benefits for the participants by participating in this research project. It also hopefully, demonstrates the concern and the examination of the risks by the researcher, as to help minimize any possible harm to participants that participate in this research project.

Summary

The primary aim of the proposed study is to examine the effects of a brief Tai Chi exercise intervention on individuals with PTSD. The researcher employed a quasi-experimental

pretest posttest method with random assignment to conditions to determine whether PTSD symptomatology is reduced over time and by intervention. Significant PTSD symptom reduction as measured by the PCL-C would support the hypothesis that individuals with PTSD experience measurable improvements in their psychological well-being following five weeks of Tai Chi training.

Chapter 4: Results

Introduction

The purpose of this quantitative pretest-posttest quasi-experimental research study was to examine the effectiveness of a Tai Chi intervention in reducing PTSD symptomatology among a community-based cohort of adults experiencing PTSD. The study hypothesis was that participation in the mindfulness exercise of Tai Chi would result in reduced PTSD symptomatology. The instrument used to measure PTSD symptomatology was the Post-Traumatic Stress Checklist (PCL-C) developed by Weathers et al. (1993). Study participants were randomly assigned to one of three study conditions: (a) an Education Only intervention group; (b) an Education and Tai Chi intervention group; and (c) a control group. Two statistical analyses were used to test the study hypothesis. The first analysis, a one-way ANOVA, was conducted to examine if significant mean PCL-C pretest-to-posttest change score differences emerged between participants in the three study conditions. The second analysis was a one-way ANCOVA, controlling for pretest PCL-C scores, which was used to assess if there were significant posttest mean PCL-C score differences between participants in the three study conditions.

The purpose of this chapter is to provide the results of this study. This chapter opens with a brief summary of the study participants, including the initial and final sample of participants. This summary is followed by descriptions of the two interventions, including their length, number of sessions, structure, and related information. Descriptive information on the PCL-C is then examined. The chapter continues with a section on the testing of assumptions for ANOVA/ANCOVA. The chapter ends with a presentation of the results from the one-way ANOVA and one-way ANCOVA statistical analyses conducted for hypothesis testing. Tables and figures augment the results.

Sample

Participation in the study was determined by one criterion: participants had to have scored a 40 or higher on the PCL-C, which was indicative of a clinical diagnosis of PTSD (Weathers et al., 1993). The initial sample of participants recruited for the study was 30. Participants were randomly assigned to one of three conditions: (a) the Education Only intervention group ($n = 10$), (b) the Education and Tai Chi intervention group ($n = 10$), and (c) the control group ($n = 10$). However, one participant in each of the three study conditions was disqualified and her/his data removed from analyses. In the Education Only intervention group, one participant showed *content nonresponsivity*, that is, he/she answered the PCL-C items “without regard to item content” by answering each item with a four on the pretest and a five on the posttest (Meade & Craig, 2012, p. 437). In the Education and Tai Chi group, one participant did not meet the study criteria as indicated by PCL-C pretest and posttest scores that were less than 40. A participant in the control group did not complete the posttest PCL-C. The study was conducted with a total of $N = 27$ participants, with nine participants in each of the three study conditions. The random assignment of participants to conditions precluded the need to control for participant demographic variables.

Descriptions of Study Interventions

A log of what occurred in classes is presented in Appendix G, attendance and detailed description of material taught is described.

Descriptive Statistics: Post-Traumatic Stress Checklist (PCL-C)

The construct under examination in this study was PTSD symptomatology, which was assessed using the PCL-C as developed by Weathers et al. (1993). Descriptive statistics were calculated for the pretest and posttest PCL-C mean scores and the PCL-C change score with the entire sample of 27 participants. Results are presented in Table 1. The pretest mean score of the

PCL-C was 52.70 ($SD = 8.44$). At pretest, the PCL-C scores ranged from 40.00 to 70.00, indicative that all participants had clinical levels of PTSD symptomatology. At posttest, the mean score of the PCL-C decreased to 44.56 ($SD = 11.31$) as did the range of scores (i.e., 24.00 to 62.00).

To determine if participants in each condition improved or worsened in their PTSD symptomatology upon completion of the study interventions, PCL-C change scores were computed by subtracting the PCL-C pretest score from the PCL-C posttest score. A lower PCL-C change score indicated lower levels of PTSD symptomatology. The overall mean PCL-C change score was $M = -8.15$ ($SD = 10.74$), which indicated an overall reduction of PTSD symptomatology. The PCL-C change scores ranged from -32.00 to 14.00. A review of the data revealed that the participant with the score of -32.00 was in the Education and Tai Chi intervention group while the participant with the score of 14.00 was in the control group.

Table 1

Descriptive Statistics: Pretest and Posttest PCL-C Scores^a and PCL-C Change Score^b (N = 27)

	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Z_{skewness}</i>	<i>α</i>
Pretest PCL-C	52.70	8.44	40.00	70.00	1.62	.75
Posttest PCL-C	44.56	11.31	24.00	62.00	-0.37	.88
PCL-C Change Score	-8.15	10.74	-32.00	14.00	-1.00	N/A

Note. M = mean; SD = Standard Deviation, Min = Minimum score; Max = Maximum Score; $Z_{skewness}$ = Skewness Z score; α = Cronbach's alpha. ^a The possible range of scores for the PCL-C is 17.00 to 85.00. ^b The PCL-C Change Score was computed by subtracting the PCL-C pretest score from the PCL-C posttest score.

Testing Assumptions of ANOVA/ANCOVA

Every parametric statistic has assumptions that must be met in the data for the results to be considered sound and reliable (Garson, 2012). ANOVA/ANCOVA analyses have three primary assumptions: (a) the dependent variable, measured using a ratio or interval scale, displays sound inter-item reliability; (b) scores on the dependent variable are normally distributed; and (c) the variance of the dependent variable is similar across independent variable conditions, called *homogeneity of variance* (Garson, 2012).

To address the first assumption of sound inter-item reliability, Cronbach's alphas were calculated for the pretest and posttest PCL-C scales. Cronbach's alphas between .70 and .80 are considered good, those between .80 and .90 are considered very good, and Cronbach's alphas

over .90 are considered excellent (Garson, 2012). The PCL-C at pretest demonstrated good inter-item reliability, with a Cronbach's alpha of .75. The PCL-C had a Cronbach's alpha of .88 at posttest, considered to be very good. Multivariate normality, or normality of the distribution of scale scores of the dependent variable(s), can visually represented by histograms. The distribution of the pretest and posttest PCL-C scale scores and the PCL-C change scores are presented in Figures 3 through 5.

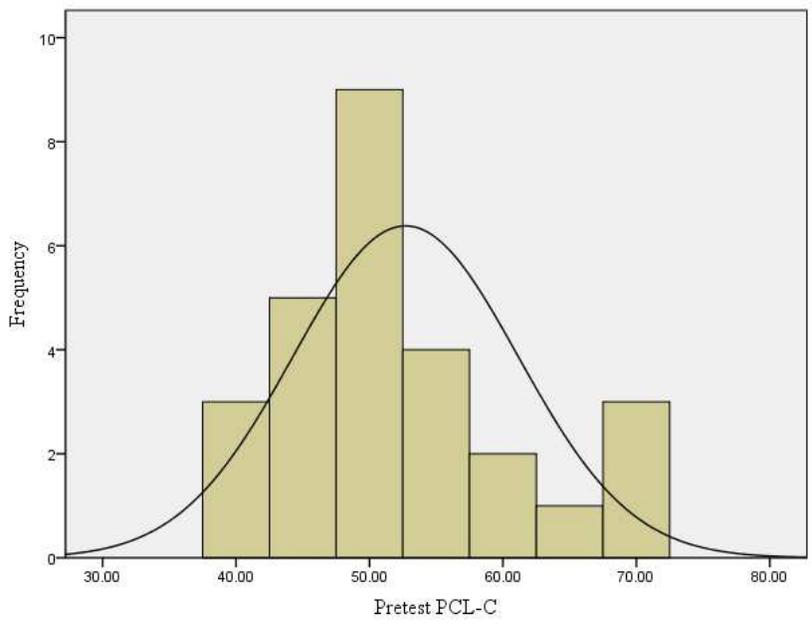


Figure 3. Pretest PCL-C distribution of scale scores.

