Acupuncture for Sleep Disturbances

In Post-Deployment Military Service Members

By

Jane J. Abanes

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Approved:

Sheila Ridner, Ph.D., RN

Bethany Rhoten, Ph.D., RN

Mary S. Dietrich, Ph.D.

Cynthia Hiers, Ph.D.

To my amazing children, Charity Mei and Sebastian Rei, wise beyond their years

and

To my beloved husband, Richard, infinitely supportive

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CHAPTER I

INTRODUCTION

Statement of the Problem

Since 2001, the Global War on Terrorism has resulted in increased operational tempo in which service members have deployed to combat theaters more than once for at least six months (Luxton et al., 2011). Twenty-six percent of service members who deployed to combat theaters reported sleep disturbances (SD) (Pace-Schott, Germain, & Milad, 2015; Seelig et al., 2010). SD may include insomnia (i.e., difficulty falling or staying asleep, or early awakening), nightmares, or fragmented rapid eye movement sleep (Pace-Schott et al., 2015). SD lead to loss of energy, daytime sleepiness, tiredness, and fatigue (Koffel, Polusny, Arbisi, & Erbes, 2013; Lande & Gragnani, 2013a). They exacerbate psychological symptoms, worsen comorbid illnesses, and result in cognitive and motor impairments (Lande & Gragnani, 2013a; Luxton et al., 2011; Macera, Aralis, Rauh, & MacGregor, 2013).

Certain environmental and occupational factors may contribute to SD in service members including blast exposure, highly physically demanding tasks, rapid entrainment to different time zones, irregular or night shift work, side effects of anti-malarial drugs, collateral duties, years deployed, and sustained operations (Good, Brager, Capaldi, & Mysliwiec, 2020; Matsangas, Shattuck, & Saitzyk, 2020). Other contributing factors for SD in military personnel may be unrelated to occupational situations and are instead related to personal factors or behaviors such as constant

worry about the future or personal problems, inability to shut down an overly active mind, racing thoughts, history of sleep problems, bedtime use of caffeine or nicotine, late-night exercise, use of multiple technological devices at bedtime, and the need to talk or text family or friends in another time zone (Hansen et al., 2018; Lande & Gragnani, 2013b; Matsangas et al., 2020).

Sleep disturbance is considered a risk factor or consequence of various psychological and physiologic diagnoses including anxiety, depression, alcohol use disorder, suicidal ideation, adjustment disorder, mild traumatic brain injury, chronic pain, and cardiovascular disease (Allan et al., 2017; Bramoweth & Germain, 2013; Hansen et al., 2018; Lincoln, Moore, & Ames, 2018; Lippa et al., 2015; Rice & Schroeder, 2019; Short et al., 2019; Stocker et al., 2016; Ulmer et al., 2015). Sleep disturbance is a hallmark symptom of posttraumatic stress disorder (PTSD) and an important antecedent in PTSD recovery in service members who were deployed to Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) (Borders, Rothman, & McAndrew, 2015; Gilbert, Kark, Gehrman, & Bogdanova, 2015). SD are important maintainers of PTSD symptoms in service members. Yet, they remain resistant to treatment for many service members (Hughes, Ulmer, Gierisch, Nicole Hastings, & Howard, 2018).

Commonly used treatment modalities for SD such as sleep medications (i.e., sedative-hypnotics) may be ineffective or have a high side effect profile (Doghramji & Jangro, 2016). Prescriptions for SD may be associated with short-term effectiveness, adverse effects, and poor job performance (Doghramji & Jangro, 2016). Despite their ineffectiveness, potential for dependency, and side effects, the number of prescriptions for sleep medications has increased over the years (i.e., 540,000 in 1994 to 6.2 million

in 2007) (Moloney, Konrad, & Zimmer, 2011). In addition to sedative-hypnotics, antidepressants and other psychotropic medications are commonly used in clinical settings in targeting sleep for their sedative side effects. Antidepressants including selective serotonin reuptake inhibitors (SSRI) have shown low-quality evidence using subjective sleep measures when compared with placebo (Everitt et al., 2018). Other antidepressants (e.g., Trazodone) have shown low to moderate improvement in subjective sleep quality but with increased grogginess over placebo (Everitt et al., 2018). Tricyclic antidepressants have shown moderate evidence in subjective sleep quality when compared with placebo (Everitt et al., 2018). Authors of a systematic review did not find any studies on Amitriptyline which is the most commonly prescribed TCA in clinical settings (Everitt et al., 2018). Many of the studies that investigate these sleep medications have not been studied for a longer duration, therefore unfavorable effects for longer-term use for SD are unknown (Everitt et al., 2018). Antipsychotic medications (e.g., Quetiapine) have been widely used off-label in the treatment of insomnia because of their sedative side effects. However, robust research is lacking which evaluates the efficacy of Quetiapine for insomnia (Anderson & Vande Griend, 2014). Therefore, given its lack of evidence and adverse-effect profile (e.g., weight gain, mood swings, and behavior changes), Quetiapine's benefit for the treatment of insomnia does not outweigh its potential risks (Anderson & Vande Griend, 2014).

Many patients continue to use sleep medications despite potential ineffectiveness and side effects (Reynolds & Ebben, 2017). The trend in consumption of these prescription sleep aids is reflected in the continuing rise in the healthcare cost of SD (Mayers & Baldwin, 2005). The annual cost of SD in the United States is

estimated to be $150.36 to $174.89 billion (Reynolds & Ebben, 2017). The expenses associated with SD include both indirect (i.e., loss of productivity, absenteeism, errors and accidents in the workplace, and use of alcohol as a sleep aid) and direct cost (i.e., clinician hours, use of sedative-hypnotics, and cognitive and behavioral therapies) (Reynolds & Ebben, 2017). Sleep medications may not only be ineffective but also costly to the patient, employers, and the healthcare system.