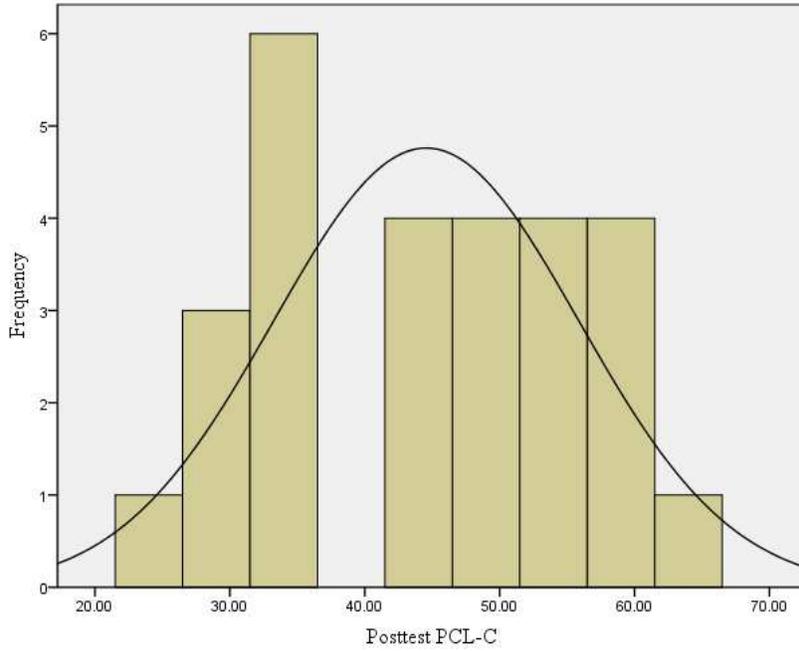


Figure 4. Posttest PCL-C distribution of scale scores.

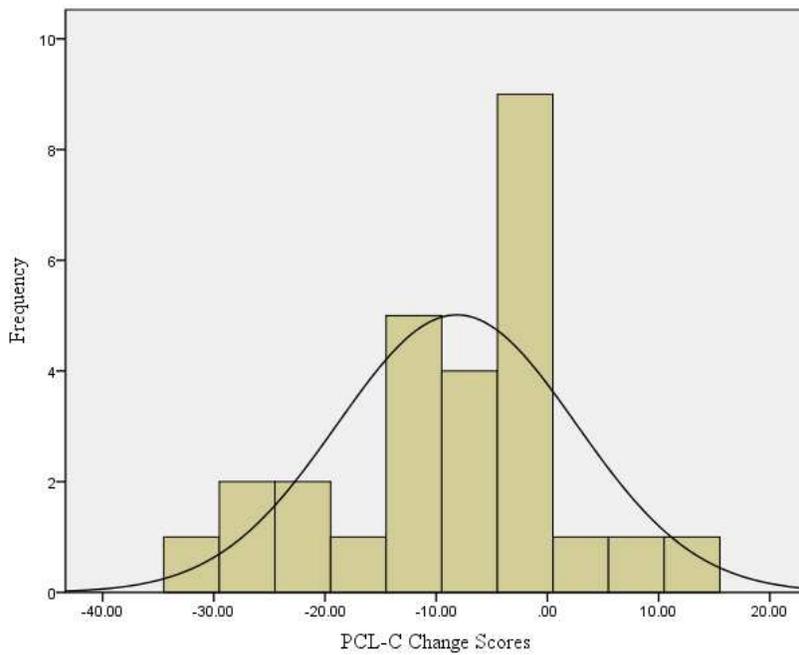


Figure 5. Distribution of PCL-C change scores.

Table 2 below gives the descriptive information for all three conditions (groups). This information further indicates that the Education and Tai Chi condition was where the greatest significance was found.

Table 2

Descriptive Statistics: Pretest and Posttest PCL-C Scores^a and PCL-C Change Score^b by Study Groups (N = 27)

	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Z_{skewness}</i>	<i>α</i>
Pretest PCL-C						
Education Only	49.33	3.87	42.00	54.00	-1.95	.71
Education & Tai Chi	57.67	8.93	47.00	70.00	0.44	.79
Control	51.11	9.66	40.00	69.00	1.00	.74
Posttest PCL-C						
Education Only	45.11	9.12	28.00	57.00	-1.10	.83
Education & Tai Chi	39.56	13.16	24.00	61.00	1.09	.93
Control	49.00	10.43	31.00	62.00	0.95	.89
PCL-C Change Score						
Education Only	-4.22	8.03	-23.00	6.00	2.33	N/A
Education & Tai Chi	-18.11	8.49	-32.00	-9.00	1.09	N/A
Control	-2.11	8.27	-14.00	14.00	0.66	N/A

Note. M = mean; SD = Standard Deviation, Min = Minimum score; Max = Maximum Score; $Z_{skewness}$ = Skewness Z score; α = Cronbach's alpha. ^a The possible range of scores for the PCL-C is 17.00 to 85.00. ^b The PCL-C Change Score was computed by subtracting the PCL-C pretest score from the PCL-C posttest score.

Analysis for Hypothesis Testing

The hypothesis of this study was that individuals with PTSD who participated in a five-week intervention that centered on the mindfulness exercise of Tai Chi would experience measurable improvements in their psychological well-being, in comparison to individuals with PTSD who participated in a five-week Education Only intervention and individuals with PTSD who participated as a control group. Two analyses were conducted to address the study hypothesis. The first analysis was a one-way ANOVA that assessed if mean PCL-C change scores were significantly different between participants in the three study conditions. The second analysis was a one-way ANCOVA, controlling for pretest PCL-C scores, which examined if significantly different mean posttest PCL-C scores emerged between participants in the three study conditions.

To address the issue of small sample sizes per group and overall, bootstrapping was used. Bootstrapping involves resampling and replication of the data to derive a more accurate estimate a population distribution, and it can be used when data meet statistical assumptions in data sets with small sample sizes (Konietschke&Pauly, 2014; Singh &Xie, 2014). While bootstrapping can enhance the robustness of the statistical analysis, it does not improve statistical sensitivity to multiple testing (Konietschke&Pauly, 2014 Singh &Xie, 2014). Multiple statistical tests can increase the likelihood of committing a Type I error, or stating that results were significant when in fact they were not (Armstrong, 2014). To reduce the probability of committing a Type I error, a Bonferroni correction was utilized to adjust the significance (p) value (Armstrong, 2014). A Bonferroni correction was calculated by dividing the significance level, $p < 0.05$, by the number of statistical tests performed (Armstrong, 2014), which in this study were two. The adjusted significance (p) value was $p < 0.025$.

Results

Results from the One-way ANOVA

The first analysis for hypothesis testing was a bootstrapped one-way ANOVA comparing mean PCL-C change scores across the three intervention conditions. Results from the bootstrapped one-way ANOVA, presented in Table 3, documented significant differences in mean PCL-C change scores across intervention conditions, $F(2,24) = 9.96, p = .001, \eta_p^2 = .45$.

Table 3

One-Way ANOVA: Study Conditions and PCL-C Change Scores (N = 27)

<i>Source</i>		<i>F</i>	<i>Df</i>	<i>P</i>	η_p^2	
	<i>PCL-C Change M</i>	<i>PCL-C Change SD</i>				
Study Condition			9.96	2,24	.001	.45
Education Only	-4.22	8.03				
Education and Tai Chi	-18.11	8.49				
Control	-2.11	8.27				

A Tukey *post hoc* test determined that individuals who participated in the Education and Tai Chi intervention group had a significantly greater reduction of PTSD symptomatology, as indicated by a lower mean PCL-C change score ($M = -18.11, SD = 8.49$), than did participants who participated in the Education Only intervention group ($M = -4.22, SD = 8.03$) and participants in the control group ($M = -2.11, SD = 8.27$), upon completion of the study (see Figure 6).

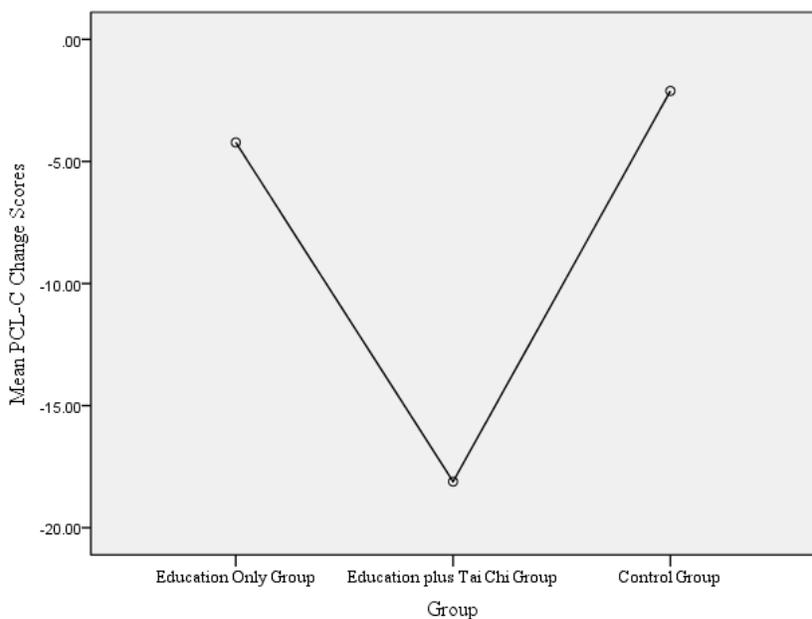


Figure 6. Mean PCL-C change scores across study conditions.

Results from the One-way ANCOVA

A one-way ANCOVA, controlling for pretest PCL-C scores, was the second analysis conducted for hypothesis testing. The results from the one-way ANCOVA are presented in Table 4. The corrected model, which included both the pretest PCL-C score covariate and the independent variable of study condition, was significant, $F(3, 23) = 7.97, p = .001, \eta_p^2 = .51$, a large effect size. As the corrected model includes both the covariate of pretest PCL-C scores and the independent variable of PTSD intervention group, results were examined for both variables. The pretest PCL-C scores were significantly associated with posttest PCL-C scores, $F(1, 23) = 18.19, p < .001, \eta_p^2 = .44$, a large effect size.

Table 4

One-Way ANCOVA: Study Conditions, Controlling for Pretest PCL-C Scores, on Posttest PCL-C Scores (N = 27)

<i>Source</i>			<i>F</i>	<i>Df</i>	<i>P</i>	η_p^2
	<i>Posttest</i>	<i>Posttest</i>				
	<i>M</i>	<i>SD</i>				
Corrected Model			7.97	3,23	.001	.510
Pretest PCL-C			18.19	1,23	< .001	.442
Study Condition			7.44	2,23	.003	.393
	Education Only	45.11	9.12			
	Education and Tai Chi	39.56	13.16			
	Control	49.00	10.43			

The one-way ANCOVA results for the independent variable of study condition on posttest PCL-C scores were significant, $F(1,23) = 7.44$, $p < .003$, partial $\eta^2 = .393$, a large effect size. Results supported the study hypothesis (see Figure 7). The participants in the Education and Tai Chi intervention group had a significantly lower posttest PCL-C mean score ($M = 39.56$, $SD = 13.16$) than did participants in the Education Only intervention group ($M = 45.11$, $SD = 9.11$) and participants in the control group ($M = 49.00$, $SD = 10.43$).

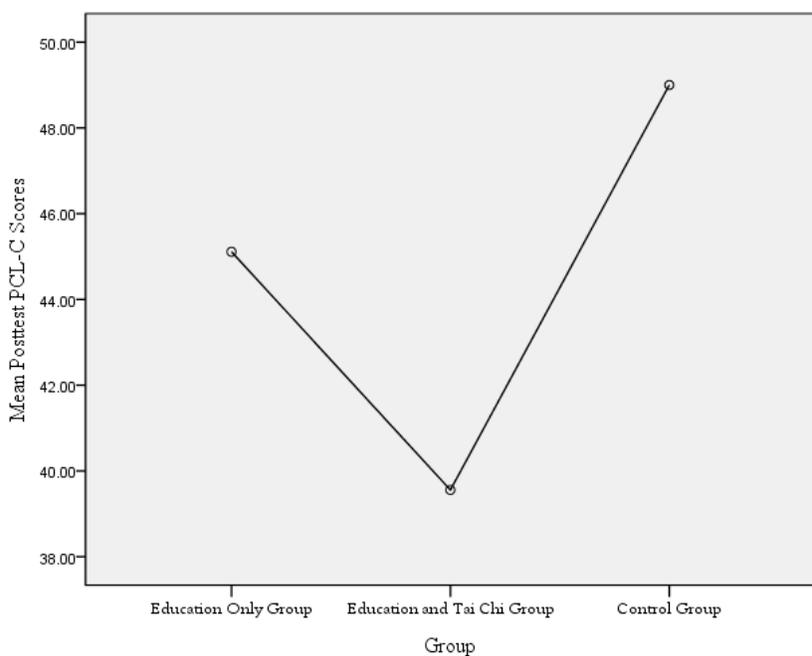


Figure 7. Posttest PCL-C mean scores by group.

In summary, both the results from the one-way ANOVA and from the one-way ANCOVA indicated that individuals who participated in the Education and Tai Chi intervention reported significantly reduced PTSD symptomatology in comparison to those who participated in the Education Only intervention and the control group. These results show promise with regard to the efficacy of a somatic mindfulness-based intervention in reducing PTSD symptomatology among individuals with PTSD. The next chapter will elaborate on the study's conclusions, relating them to previous research topics as well as recommendation for future research.