Another commonly used treatment to alleviate SD is cognitive behavioral therapy (CBT). CBT is a psychotherapeutic intervention that has shown to alleviate SD (Morgenthaler et al., 2018; Reynolds & Ebben, 2017). Traditional CBT to target SD generally demands four to eight weeks of face-to-face sessions (Perlis, Jungquist, Smith, & Posner, 2006). This treatment involves once a week sessions that range from 60 to 90 minute meetings with the clinical provider, depending on the focus of treatment and the patient's adherence to the intervention (Perlis et al., 2006). CBT improves SD through lifestyle changes and cognitive restructuring which are important factors in one's sleep efficiency and maintenance (Margolies, Rybarczyk, Vrana, Leszczyszyn, & Lynch, 2013). However, although evidence suggest that traditional CBT is effective in the treatment of SD, this intervention requires consistent coaching from the practitioner and deliberate practice on the part of the patient before good outcomes are achieved (Dixon, Ahles, & Marques, 2016). Traditional CBT may not be an achievable strategy for service members who are faced with unpredictable missions, deleterious habits surrounding sleep, and occupational demands. Given the economic burden as well as adverse effects associated with sedative-hypnotics and concerns about traditional CBT

for SD in this population, pragmatic alternatives and complementary treatments to SD are needed.

Evidence shows that an abbreviated form of CBT is an effective intervention in mitigating SD (Bastien, Morin, Ouellet, Blais, & Bouchard, 2004). Using an abbreviated form of CBT, in additional to a complementary treatment, could provide a more rapid yet effective relief from sleep disturbance's debilitating consequences. Because relief is achieved sooner, an abbreviated form of CBT may potentially lessen the use of sedative-hypnotics that are known to cause more harm than benefits (Doghramji & Jangro, 2016). Abbreviated CBT or ACBT (i.e., a two-session treatment) has shown to be effective for SD in psychiatric outpatients and may be more pragmatic yet effective approach for service members with hectic schedules (Wagley, Rybarczyk, Nay, Danish, & Lund, 2013). Moreover, research shows that group and telephone consultations are as effective as individual therapy for the management of SD while reducing frequent trips to the clinic and time spent in therapy (Bastien et al., 2004). Service members may be assigned to areas that are farther away from military treatment facilities, and having an access to SD treatment in remote locations (i.e., via the telephone) is a more feasible approach than traditional therapies in treating service members. Aside from the economic burden involved in the treatment of SD, the suffering of patients and the frustrations of healthcare practitioners with inadequate SD treatments are pervasive. An adjunct therapy to conventional treatments of SD is therefore needed.

A promising adjunct therapy that has shown to reduce SD in those with PTSD symptoms is acupuncture. Acupuncture as a complementary treatment added to usual care (i.e., pharmacotherapy and/or psychotherapy) has been shown to be effective in

decreasing SD and stress and with few side effects (Engel et al., 2014b; King et al., 2015). Researchers have examined two styles of acupuncture: Traditional Chinese Acupuncture (TCA), and Auricular Acupuncture (AA) (Engel et al., 2014a; King, C. H., Moore, C., & Spence, D. L., 2016a). While these styles show promising results in the treatment of SD, they have the following challenges: 1) TCA requires use of a complex array of elusive diagnostics and acupuncture points, 2) TCA treatment depends on the practitioner's subjective assessment of the patient, 3) TCA requires a great deal of time from both practitioner and service member, 4) ASPs or *Aiguille Semi-Permanent*e (i.e., semi-permanent ear needles used in AA) are at times painful for the patient, and 5) some service members hesitate to receive ASPs because the needles are visible on their ears for days as they wear the military uniform. To minimize the challenges associated with the implementation of the TCA-style and the AA acupuncture, we propose a standardized approach to the TCA-style acupuncture treatment in which acupuncture points will be selected based on previous research. The acupuncture points selected have shown to be effective in mitigating SD.

SD could lead to physiological, psychological, and behavioral sequela when left untreated (Fuller, Gooley, & Saper, 2006; Gehrman et al., 2013). Targeting SD with an evidence-based treatment psychotherapy such as CBTi has shown to improve psychological and behavioral consequences (Ashworth et al., 2015). However, despite patient's adherence to CBTi's recommended strategies, this therapy may not effectively alleviate the physiological consequences of SD (de Dassel, Wittmann, Protic, Hollmer, & Gorzka, 2018). A promising treatment that has shown to improve physiological problems associated with SD is acupuncture (Walling, 2006a). Investigating the effect

of acupuncture as an adjunct treatment with CBTi could help clinicians provide a holistic approach in mitigating a complex problem such as SD.

Significance of the Issue and the Study

Significance to Society

Sleep disturbance, as a symptom of deployment exposure, is associated with decreased work productivity and increased use of medical resources resulting in substantial socioeconomic burden (Daley, Morin, LeBlanc, Gregoire, & Savard, 2009). In the general population, the annual cost in the treatment of SD is estimated to be $106 million for healthcare visits and $16.5 million for prescription medications (Daley et al., 2009). The annual direct cost associated with missed work days because of SD is approximately $970.6 million with SD-related productivity losses of $5.0 billion annually (Daley et al., 2009).