Chapter 5: Discussion

Introduction

PTSD, with a prevalence rate of 6% to 8% in adult men and 10% to 20% in adult women in America, is a serious mental health issue and the only mental health disorder in which its diagnosis depends on the presence of a factor – a traumatic event -- external to the individual (Greenberg, Brooks, & Dunn, 2015). PTSD often negatively impacts individuals' health, quality of life, and social relationships and can ultimately incur numerous costs to society, including considerable fiscal and human resources and time spent on the development and implementation of treatments for health conditions resulting from PTSD (Greenberg et al., 2015; Seedat, Lochner, Vythilingum, & Stein, 2006). PTSD interventions that focus on enhancing individuals' coping styles and cognitive skills have been shown to be effective low-cost initiatives that often result in improved health, mental health, and quality of life outcomes among individuals with this disorder (Cukor, Spitalnick, Difede, Rizzo, & Rothbaum, 2009).

The purpose of this chapter is to elaborate on study findings. The chapter opens with a discussion of issues as they pertain to study methodology, participants, and data collection procedures. The results of the study are summarized and then considered in light of the previous research on the topic(s). After results are reviewed, implications for practice and recommendations for future research are summarized. The chapter ends with a review the study's weaknesses and strengths.

Review

Study Participants and Data Collection Procedures

The purpose of this study was to determine if participation in a Tai Chi intervention was effective in reducing PTSD symptomatology among adult community members. To participate in the study, individuals had to meet two study criteria: (a) they were at least 18 years of age, and

(b) they had a PCL-C score of 40 or higher, indicating presence of PTSD. A total of 30 adults were recruited from the general population and were randomly assigned to one of three conditions: (a) Education only, where participants received information on the neurobiology of PTSD, (b) Education plus Tai Chi, where participants engaged in both types of interventions, and (c) control, where participants received no education or Tai Chi training. The PTSD Checklist (PCL-C) was used to evaluate the level of PTSD symptomatology in each of the participants, with participants taking the PCL-C immediately before and after the intervention.

Conclusions Drawn from Study Results

In this study, it was posited that participation in a mindfulness-based Tai Chi intervention in comparison to education-only and control conditions would result in significant reductions of PTSD symptomatology among a community sample of individuals identified as having PTSD. The intervention of Tai Chi was the independent variables. PTSD symptomatology, as measured by the PCL-C, was the dependent variable. The randomization of participants to conditions precluded the need to include and test for demographic covariate effects.

Two statistical analyses were performed to test for intervention effects: a one-way ANOVA to assess group differences on PCL-C change scores and a one-way ANCOVA, controlling for pretest PCL-C scores, that examined posttest PCL-C scores across the three groups. Bootstrapping, a resampling and replication data technique, was used to offset the small sample size in both analyses. A Bonferroni correction, which adjusted the significance (p) level to $p < 0.025$, was used to reduce the likelihood of a Type I error that is more likely to occur when numerous statistical tests are performed (Armstrong, 2014).

One-way ANOVA: Results

In the first analysis, a one-way ANOVA, PCL-C change scores were analyzed across the three study conditions. PCL-C change scores were indicators of improvement of PTSD

symptomatology from pre- to post-intervention, and a *negative* PCL-C change score indicated a reduction in PTSD symptomatology from pre- to post-intervention. Results from the one-way ANOVA, with the PCL-C change score as the dependent variable, showed that individuals in the Education and Tai Chi intervention reported significantly reduced levels of PTSD symptomatology in comparison to the Education Only intervention participants and participants in the control group. This finding suggested that the Tai Chi intervention was effective in reducing pre- to posttest PTSD symptomatology among adults with PTSD.

One-way ANCOVA: Results

Results from the one-way ANCOVA, controlling for pretest PCL-C scores, showed that, at post-intervention, participants in the Education and Tai Chi intervention had a significantly lower posttest PCL-C mean score in comparison to participants in the Education Only intervention and control group conditions. This finding suggested that the Tai Chi intervention was effective in reducing posttest PTSD symptomatology among adults with PTSD.

Results from this study were very promising in supporting the idea that the Tai Chi intervention was most effective in reducing PTSD symptomatology. The significant differences in participants' PCL-C scores between the Education and Tai Chi intervention and the Education only intervention documented that the program influencing PTSD symptomatology was the Tai Chi component of the intervention. Participants in the Education and Tai Chi intervention had significantly lower PCL-C posttest scores than did participants in the Education Only and control conditions. This finding suggested that the Education Only condition did not confer PTSD symptom reduction benefits any more than the control condition did.

Study Conclusions

Comparisons to Previous Studies

In response to the epidemic of PTSD among soldiers returning from the front lines, national health, PTSD, and military organizational leaders have increasingly advocated for the implementation and evaluation of effective PTSD treatments, including mindfulness-based Tai Chi interventions for not only members of the military but the general public as well (Greenberg et al., 2015; Wisco, Marx, & Keane, 2012). The empirical examination of effective treatments for PTSD have documented numerous health and mental health benefits of Tai Chi interventions among diverse groups of participants, including adult survivors of child abuse, torture, and/or government persecution (Dunleavy & Slowik, 2012; Goodyear-Brown, 2011; Jaranson & Quiroga, 2012); individuals with health conditions such as cancer, heart disease, traumatic brain injury, fibromyalgia, and chronic pain (Hennard, 2011; Jin, 1989; Mustian et al., 2004; Reid-Arndt, Matsuda, & Cox, 2012); and adults with depression and anxiety (Wang et al., 2009).

The effects of Tai Chi interventions on the reduction of PTSD symptomatology have received minimal empirical attention. Kim, Schneider, Kravitz, Mermier, and Burge's (2013) empirical work on the efficacy of mindfulness interventions such as Tai Chi in reducing PTSD symptomatology included a review of just 14 quantitative studies. Only one of these studies involved Tai Chi. The results from their review were promising for mindful interventions: Kim et al. (2014) found that 11 out of 14 studies documented that intervention participants reported markedly decreased symptoms of PTSD in comparison to participants in control conditions. This study was conducted with community members who had not received a diagnosis of PTSD but whose scores on the PCL-C did indicate they were at high risk for developing PTSD. Results from this study align with previous studies (Kim et al., 2012) documenting the positive effects of mindful interventions, such as Tai Chi, among participants with sub-clinical PTSD.

Study Implications for Practice

Wang et al., (2009) suggested that participation in Tai Chi interventions can lead to improvements in psychological well-being, including reduced stress, anxiety, depression and mood disturbance, as well as increases in self-esteem. Tai Chi practice has been associated with increased heart rate variability (a non-invasive marker of sympathetic modulation) and other favorable cardiovascular changes that represent reduced PTSD physiological responses (Figuroa, Demeersman, & Manning, 2012). Results from this study support the idea that individuals struggling with PTSD may benefit from participation in a mindfulness intervention such as Tai Chi.

The top three treatment recommendations for PTSD as established by the Institute of Medicine (2008) and the Veterans Administration (2003) are medication, Cognitive Behavior Therapy (CBT), and Eye Movement Desensitization Reprocessing (EMDR). It is highly possible that, by augmenting the established PTSD treatments with a mindfulness component, individuals with PTSD can demonstrate quicker and more long-term successes in managing their PTSD.

Cukor et al., (2009) discussed the different and emerging treatments being developed for PTSD. Approaches such as social and family based treatment, imagery based treatment, technological treatment, pharmacological treatment, mindfulness interventions, and behavioral treatments are all being explored and researched. Many of the treatments seem to have significant potentials. It would be interesting to develop a center that takes an integrative approach with each individual that came for treatment, utilizing a unique protocol for the special needs of each individual by incorporating a combination of treatments that have been found to have efficacy.