Sleep disturbance is known to be a major risk factor and could worsen PTSD in service members (Lang, Veazey-Morris, & Andrasik, 2014). In service members, those with SD are more likely than those without SD to have more outpatient visits and/or longer hospitalizations for general health concerns (Seelig et al., 2016). Shortened sleep duration was also associated with early separation from service (Seelig et al., 2016). Compared with those who sleep seven hours per night, service members who sleep less than six hours per night had a 30% higher probability of separating early from military service (Seelig et al., 2016). Service members with deployment experiences chronically suffer from SD even after return from a deployment (Steele, Germain, &

Campbell, 2017). Upon leaving military service, veterans continue to struggle with SD and PTSD symptoms (Vasterling et al., 2016). For instance, older veterans who served in the Vietnam or Korean war continue to suffer from sleep problems even decades since the war (Hughes et al., 2018). Although the exact mechanisms that contribute to the chronicity of sleep problems remain unclear, acute SD may become chronic because of perpetuating factors (i.e., negative coping behaviors including alcohol use, unhealthy sleep patterns, and the presence of conditioned arousal) (Hughes et al., 2018). Given the chronic nature and proliferation of sleep problems, service members with SD are at risk for long-term and damaging problems. Therefore, treating service members early and investigating ways to improve their health before symptoms become severe, are imperative for clinicians and researchers.

SD impact not only the personal well-being of service members but also their re-integration at the family and community levels (Yambo et al., 2016). Those with chronic SD report lower self-rated health, more lost days from work, and frequent use of health care (Seelig et al., 2016). SD contribute to substance abuse problems, cognitive decline, and aggression in those with other PTSD symptoms (LaMotte, Taft, et al., 2017a; Vandrey, Babson, Herrmann, & Bonn-Miller, 2014; Verfaellie, Lee, Lafleche, & Spiro, 2016). Furthermore, spouses and children of service members report psychological strain, emotional struggles, and difficulties maintaining the household (Yambo et al., 2016). A public health concern that needs further investigation and intervention is that service members from deployment who suffer from PTSD symptoms and social skills deficits are more inclined to intimate partner aggression, which results in increased demands for societal resources such as law enforcement agencies and

healthcare institutions (LaMotte, Taft, et al., 2017b; LaMotte, Taft, Weatherill, & Eckhardt, 2017).

In summary, SD are debilitating to service members. Service members become less productive in the workforce which results in economic inefficiency and possible societal burden. SD also lead to chronic and incapacitating psychological and physiological consequences and affect the family dynamics of service members. Thus, SD have enormous consequences to families, communities, and the society.

Significance to Healthcare

For some service members who have experienced deployment stressors, SD may be a psychologic, behavioral, and physiologic consequence of a traumatic event (Borders et al., 2015). Many service members who were wounded in overseas contingency operations in Afghanistan and Iraq continue to experience problems after their return from service and as they transition from active duty service to being a veteran (CBO, 2012). Among those U.S. service members who were deployed to Iraq or Afghanistan, sleep disturbance was the most commonly reported symptom of PTSD (McLay, Klam, & Volkert, 2010).

To address their problems, the Department of Defense and the Veterans' Healthcare Administration (VHA) devoted increased resources to the care of the wounded (CBO, 2012). The VHA treated 103,500 veterans with posttraumatic stress disorder (PTSD) between 2004 and 2009 (CBO, 2012). VHA spent $2.2 billion on patients with PTSD, traumatic brain injury, or both (CBO, 2012). In 2010, 190,378 (3.4%) of those receiving care at the VHA received an insomnia diagnosis (Hermes &

Rosenheck, 2014). These veterans received an average of four more psychotropic prescriptions refills within a year compared with those without the insomnia diagnosis (Hermes & Rosenheck, 2014). In the VHA, 101,065 of those who were diagnosed with insomnia disorder received anxiolytics or hypnotics and 22,364 received antipsychotics (Hermes & Rosenheck, 2014). Commonly prescribed medications for SD are Trazodone and Prazosin (Greenbaum, Neylan, & Rosen, 2017). Prazosin, as a treatment for nightmares and other sleep problems, was either not superior to image rehearsal therapy (IRT) or less effective than psychotherapy (Petrakis et al., 2016; Seda, Sanchez-Ortuno, Welsh, Halbower, & Edinger, 2015). In a randomized trial among 304 veterans with chronic PTSD, Prazosin did not improve sleep quality or distressing dreams over placebo (Raskind et al., 2018). Despite warnings against benzodiazepines' inefficacy, adverse effects, and their potential for abuse and dependency, they are the most prescribed hypnotics for those with insomnia complaints (Greenbaum et al., 2017). Other hypnotics prescribed for insomnia such as Zolpidem, Eszopiclone, Zaleplon, and Ramelteon may present with similar risks as that of benzodiazepines (e.g., behavioral sleep problems including sleepwalking or impaired memory) (Greenbaum et al., 2017). Pharmacotherapy, although mostly ineffective, remains to be a common treatment of choice for providers and patients who report psychotherapy as ineffective or for those who decline psychotherapy (Schoenfeld, Deviva, & Manber, 2012).

The VHA, as the major sector that supports veterans, is tasked with the overwhelming endeavor to care for all those who served in the military. The treatment outcomes for SD in service members and veterans continue to be ineffective yet costly.

Despite the effort of our healthcare system to provide the needs of this vulnerable group, many of their problems, including SD, remain resistant to treatments. The treatment of SD with marginally effective yet expensive prescriptions may play a role in the high expenses associated with SD. Given the cost associated with treating SD in the VHA, SD in service members is a public health concern.