Alcohol and drug treatment facilities have at least 30 day detoxification and rehabilitation programs. The more successful programs, such as Caron Foundation, have a 90 day plus

program. Graduation from this program only occurs when the individual is deemed ready. A residential center could allow individuals to seek in-house treatment to “detox” their nervous system from being caught in what Porges (2001, 2010) describes as the hyper or hypo range. The time in a residential treatment center could allow an individual to learn methods like mindful somatic movement to allow to them return to the optimal range of social engagement with their nervous system in a safe supportive environment. It would also provide the social support that these individuals so need (Arnsberg, Hultman, Michel, &Lundin, 2012).

The primary implication for professional practice or applied settings is that integrative PTSD treatment approaches may confer the most benefits for individuals with PTSD or PTSD symptomatology. Developing programs that implement an integrative approach and setting for treating PTSD warrant attention and funding.

Study Limitations

As with any study, this study had both limitation and strengths, many of which aligned with issues commonly seen in intervention studies (Thomas & Rothman, 2013). The small sample size overall and per group was a limitation as it lessened power and increased the likelihood of committing a Type II error, or concluding that there were no significant results when in fact there were (Harris, 2014). The investigator had difficulty recruiting the original sample of 40 participants despite having a strong recruitment plan that included newspaper and television advertisements. It became apparent during the recruitment phase when unforeseen challenges arose that the investigator had a lot more to learn about applied research and implementing an intervention for individuals with PTSD. A major challenge in recruitment was the reticence of individuals with PTSD to participate in the intervention despite making enthusiastic promises to attend. When the investigator contacted potential participants, she was told by many individuals that they “froze” at the thought of going out in public. Others reported

that they just felt too depressed and or had fear of venturing out into the world. Participants' inability to attend a program that may have alleviated many of the symptoms of PTSD underlines the perniciousness and crippling effects of PTSD as well as the need to develop interventions that are sensitive to the culture of PTSD.

Another barrier was the lack of cooperation and support from military agency representatives to recruit veterans for the study. The concern of protecting veterans is understandable, but given the current alarming rate of suicide and other problems among military personnel (Kaplan, et al., 2007; Sayer et al., 2011; Valenstein, 2011), it was disheartening to see that few military agency leaders advocated for veterans in need of PTSD treatment. Experiences with these barriers nonetheless offered to the investigator insight on future implementation of PTSD interventions. Participation would likely increase if PTSD interventions were offered in places where participants felt safe; such places might include the hospital where the individual receives treatment, churches, and community centers. Online interventions may be especially effective for these individuals.

Another limitation of the study was the inability to blind participants to the intervention intent, which may have led to specific threats to external validity. One threat to external validity that may have occurred in this study is the *Hawthorne effect*: participants altered their behavior not in response to the intervention but as a result of being observed in the study (Harris, 2014). The *social desirability bias* may have been an additional threat to external validity in this study: participants may have reported less severe PTSD symptoms in order to be perceived more favorably (Harris, 2014).

Many of the limitations of the study were offset by its benefits. As it is a low-cost activity that can be performed by individuals regardless of their age, gender, and fitness and

ability level, the Tai Chi intervention can be easily replicated in diverse groups of individuals. Intervention participants are most likely to retain and utilize information and learned skills in PTSD interventions that have between 9 and 12 sessions (Cloitre et al., 2011; Thomas & Rothman, 2013). The two interventions in this study were implemented over 10 sessions, an ideal length of time (Thomas & Rothman, 2013). One last limitation was the possibility that unmeasured or unknown variables may have accounted for all or part of any observed effects. The randomization of participants and the use of a control group helped to minimize this possibility. Nonetheless, a more intensive Tai Chi training format such as holding the class three times a week, or conducting a one-week in-depth residential retreat, would be a way to limit confounding variables in future research.

The use of the PCL-C to measure participants' PTSD symptomatology was another strength of this study. The PCL-C, comprised of 17 items that correspond to the DSM-IV criteria for PTSD, is the most frequently utilized screening tool for PTSD and has a strong psychometric history in numerous studies conducted with diverse samples (Thomas & Rothman, 2013). A trained clinical psychologist administered the PCL-C at both pretest and posttest, which likely decreased instrumentation and testing threats to study internal validity.

It is the hope of this researcher that findings from this study will help advance the dialogue about the potential benefits of a mindfulness-based practices for PTSD that can be carried out with relative ease in a variety of settings. Results from this study suggest that participants with PTSD may receive positive, albeit short-term, benefits from Tai Chi interventions. However, large-scale randomized clinical trials are needed to determine the long-term benefits of participating in Tai Chi interventions.

It is also recognized that a possible confounding variable in the Tai Chi group might have been the developing relationship or kinship with others. The research project tried to account for this by using the PCL-C by looking at both the Education only group and the Tai Chi and education scores. Improvements in psychological outcomes based on this standardized evaluation tool would be unlikely to result simply from the social contacts participants received in Tai Chi classes and education since both intervention groups and control groups will engage in social activities. In future research, this would be an excellent variable to examine. More research needs to be done with a larger and more diverse group of individuals to best assess overall intervention effects. It would also be interesting to explore if certain causes of PTSD resulted in specific outcomes when combined with different treatment modalities. A longitudinal study would be warranted at this time to determine the long-term effects of participation in these interventions.

Recommendations for Future Research

Questions for future research may focus on whether Tai Chi could alter neuroendocrine pathways relevant to PTSD, as has been demonstrated with yoga and meditation. Of special interest would be to look at the relationship of Oxytocin and its possible increase when practicing a somatic mindful exercise. It is believed that oxytocin helps us adjust to stress, anxiety, and depression. A study done by Carter, Grippio, Pournajafi-Nazarloo, Ruscio, and Porges (2007) found that oxytocin and its receptors were important for regulation of the hypothalamic-pituitary-adrenal axis and the autonomic system. Another study done by Carter and Getz (1993) compared the stress reactions of female prairie voles that lived in isolation for four weeks versus those living with their siblings. The prairie voles that lived in isolation had greater levels of stress, behavioral anxiety, and depression compared to those still living with their siblings. The team had a control group that received saline, while the other group received

oxytocin during the last two weeks of the four-week period. The isolated voles treated with oxytocin no longer showed signs of stress, depression, or anxiety, which was not the case for the control group. Interestingly, the oxytocin had no measurable effects on those that were already paired with siblings. This study indicates that the effect of oxytocin is most apparent under stressful conditions. The above studies show importance to study oxytocin and try and understand its possible relationship to PTSD and healing.

A research study using FMRI's to evaluate possible changes in brain structure following Tai Chi training may be considered if sufficient funding becomes available to utilize the technology and assess the FMRI scans.

If there is development of residential centers as described above for PTSD, it would be interesting to explore what combinations of treatment have the most efficacy. It would be interesting to also look at other somatic movement practices such as Continuum Movement or Body Mind Centering and see if they also reduce PTSD symptomatology.

Creating methods to help reduce and change the trauma response in the body is important in today's world. The United States and its alliances have been engaged in two wars over the past years. There is presently an urgent need for interventions to help soldiers suffering from PTSD. With the emergence of our global media community, traumatic events are now broadcast repeatedly on televised news worldwide. Examples of traumatic events such as 911, the Iraq and Afghanistan wars, mass shootings, and tsunamis in Japan and Indonesia, all may be having an effect on brain function and psychological health that we do not yet understand. There is a need to address the possibility of an elevated trauma level in the general population that may be occurring in response to repeated viewings of trauma. A study by Palacios et al., (1986) found that during the Mexican earthquake of 1985, "an enormous psychological impact was

experienced not only by the victims themselves but also by the large majority of the population” (p. 281). The study pointed to the mass media as the main traumatic agent in creating the psychological impact. Future research that examines the effect of the media and the possible activation of the nervous system from the repeated viewing of catastrophes and tragedies such as Sandy Hook and Charleston incidents warrant attention.