Significance to Science/Discipline of Nursing

Nursing. Nursing is a profession that promotes all aspects of health at the individual, community, and policy level (Skarsater & Willman, 2006). Advanced practice registered nurses [i.e., Psychiatric Mental Health Nurse Practitioners (PMHNPs)] are trained to address the problem of deployment-related concerns in a more comprehensive endeavor than general medical practitioners (APNA, 2018). PMHNPs are given the task to care for service members who experience a complex set of problems: traumatic brain injury, polytrauma, hazardous exposures, chronic pain, substance use disorders, military sexual trauma, homelessness, PTSD, and suicide (Johnson et al., 2013). PMHNPs fulfill various roles (i.e., therapists, prescribers, case managers, and policy makers) in the care of service members who were deployed to combat theaters. Sleep disturbance is an important topic in nursing because this disorder does not only impact the mental and physical health of service members but also affects family dynamics, occupational performance, community re-integration, and the welfare of our societies (Yambo et al., 2016). Despite efforts to maintain the health of our military service members, this endeavor continues to be a health and societal concern in which nursing will continue to be a major player (Bass, 2012).

Health. Research shows that compared to service members who endorsed none to minimal sleep problems, those who endorsed moderate to severe problems with sleep onset and sleep maintenance had higher odds of being a smoker, having hypertension, and having a diagnosis of depression (Ulmer et al., 2015). Service members who had combat exposure and slept less than six hours a night during post-deployment endorsed aggression, alcohol use, and opioid use (Osgood, Finan, Hinman, So, & Quartana, 2019). The role of SD and other PTSD symptoms in mediating between deployment exposure and physiological health outcomes is well-known in the literature (Armenta et al., 2018). SD contribute to the exacerbation of PTSD and other debilitating health consequences for our service members who have deployed to austere environments. PTSD increases mortality and morbidity risks in which sleep disturbance severity is a strong mediator between deployment trauma and physical health (Armenta et al., 2018). PTSD adversely affects multiple organ systems in the body (Dennis et al., 2016; Lerman et al., 2016; Rao et al., 2014; Turner, Neylan, Schiller, Li, & Cohen, 2013).

The research literature is replete with evidence about the physiologic correlates of PTSD in service members: a) positive association between inflammation and PTSD (Dennis et al., 2016; Lerman et al., 2016; Lindqvist et al., 2014), b) positive association between metabolic syndrome and PTSD (Rao et al., 2014), and c) those with PTSD had twice the odds of having ischemia and had higher cardiovascular disease risk (Turner et al., 2013). Moreover, as a PTSD symptom (i.e., sleep disturbance) severity increases, the risk for other medical disorders also increase (Schnurr, Spiro, & Paris, 2000). For instance, at least 12 medical disorder categories persist in service members with PTSD:

malignant cancer, endocrine, cardiovascular (including hypertensive ischemic and arterial as sub categories), pulmonary, upper gastrointestinal, lower gastrointestinal, genitourinary, dermatologic, and musculoskeletal (Schnurr et al., 2000).

Person. In addition to the physiologic problems associated with SD, service members with SD experience psychological incapacity and moral dilemmas (Fernandez-Mendoza & Vgontzas, 2013). In a large sample of Soldiers, SD has shown to contribute to daytime impairment which affected their quality of life, work performance, and unit readiness to accomplish operational missions (Klingaman, Brownlow, Boland, Mosti, & Gehrman, 2018). Nearly four times as many Soldiers with SD, compared to those without SD, endorsed dissatisfaction with work, low morale, and indecision complete their contract in the Army or remain in service to fulfill a full career (Klingaman et al., 2018). Research has shown that there is a link between agitation and SD, and both of which are considered risk factors for suicide in military personnel (Fisher, Houtsma, Assavedo, Green, & Anestis, 2017).

Research findings show that SD contribute to other PTSD symptoms, emotional dysregulation, and alcohol misuse (McLay et al., 2010). Emotional dysregulation pertains to their struggle to make sense of their new perspective that the world is a dangerousness place (McLay et al., 2010). As a result, service members often engage in maladaptive coping strategies such as alcohol misuse (Tripp & McDevitt-Murphy, 2015). Among men, both impulse control difficulties and lack of emotional clarity significantly mediated the relationship between PTSD symptoms and alcohol misuse (Tripp & McDevitt-Murphy, 2015). SD has been shown to exacerbate alcohol use disorder symptoms in service members (Short et al., 2019). Alcohol misuse may be a

coping strategy, albeit maladaptive for many service members (Tripp & McDevitt-Murphy, 2015). Given the link between sleep disturbance and emotional dysregulation, interventions that target SD should be examined.

Environment. In addition to the debilitating impact of SD to the physiological and psychological health of the service member, SD could also have a negative social influence. Specifically, spouses of service members who return from combat zones report that life at home has become challenging and unpredictable (Macdonell, Thorsteinsson, Bhullar, & Hine, 2014). A positive correlation exists between the veteran's PTSD symptoms and his or her partner's poor well-being which was mediated by caregiver distress (Macdonell et al., 2014). This finding suggests that PTSD symptoms in veterans have a negative impact to their partners. In a study among U.S. Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) veterans, authors found that PTSD symptoms were significantly positively associated with anger expression and intimate partner violence (2015). These findings suggest that PTSD symptoms such as sleep disturbance of those who were deployed to OEF/OIF could result in problematic social problems including partner violence which may potentially affect not only families but also communities.

Summary of Overall Significance

SD affect the person's overall health and environment, and thus, this is an important healthcare issue for advanced practice nurses. Advanced practice nurses are in the front lines in the treatment of service members. Many PMHNPs are stationed within military units, and they are available for service members before and after their

deployments overseas. Upon the service members' return from deployment, PMHNPs are the source of immediate care for personnel. When service members continue to suffer from SD and other deployment-related symptoms upon return from the operational theaters, PMHNPs provide the therapy and medication management they need. The goal of PMHNPs is to not only to return the service member to the military mission at hand but also improve their wellbeing after trauma exposure from deployment experiences. When symptoms get worse for the service members, PMHNPs alleviate their psychological and physical needs by providing more intensive treatments including therapy, medication, and other referral services. Finally, PMHNPs working in the VHA and in civilian institutions continue to care for service members who leave the military. PMHNPs help service members reintegrate in the civilian society, facilitate their ongoing needs, and deliver ongoing healthcare services for themselves and their families.

Purpose of the Study

The purpose of this study is to examine a more pragmatic yet potentially effective approach in treating service members with SD. The manual standardized stress acupuncture (MSSA) is a standardized form of TCA acupuncture that includes acupuncture points shown to be effective in research and clinical practice in military personnel with stress and SD (Koffman, 2011; Yeung, Chung, Zhang, Yap, & Law, 2009). The overall goal of this study is to evaluate the effectiveness and perceived benefits of MSSA as an adjunct therapy to an abbreviated CBT in the treatment of SD in post-deployment military service members. MSSA offers a pragmatic approach to

acupuncture treatment in busy military treatment facilities or operational environments whereby the acupuncture points used are evidenced-based rather than the practitioner's subjective assessment. Given the occupational demands and the hectic schedules experienced by service members, ACBT intervention was chosen for this study. ACBT was shown to be effective in the treatment of SD (Wagley et al., 2013). The ACBT intervention for this study will be based on Wagley and colleagues' (2013) psychotherapeutic protocol (Wagley et al., 2013).

This study is considered novel in that: no known clinical trial has explored the effects of MSSA as an adjunct treatment in addition to ACBT for SD in service members. Based on my pilot study, the acupuncture points in head and extremities are reported by patients to be effective in targeting stress (Abanes, Hiers, Rhoten, Dietrich, & Ridner, 2019). However, to this date, there is no known research that investigates a standardized form of acupuncture treatment in a military sample with SD.

To evaluate the effectiveness and perceived benefits of MSSA, a mixed methods approach was used. *Effectiveness* was defined as improvement in service members' sleep disturbance as measured by reliable and valid measures and instruments(Institute of Medicine Committee on, Behavior: Research, & Policy, 2001). *Perceived benefit* was defined as perceptions of the helpfulness of the intervention to the service members' sleep disturbance and their experience of their treatment (Institute of Medicine Committee on et al., 2001). Additionally, participant expectation is known to either negatively or positively impact the effectiveness of acupuncture in targeting symptoms (Mao, Armstrong, Farrar, & Bowman, 2007; Mao, Xie, & Bowman, 2010; Zheng et al.,

2015). In this study, we evaluated if the participant's expectations from the acupuncture treatment influenced outcomes of interest.

Research Aims and Hypotheses

Aim 1a: To evaluate the *effectiveness* of MSSA as an adjunct treatment with ACBT, as compared to ACBT alone, for SD using the *Insomnia Severity Index (ISI)*(Morin, 2017) and *Pittsburg Sleep Quality Index (PSQI)* (Buysse, Reynold, Monk, Berman, & Kupfer, 1988) in post-deployment military service members.

Hypothesis 1a: Compared to participants in the ACBT only group, those who received MSSA and ACBT for SD will report greater improvement in SD at the completion of acupuncture treatment compared with baseline scores.

Aim 1b: To describe the *perceived benefit* of MSSA as an adjunct treatment with ACBT, as compared with ACBT alone, for SD using *journal log entries* in post-deployment military service members.

Hypothesis 1b: Compared to participants in ACBT only group, participants who received MSSA and ACBT for SD will report greater benefits in reducing SD at the completion of acupuncture treatment.

Aim 2: To explore the influence of participant expectation on the effectiveness of acupuncture on stress using the *Acupuncture Expectancy Scale (AES) (Mao et al., 2007)* in post-deployment military service members in the experimental group.

Hypothesis 2: Participants with higher expectations from MSSA will report improved stress at the completion of acupuncture treatment compared with baseline scores.

CHAPTER II

LITERATURE REVIEW

History of the Problem of Interest

Abram Kardiner, a psychiatrist and psychoanalytic therapist, provided the diagnosis of *war neurosis* among combat soldiers during World War I (van der Kolk, 2000). He described symptoms of hypervigilance, hyperarousal, pain, flashbacks, nightmares, paranoia, and alteration in personality (DiMauro, Carter, Folk, & Kashdan, 2014; van der Kolk, 2000). Other diagnoses in this era include *shell shock* and *combat neuroses. Shell shock* so called because of the artillery weapons that were predominantly used during this war (DiMauro et al., 2014). Soldiers diagnosed with *shell shock* reported somatic symptoms such as chest pain, tremors, paralysis, fatigue, jumpiness, agitation, and nightmares (DiMauro et al., 2014). *Combat neuroses* pertains to the body's reaction to the adrenal gland's overproduction of adrenaline (DiMauro et al., 2014; Van der Kolk, 1994) Physical manifestations include increased fear response, tremors, sleep problems, and nightmares40.

Researchers revisited Kardiner's work during the outbreak of the Second World War (WWII) and then again during the Korean and Vietnam Wars, and noted that his insights remained relatable in the respective war era in question (van der Kolk, 2000). However, in WWII, *battle fatigue* was beginning to replace the term *hysteria* to describe neuropsychiatric symptoms similar to *shell shock (Corvalan & Klein, 2011).* More recently, the *Gulf War Syndrome* became the trademark diagnosis for Gulf War veterans who were potentially exposed to environmental and chemical hazards while

serving in the region and subsequently reported neuropsychiatric symptoms, gastrointestinal disturbances, and other unexplained symptoms (Corvalan & Klein, 2011).