Conclusion

In the United States, more awareness is developing of the need for more mental health interventions. Under the Affordable Care Act (ACA), mental health treatment has been expanded (Grohol, 2013), as well, as President Obama has signed into law the Clay Hunt Suicide Prevention for American Veterans Act (SAV) in February of 2015 (Congress.gov, 2015). This legislation hopes to improve veterans’ access to mental health treatment. The Pan American Health Organization, the EU Council of Ministers, the UK Royal College of Psychiatrist, and the World Federation of Mental Health have endorsed the idea that there is “No health without mental health” (Prince et al., 2007). If research can explore and validate more affordable and non-invasive methods such as Tai Chi, yoga, or other mindful somatic meditation practices that may allow individuals to learn possible ways to self-regulate their nervous system, then the state of our overall health may improve. In our fast-paced society, it is important for individuals to learn self-regulation methods that can help the nervous system return to its optimal zone of conscious functioning (Porges, 2001).

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Appendix A: Power Analysis

Analysis: A priori: Compute required sample size

Input: Effect size f = 0.2

α err prob = 0.05

Power ($1-\beta$ err prob) = 0.8

Number of groups = 3

Number of measurements = 6

Corr among rep measures = 0.5

Nonsphericity correction ϵ = 1

Output: Noncentrality parameter λ = 17.2800000

Critical F = 1.8884801

Numerator df = 10.0000000

Denominator df = 165

Total sample size = 36

Actual power = 0.8036256

Appendix B: Informed Consent Form



Informed Consent

Title:**Tai Chi and its effect on Post-Traumatic Stress**

Investigator: Donnalea Van Vleet Goelz

We are asking you to participate in a research study. Please take your time to read the information below and feel free to ask any questions before signing.

Purpose: This research project will examine the effect of using Tai Chi (an exercise program) to possibly reduce the effect of Post-Traumatic Stress Symptoms in the body.

Procedures:

A physician's release form is required to assure one is physically and mentally capable of participating in the class.

I understand and agree to take the PCL-C, a self-report test (usually a 20-25 minute test), to evaluate my level of PTSD symptoms at the beginning of this research project. If this information qualifies me to participate, I may be randomly assigned to one of three groups:

1. An education group - a one hour training about the neuroscience of trauma
2. An education group - (see above) and Tai Chi training for five weeks twice a week for hour and half.
3. A control group - no education or Tai Chi for five-weeks.

(At the end of the five week study all participants will be given the choice to participate in either of the other programs to which they had not originally been assigned.)

Two certified teachers from the Cobalt Moon Center Tai Chi School will provide the instruction and training free of charge for groups receiving the Tai Chi training.

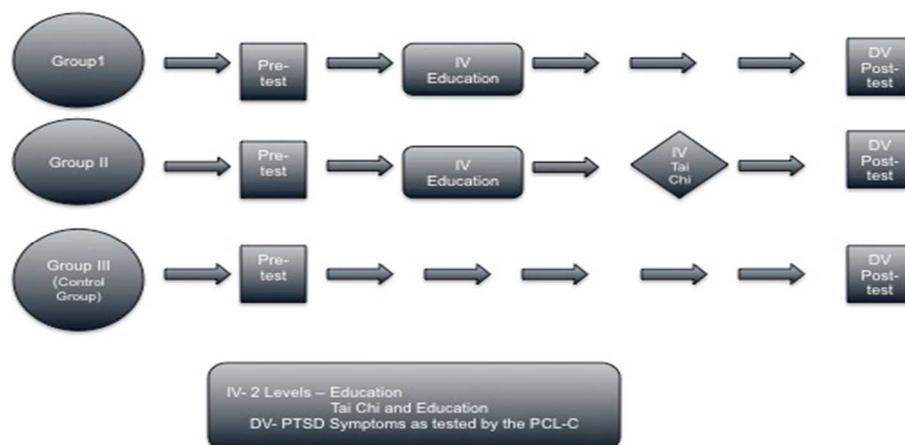
At the end of five weeks I agree to take the PCL-C self-report test again to evaluate my level of PTSD symptoms.

Particiatpants will be debriefed at different times during the research project;

1. After the introduction and taking of the PCL-C on the first night.

2. At the end of five weeks after taking the second PCL-C
3. After the results have been attained and shared with the participants.

A diagram of the research project:



Risks:

5. Physical harm – Tai Chi is a gentle, low impact form of movement and has been well studied as a health oriented form of movement.
6. Legal action – no foreseen issues such as criminal/civil proceedings, research being subpoenaed, mandating reporting of abuse or deportation/immigration as this project does not seek information during its course of time that would require such information from the participant
7. Psychological/mental risk- Issues of how the body responds when stressed or traumatized will be discussed. No direct recall of the participant's traumatic events will be asked for or solicited by researcher to help minimize this risk factor. A list of mental health practitioners' and agencies' telephone numbers will be given in case of need by the participants if psychological or mental issues arise.
8. Social risk- privacy and confidentiality will be strictly adhered to by researcher, psychologist, and teachers of Tai Chi as well as being asked of fellow participants.- Participants, psychologist, researcher, and teachers will be given a written form about confidentiality that they must sign in order to participate in the study. The confidentiality form will state that all participants, instructors, psychologist as well as researcher are required to keep confidential any information shared within the group. This is to ensure safety and trust within the group. At the end of each session, participants will be reminded of confidentiality of the experience they have just participated in and the form they signed.

Benefits:

11. Learning/insight – It is hoped that the learning of a mindful exercise tool such as Tai Chi will help in reducing trauma-related reactions.
12. Medical/ mental health services- A list of mental health practitioners' and agencies' telephone numbers will be given in case of need by the participants

13. Empowerment- The learning of a martial art as well as learning more information about one's body's reaction to trauma could be helpful in one's feeling of self-empowerment.
14. Altruism-Feeling worthwhile by participating - Participating in a research program that may offer a potential benefit to others with PTSD, if shown significant, may support the participant's feelings of being of help to others.
15. Kinship with others - The twice weekly classes in Tai Chi as well as the education about the body's reactions may create a sense of connection and kinship among the different groups.
16. Scientific knowledge/outcomes are hoped to be increased by this quantitative research project.
17. Gain resources—Several resources are hoped to be gained by participants such as being able to do Tai Chi to help relax and regulate their body responses. Cognitively being able to understand more about their body's reaction through education.
18. Gain recognition- It is hoped that by learning a method that can be helpful to relax and calm one's nervous system the participants can be leaders in their community and encourage and help others to receive the same training. If program is successful it will be offered free of cost over the next few years by Cobalt Moon Center to other participants with high PTSD scores.
19. Material Resources- no money or food will be given to participants in this research project but the twice weekly classes in Tai Chi as well as an educational class both have financial value.

Alternatives to Participation. Currently, techniques such as Cognitive Behavior therapy (CBT), Cognitive Restructuring (CT), Exposure therapy (ET), Eye Movement Desensitization Reprocessing (EMDR), yoga, and medication are being used to treat PTSD symptoms.

Withdrawal. Participation is voluntary. You may withdraw from study participation at any time without penalty. You may also withdraw your data from the study as well.