Global efforts to maintain modern overseas contingency operations have resulted in the creation of new terms, diagnostic assessments, and treatment modalities for PTSD. For example, given the frequency of improvised explosive devices and blast injuries experienced by service members in the current wars in Iraq and Afghanistan, the signature neuropsychiatric symptoms commonly associated with PTSD became traumatic brain injury, a disorder that is associated with complex cognitive, psychological, and physiological consequences (Corvalan & Klein, 2011; Gilbert et al., 2015).

In 1952, the Diagnostic and Statistical Manual for Mental Disorders (DSM) I placed combat-related stress under the umbrella of *gross stress reaction* (GSR) diagnosis (DiMauro et al., 2014). In this category, reactions to extreme stressors were considered transient, a brief ego disturbance as a result of a traumatic event (DiMauro et al., 2014). Despite the perceived ephemeral nature of GSR, post-combat symptoms among WWII veterans remained chronic and included exaggerated startle responses, sleep difficulties, dizziness, blackouts, and avoidance of triggers to the traumatic event (DiMauro et al., 2014). In 1968, GSR was replaced with *transient situational disturbances* (TSD) which encompassed a wider range and less extreme types of stressors (DiMauro et al., 2014). The underlying temporal nature of this diagnosis resulted in the continued minimization of combat-related symptoms and the assumption that veterans presenting with these symptoms had life-long personality disorders or

were weak and therefore less resilient (DiMauro et al., 2014).

In light of the sociopolitical climate after the war in Vietnam, PTSD was added in the DSM III (DiMauro et al., 2014). In 1980, with the advent of the DSM IV, the diagnostic criteria were expanded to incorporate other traumatic events such as natural disasters, life-threatening disasters, sexual assault, and other traumatic events that could be deemed as 'traumatic' under the umbrella of PTSD (DiMauro et al., 2014). The understanding of PTSD symptoms, however, have continued to evolve since its inception in DSM III. In 2013, upon the release of DSM 5, debates raged about the changes in PTSD criteria and the move towards the objectivity versus subjectivity of the diagnosis of PTSD symptomatology (DiMauro et al., 2014). According to the current DSM 5, PTSD is a trauma- stressor-related disorder that includes four symptom clusters: alteration in cognition or emotions, re-experiencing, avoidance, and hyperarousal (APA, 2013). Notwithstanding the ongoing changes and debate in the diagnostic criteria, PTSD remains ubiquitous, and resistant to treatment, particularly in veterans who served in combat including the current wars in Iraq and Afghanistan.

Although certain elements in the PTSD criteria (e.g., the definition of trauma as a diagnostic precursor) remain controversial among experts, the role of sleep in the diagnosis of PTSD has been consistent since its inclusion in the DSM-III (North, Suris, Smith, & King, 2016). Both versions prior neither described specific symptoms nor enumerated the diagnostic criteria associated with GSR syndrome (Straus, Drummond, Nappi, Jenkins, & Norman, 2015). However, in the DSM-III (1980), *dreams* and *sleep disturbance* were included in the re-experience and arousal/avoidance symptom clusters, respectively (North et al., 2016). *Dreams* was later replaced by *distressing*

dreams in the DSM-III-R (1987) which was then subsequently superseded by *fearful dreams* in the DSM-IV (1994) (North et al., 2016). Currently, in the DSM-5 (2013), *dreams* need not be associated with the traumatic event but could be linked to the content and/or effect related to the event (North et al., 2016). *Sleep disturbance* was moved under a new category, hyperarousal, in DSM-III-R, and has remained in there since (North et al., 2016).

Insomnia as a disorder has historically been dichotomized in terms of duration (i.e., acute vs. chronic), assumed etiology (e.g., medical vs. psychiatric), or morbidity status (i.e., primary vs. secondary or comorbidity) (Sateia, 2014). Over the years, experts in the area of sleep have challenged these classifications, which rather implies the lack of consensus about the pathophysiology of chronic insomnia (Sateia, 2014). What is clear, however, is that insomnia affects the body in complex ways and involves multiple biological systems (Sateia, 2014). Furthermore, precipitating and perpetuating factors for insomnia that are unique to deployment may add to the complexity of treating this problem in service members. For instance, deployment-related symptoms may involve seemingly mundane stressors (e.g., communication within the organization, unpredictability of operations or job duty, increase in workload, competing tasks within the chain of command, long work hours, and conflicts between professional duties and personal relationships or goals) that constantly bombard the service member's quality of life (Bravo, Kelley, Swinkels, & Ulmer, 2018). Research shows that higher work stress is linked with higher depressive symptoms and lower sleep quality among Sailors deployed to ship duties (Bravo et al., 2018). Straus and colleagues (2015) conducted a study on Operation Iraqi Freedom/Operation Enduring Freedom/Operation New Dawn

veterans with PTSD and showed that these veterans had more sleep complaints, greater sleep variability, and worse sleep quality as compared with both healthy controls and patients with sleep disturbance who did not have PTSD (Straus et al., 2015). Given the physiological as well as psychological sequela associated with SD in service members who were deployed to war zones and other austere environments, treatments such as acupuncture have been investigated by researchers. The current literature shows that acupuncture may be effective in targeting SD in service members.

Analysis of Relevant Literature

To date, there are five cross-sectional studies (Table 1) that investigated the effect of auricular acupuncture and traditional acupuncture for SD in service members (Garner, Hopkinson, Ketz, Landis, & Trego, 2018; Huang et al., 2018; Jonas et al., 2016; King, C. H., Moore, L. C., & Spence, C. D., 2016b; King et al., 2015). Four of these studies were randomized controlled trials (Garner et al., 2018; Huang et al., 2018; Jonas et al., 2016; King et al., 2015), two were feasibility studies (Garner et al., 2018; King et al., 2015), and one was a qualitative study (King et al., 2016b). Three of these studies found acupuncture to be an effective treatment for SD (Garner et al., 2018; Huang et al., 2018; King et al., 2016b).

Table 1

Comparison of acupuncture studies in service members

Study/Author	Purpose	Design	Variables & Instruments	Relevant Findings	Strengths & Weaknesses of Design
Auricular acupuncture for chronic pain and insomnia: a randomized clinical trial (Garner et al., 2018)	1. To assess the feasibility and credibility of auricular acupuncture treatment (semi-permanent needles for up to four days). 2. To evaluate the effectiveness of auricular acupuncture using a standard protocol on	Cross-sectional. Randomized controlled trial. 45 active duty, retirees, and family members (56% female, 77% Caucasian, family members 38%, active duty 36%) completed self-report questionnaires, sleep diaries, and actigraphy. The study was conducted in a	Feasibility: Number of participants recruited, enrolled, randomized, and retained. Credibility: Borkovec and Nau's credibility scale Pain: 1. BPI Pain Severity	1. Pain severity mean score: acupuncture group > than control group on day 1 and day 4. The control group > than the acupuncture group on day 8. 2. Pain interference mean score: acupuncture group > than the control group on day 1 and 4. Control group > than acupuncture group on day 8. 3. Pain impact: acupuncture group less impact in overall areas	Strengths: 1. Used a standard auricular protocol. 2. Used a pain instrument that assessed both pain severity and interference. 3. Compared several sleep instruments. Weaknesses: 1. Variability in the types of "usual care" in the control group. 2. Participants' location and baseline severity of pain were not mentioned. Potential variability in the

Study/Author	Purpose	Design	Variables & Instruments	Relevant Findings	Strengths & Weaknesses of Design
	pain severity and interference scores and insomnia severity, compared to usual care.	military treatment facility in Germany.	2. BPI Pain Interference Insomnia: 1. ISI 2. Sleep Diaries 3. Actigraphy	of daily functioning and significant impact on sleep and enjoyment. 4. ISI score: acupuncture group > than control group at day 1 and day 4. Control group > than acupuncture group at day 8.	location and etiology of pain among participants at the start of the study. 2. Required removal of the ASP needles on day 8 may have affected pain levels for some participants.
Acupuncture for treatment of persistent disturbed sleep: a randomized clinical trial in veterans with mild traumatic brain injury	1. To evaluate real acupuncture (twice weekly for five weeks aiming for 10 sessions), as compared with sham, acupuncture in	Cross-sectional. Randomized Controlled Trial. 60 veterans (76.7% male, 45% Caucasian, 55% African American) receiving care at the Veterans	Disturbed Sleep: 1. PSQI 2. Wrist Actigraphy	1. Mean scores improved in both real and sham acupunctures by 4.4 and 2.4 points, respectively regardless of presence of PTSD. 2. Sleep efficiency improved in the acupuncture group and	Strengths: 1. Stratification of participants by comorbid PTSD. 2. Randomization of participants between sham and real acupuncture.

Study/Author	Purpose	Design	Variables & Instruments	Relevant Findings	Strengths & Weaknesses of Design
and posttraumatic stress disorder (Huang et al., 2019)	improving persistent sleep disturbance in veterans with mild traumatic brain injury and posttraumatic stress disorder.	Medical Center completed self-report questionnaires and actigraphy. The study was conducted in the United States.		worsened in the sham group. 3. No significant difference between real and sham groups in PSQI global score at 4-week follow up.	3. Blinding of participants about their group assignment. Weaknesses: 1. Lack of treatment fidelity procedures as interventionist was not blinded to the group randomization. 2. No needle manipulation for the real acupuncture which may have contributed to the lack of difference in response between groups. 3. Variability in the number of treatment

Study/Author	Purpose	Design	Variables & Instruments	Relevant Findings	Strengths & Weaknesses of Design
					sessions among participants.
A randomized exploratory study to evaluate two acupuncture methods for the treatment of headaches associated with traumatic brain injury (Jonas et al., 2016)	To determine if traditional acupuncture (ten 60-minute sessions given over a six-week period) was more effective than auricular acupuncture (a combination of disposable needles were inserted for 45 minutes for a total of 10 sessions over	Cross-sectional. Three-arm randomized controlled trial. 29 and 22 service members completed self-report post assessment questionnaires at week 6 and week 12, respectively (88.4% male and 57.9% Caucasian). The study was	Headache: 1. HIT 2. Headache Diary 3. Medication Log Pain: NRS Sleep Disturbance: PSQI Posttraumatic Stress: PCL-C	1. HIT scores: A statistically significant reduction in auricular group compared with usual care. Traditional acupuncture > than usual care but not statistically significant. No significant differences between groups but had clinically meaningful improvements: 6.4 in auricular group and 2.9 points in the traditional groups, respectively. 4. NRS scores decreased for both	Strengths: 1. Multi-site study with several secondary outcomes measured at two different times points (i.e., 6 and 12 weeks). 2. Compared traditional versus auricular acupuncture against usual care. Weaknesses: 1. Variations in treatments received by those in the usual care group. 2. Variability in acupuncture points for

Study/Author	Purpose	Design	Variables & Instruments	Relevant Findings	Strengths & Weaknesses of Design
	a six-week period followed by semi-permanent needles left in place for up to three days) and usual care in the improving three areas: 1) headache-related quality of life, 2) headache frequency and severity, and 3) comorbid symptoms.	conducted in three military treatment facilities in the United States: Walter Reed Army Medical Center, Walter Reed National Military Medical Center, and Fort Belvoir Community Hospital.	Somatic Dysfunction: SCL Physical and Psychologic Functioning: 1. MOS SF-36 2. BDI-II 3. STAI 4. ANAM	auricular and traditional acupuncture. Scores improved in traditional acupuncture than auricular group. 5. No statistically significant improvements in secondary outcomes including sleep.	both the traditional and auricular acupuncture.