Confidentiality. I understand that I will be given a written form about confidentiality that I must sign in order to participate in the study. This confidentiality form states that all participants as well as instructors are required to keep confidential any information shared within the group. This is to ensure safety and trust within the group.

Data Management. The researcher and the chair of the research project, Dr. Sukal will be the only persons who has access to the data and information about this research project (including signed ethical rights, confidential, physician release form, and consent forms). **However, if necessary research records may be reviewed by federal agencies whose responsibility is to protect human subjects participating in research, including the office of Human Research Protections (OHRP) and by representatives from The Chicago School of Professional Psychology Institutional Review Board.** Using a list of numbers, the researcher will assign each participant an ID number to help with keeping confidentiality. This number will be the identification of participants on all data. The researcher will keep this list in a locked safe separate from study data, which will be in a locked file cabinet and only she will have access to records. The research records will be stored for at least 5 years, in accordance with the APA guidelines. When the information collected from this study is no longer needed it will be destroyed using a paper shredder.

Questions/Concerns:

If you have questions regarding this research, please contact:

Donnalea Van Vleet Goelz, researcher

Cell: 904 874-3400 or email at: DXG2409@ego.thechicagoschool.edu

Or

Dr. Marlon Sukal, chairperson of this research

Phone: (805) 268-6364 or email at: msukal@thechicagoschool.edu

If you have questions concerning your rights in this research study you may contact the Institutional Review Board (IRB), which is concerned with the protection of subjects in research project. You may reach the IRB office Monday-Friday by calling 312.467.2343 or writing: Institutional Review Board, The Chicago School of Professional Psychology, 325 N. Wells, Chicago, Illinois, 60654.

Consent

Subject

The research project and the procedures have been explained to me. I agree to participate in this study. My participation is voluntary and I do not have to sign this form if I do not want to be part of this research project. I will receive a copy of this consent form for my records.

Signature of Subject: _____

Date: _____

Signature of the Person Obtaining Consent: _____

Date: _____

Appendix C: Confidential Forms

There will be three confidentiality forms – one for each group so that it can be more specific to the intervention.

1. Confidentiality Form A for group one- education about PTSD
2. Confidentiality Form B for group two- education and Tai Chi course
3. Confidentiality Form C for group three – control group. (no intervention for five weeks and then they can choose to receive all interventions if they so decide)

Confidentiality Form A

This will be a research project that will explore the effect of education on PTSD symptoms. The nature of the education and group talk involves personal sharing and discussions of personal information of the participants, if they decide to share. It is important to create a safe and trusting environment that all participants to uphold. It is therefore essential that all participants agree to keep complete confidentiality of anything that is shared by others during this session. In other words, no talking or sharing with others the stories of other participants. One may feel free to share their own individual experiences and stories but not those of other participants. Keeping confidentiality is essential to the nature of this workshop.

I agree to keep confidentiality of the other participants in this workshop.

Name

Date

Confidentiality Form B

This will be a research project that will explore T'ai Chi's effect on relaxation and PTSD symptoms in the body. The nature of the education, group talk and Tai Chi involves personal sharing and discussions of personal information of the participants, if they decide to share. It is important to create a safe and trusting environment that all participants to uphold. It is therefore essential that all participants agree to keep complete confidentiality of anything that is shared by others during this session. In other words, no talking or sharing with others the stories of other participants. One may feel free to share their own individual experiences and stories but not those of other participants. Keeping confidentiality is essential to the nature of this workshop.

I agree to keep confidentiality of the other participants in this workshop.

Name

Date

Confidentiality Form C

This will be a research project that will explore the effect of Tai Chi, education and group process on PTSD symptoms. The nature of the education and group talk involves personal sharing and discussions of personal information of the participants, if they decide to share. It is important to create a safe and trusting environment that all participants to uphold. It is therefore essential that all participants agree to keep complete confidentiality of anything that is shared by others during this session. In other words, no talking or sharing with others the stories of other participants. One may feel free to share their own individual experiences and stories but not those of other participants. Keeping confidentiality is essential to the nature of this workshop.

I agree to keep confidentiality of the other participants in this workshop.

Name

Date

Appendix D: PTSD Checklist – Civilian Form (PCL-C)

*Instructions to patient: "Below is a list of problems and complaints that people sometimes have in response to stressful life experiences. Please read each one carefully, and then fill in the circle of the response to indicate how much you have been bothered by that problem **IN THE PAST MONTH.**" Please fill in ONE option only for each question."*

	Response	Not at all (1)	A little bit (2)	Moderately (3)	Quite a bit (4)	Extremely (5)
1.	Repeated, disturbing <i>memories, thoughts, or images</i> of a stressful experience from the past?					
2.	Repeated, disturbing <i>dreams</i> of a stressful experience from the past?					
3.	Suddenly <i>acting or feeling</i> as if a stressful experience <i>were happening again</i> (as if you were reliving it)?					
4.	Feeling <i>very upset</i> when <i>something reminded</i> you of a stressful experience from the past?					
5.	Having <i>physical reactions</i> (e.g., heart pounding, trouble breathing, or sweating) when <i>something reminded</i> you of a stressful experience from the past?					
6.	Avoid <i>thinking about</i> or <i>talking about</i> a stressful experience from the past or avoid <i>having feelings</i> related to it?					
7.	Avoid <i>activities or situations</i> because <i>they remind you of</i> a stressful experience from the past?					
8.	Trouble <i>remembering important parts</i> of a stressful experience from the past?					
9.	Loss of <i>interest in things that you used to enjoy</i> ?					
10.	Feeling <i>distant</i> or <i>cut off</i> from other people?					
11.	Feeling <i>emotionally numb</i> or being unable to have loving feelings for those close to you?					
12.	Feeling as if your <i>future</i> will somehow be <i>cut short</i> ?					

13.	Trouble <i>falling</i> or <i>staying asleep</i> ?					
14.	Feeling <i>irritable</i> or having <i>angry outbursts</i> ?					
15.	Having <i>difficulty concentrating</i> ?					
16.	Being " <i>super alert</i> " or watchful on guard?					
17.	Feeling <i>jumpy</i> or easily startled?					

Total Score

Appendix E: Permission for Using the PCL-C

The following is an email from George J. Decker, who is on staff with the National Center for PTSD, stating that the PCL-C is free for use by qualified health professionals. It was sent to me, as a PhD student doing research, did meet their requirements.

george.decker@va.gov

April, 25th, 2013

Greetings, and thank you for your assessment instrument request. You may access these instruments by Ctrl+Click on: <https://downloads.va.gov>

Step 1: Click “multiple files” link. If that does not work, go to “single files”

Step 2: Once file browser window opens, double click to open “PTSDinfo” folder.

Step 3: Double click to open “PTSD Assessments”.

Step 4: Measures are grouped within folders by type. Select the trauma measure or measures you are looking for within each folder. Refer to the folder listing in the left panel of the screen to access particular folders. You may need to right click on the document you want to download. Select ‘Download’. Select ‘Save’.

You may have to click to get past a security page. If it asks for a **Username and Password**, the Username is “PTSD” and Password is “Assessments” – these are case sensitive.

These assessment tools were created by government employees and therefore are not copyrighted and are **free for use by qualified health professionals**. Please let us know if you have any trouble downloading these instruments. Also, no thank you email is necessary.

Sincerely, National Center for PTSD Staff

Appendix F: Tai Chi Information Sheet

Practice

To maximize your benefit from Tai Chi study, it is necessary to practice. We suggest you establish a daily practice such as 10 minutes of practice upon rising in the morning and again at night before you retire. When practicing Tai Chi, do the movements from the beginning through as far as you've learned. Each set is called a "round." If you find that you have forgotten some of the moves, don't let that stop you from practicing. Practice the part that you do remember and bring your questions to class. Sometimes you may want to focus your practice on points made in class by stopping to check yourself or by going through the movements with a specific awareness (e.g., straightness). Each practice session should include some time for going through the moves in a smooth, continuous way.

Footwear and Clothing

We recommend appropriate footwear and clothing for best results. It is important that your feet feel flat on the floor. Flat-soled shoes or slippers or thick socks will work best. It is recommended that your footwear be made of natural materials such as cotton, wool or leather, not rubber, vinyl or crepe. Any clothing which does not restrict your movement is acceptable for Tai Chi practice. If at all possible, practice on a flat smooth floor – wood, vinyl or polished stone. If you must practice on carpet then try to work on a low pile carpet to minimize resistance to movement.

Appendix G: Tai Chi Class Log

The Tai Chi classes met twice a week for 5 weeks. Below is a log of attendance and material covered in the classes. The form that was taught was the Ching Man Ching short form. The whole form is usually taught over an extended period with a total of thirty classes. This research project focused on what the Tai Chi Foundation calls the first third or beginners level I, which consists of ten classes. Classes were an hour and half in time length.

Two male teachers taught the form, one of the teachers is a veteran himself. Also in attendance for all classes were Dr. Bruce Kristol, a registered psychologist with the state of Florida and he has an expertise in working with clients who struggle with PTSD as well as the researcher.

Participants were randomly selected by a computer to be in one of three groups

- I. An education Group
- II. An Tai Chi and education group
- III. A control group

It should be mentioned that one of the participants that had been randomly selected for the Tai Chi and education group could not fully participate in the Tai Chi classes, as they needed to go for surgery. They very much wanted to participate though and the researcher moved them to the control group, as they could participate in this groups schedule as well as being able to take Tai Chi classes after the research project was completed. One participant from the control group was then randomly selected by computer to be in-group II, the control group.

In the original 30 participants there were 16 females and 14 males. The makeup of each group was:

- I. An education Group- females 6, male 4

- II. An Tai Chi and education group- females 7, male 3
- III. A control group- females 7, male 3

After the removing one participant from each group as mentioned before the composition was:

- I. An education Group- females 6, male 3
- II. An Tai Chi and education group- females 6, males 3
- III. A control group- females 6, males 3

All together three-introduction sessions were held to gather enough participants. The researcher had a very difficult time trying to recruit participants given the limitations that will be explained farther in the discussion chapter. It was decided that even though the research project had not reached its targeted number of people to participant (36) that the research should start as some of the participants that were already recruited were beginning to have schedule conflicts because of the delayed start of the research project. At this point there were 30 participants who had consented to participate in research but due to different circumstances the research ended with 27 participants.

During all the introductions, the research was explained, those that wished to participate turned in their doctor's permission slips, consent forms were signed and then the PCL C was taken. At the end of the night, the psychologist with the researcher assisting did a debriefing. Participants were told they would be contacted and told if they qualified and what group they would be in.

A meeting was held for both the education (group I) and education and Tai Chi (group II) to give a presentation on the neurobiology of trauma. All participants were in attendance (20 people). This class was presented by both the psychologist and researcher. A debriefing

occurred after presentation. The class lasted an hour and a half. Group I was told when to come back in five weeks and allowed to leave.

Group II stayed and the first Tai Chi class was given.

Tai Chi classes:

Class 1

All of the participants were present. An introduction to the form was given and the form was taught from the beginning posture through the first opening breath. Emphasis was on slowing down, feeling one's body, and trying to relax.

Class 2

One of the participants was absent, a total of 9 attending. Material that was covered was a review of Class 1 material and then the new material from the breath to the first posture, ward off left.

Class 3

There was one participant missing. There was a review and much attention paid toward feeling one's body. What muscles were tight or tense? The participants were asked to try and relax the portion of their bodies that they felt tension in. Slowing down was discussed again. The new material was from the posture ward off left to the posture ward off right.

Class 4

One participant absent. The new material taught was from ward off right to the posture called the press. Again Tai chi principles were covered such as feeling one's body as one moves, relaxing, and slowing down.

Class 5

All participants were present. The new material taught was from the press to single whip. Tai Chi principles covered were feeling one's body especially one's feet while moving, slowing down, relaxation, and feeling an internal straightness within the body.

Class 6

One participant was absent. Review of material already covered was done in first part of class and then new material was presented. New material was from single whip to white stork spreads its wings. Tai Chi principles were reminded throughout class. Relaxation of arms and hands was emphasized.

Class 7

There were two people absent. Review of previous material was done and the new material was from white stork spreads its wings to the first brush knee twist step left.

Class 8

There was one participant missing. Review was done of the previous taught material. New material was from brush knee twist step left the push. Principles of Tai Chi were discussed and emphasized as the class practiced the form.

Class 9

There was one participant missing. Review was done of the previous material covered, including Tai Chi principles. New material taught was from the push to the end of this part of the form called entering the Tao.

Class 10

All of the participants were present. The instructors spent the class time in reviewing the material that had been taught and answering questions that the participants had about the form. The class

shared their feeling of success as well as what they felt they still needed to work on for Tai Chi to be helpful for them.

Attendance of most participants was very good. One participant did miss three classes as they had missed the second class and then came down with flu in class eight and nine. One other participant missed two classes; all of the others who missed class only missed one time.

After class 10 of the course, Group I and Group III also joined so the second PCL-C test could be given. One participant did not come from control group. Following the test Dr. Kristol and the researcher conducted a debriefing of all of the participants.

The participants were asked to share what they had experienced, asked what had been helpful, what had they liked, was there anything they had difficulty with. Everyone spoke of positive experiences.

Appendix H: Research Flyer

A Research Study about PTSD



This research project will examine the effect of Tai Chi (a Chinese Health and Martial art exercise) on Post Traumatic Stress Disorder Symptoms. This research study is for adults of the age of 18 to 75 who have PTSD. Participation is always voluntary!

Would the study be a good fit for me?

This study might be a good fit for you if:

- You have a PTSD diagnosis, if you do not know if you have PTSD but do have a high level of stress symptoms, please come and you can be tested free of charge to see if you qualify for this project

What would happen if I took part in the study?

If you decide to take part in the research study, you would:

- Need to submit your doctors permission form to take part in this project
- Come to an introductory meeting at UNF to learn about the project and about Tai Chi
- If you decide to participate - You would take a self-report test accessing your level of PTSD symptoms

A computer will assign you to one of three groups for the research if you meet the requirements of having an elevated level of PTSD symptoms.

1. A Tai Chi course that meets twice a week and an one hour Education class on the neuroscience of PTSD trauma
2. Education class only
3. Control group.

You will have options to do all the activities and classes at the end of the five week project.

At the end of research you will have the option to take final self-report test at the end of five weeks to measure if there are any differences in the way you feel.

This is a research project to examine the possible effectiveness of Tai Chi in helping to reduce PTSD symptoms. We can make no claims about the effectiveness until after the research is complete. All classes will be free to any who desire to participate. To take part in this PTSD research study or for more information, please contact Donnalea Goelz at 904-874-3400 or donnagoelz@gmail.com. The principal researcher for this study is Donnalea Goelz a doctorate Candidate at The Chicago School of Professional Psychology.