Study/Author	Purpose	Design	Variables & Instruments	Relevant Findings	Strengths & Weaknesses of Design
Auricular acupuncture for sleep disturbance in veterans with posttraumatic stress disorder: A feasibility study (King et al., 2015)	1. To examine the feasibility and acceptability of an auricular acupuncture (three treatments per week, total of nine treatments within three weeks) insomnia regimen among service members with PTSD and have deployed	Cross-sectional. 20 veterans (50% Marines, 40% Navy, and 10% Army personnel) in a 10-week residential treatment for PTSD completed self-report questionnaires and sleep diaries and wore actigraphy for a total for 14 nights. The study was conducted in	SD: 1. CSD 2. Wrist Actigraphy 3. PSQI Acceptability: 5-point Likert Scale	1. No significant difference in actigraphy and CSD results and PSQI component scores results between groups. 2. Significant difference between groups on sleep quality component of the PSQI ($p = 0.003$). 3. Significant difference between groups on daytime dysfunction component of the PSQI ($p = 0.004$).	Strengths: 1. Use of both subjective and objective measures in the assessment of SD. 2. Use of standardized points. Weaknesses: 1. Wrist actigraphy was worn by each participant for seven days before and for seven days after the intervention. Disposable ear needles were used in the study (versus semi-permanent needles) may have limited effect to sleep efficiency.

Study/Author	Purpose	Design	Variables & Instruments	Relevant Findings	Strengths & Weaknesses of Design
	to Afghanistan or Iraq. 2. To measure the effect of an auricular acupuncture insomnia regimen using wrist actigraphy, sleep diary, and a self-report questionnaire.	the United States.			2. The residential setting and influence of roommates may have affected the sleep patterns of the participants.
Exploring self-reported benefits of auricular acupuncture	To explore the self-reported benefits of receiving a standardized	Cross-sectional. Qualitative analysis using thematic content analysis	Experience of receiving auricular acupuncture:	1. Improved sleep: 11 participants reported improvement in sleep including ability to fall	Strengths: Use of open-ended questions Weaknesses:

Study/Author	Purpose	Design	Variables & Instruments	Relevant Findings	Strengths & Weaknesses of Design
among veterans with posttraumatic stress disorder (King et al., 2016)	auricular acupuncture treatment.	as part of a pilot feasibility study (King et al., 2016). 17 active duty veterans provided written comments regarding their participation in the study.	Open-ended questions	asleep, stay asleep, and fewer nightmares. 2. Increased relaxation: 11 participants reported feelings of relaxation during and after acupuncture treatments. 3. Decreased pain: Seven participants reported reduced musculoskeletal pain. Four participants reported decreased in headache, 4. Loved/liked auricular acupuncture treatments: Six participants loved the	Only asked participants in the acupuncture group and not those in the control group about their PTSD treatment or perception of acupuncture.

Study/Author	Purpose	Design	Variables & Instruments	Relevant Findings	Strengths & Weaknesses of Design
				treatment and made them feel good.	

Sampling and self-report measure completion methods

Convenience sampling was used for all the five studies. Convenience sampling involves using the most accessible and available people that meet the study's eligibility criteria. This sampling method is the most commonly used, inexpensive, and easy method to recruit participants in research (Setia, 2016). Participants for all these studies completed self-report questionnaires in person.

Synthesis of study design and methods

Design. Several gaps exist in the methodological approaches used in the current literature that investigated acupuncture for SD in service members: 1) The effect of acupuncture was compared with usual care in all studies but one RCT which compared true acupuncture with sham (Huang et al., 2018). Part of the practical barrier to utilizing experimental designs in acupuncture research is the difficulty in deciphering the type of control intervention in which to compare the "true" acupuncture with (De Vaus & de Vaus, 2001). Having a no-treatment control (i.e., usual care) may not be a sufficient control because this approach weakens causal inferences that acupuncture had an effect on the outcome. The advantage of using sham is to decipher if true acupuncture points are indeed effective. However, sham acupuncture is not clearly defined in the research literature and may have placebo effects. As an alternative, using an evidence-based treatment for SD could not only be a more appropriate approach than usual care or sham but also an ethical method in treating SD in the military setting wherein attrition is high and logistics are challenging. 2) All the quantitative studies reviewed have adequately controlled for problematic internal threats to validity by using RCTs.

However, the generalizability of these finding remains difficult because of the heterogeneity of the samples, acupuncture dosing, and the acupuncture points used. 3) Because acupuncture is a complex phenomenon which involves a potential placebo effect, longitudinal studies may be a more definitive approach in answering the questions in this research area.

Methods. In addition to using a robust design (e.g., randomization and other stronger quasi-experimental designs in order to strengthen the equivalence of the group and causal inferences) and assessing outcomes at later time points after the intervention, consideration of the following factors is essential in this area of research: 1) the blinding of practitioners and participants, 2) treatment fidelity procedures, 3) other treatments previously or currently received by participants, 4) co-morbid diseases and presence of severe diagnosis, 5) the duration and regimen of choice of acupuncture, and 6) the practitioner and patient perception of observed benefits of acupuncture. Existing studies are all cross-sectional but one study which assessed outcomes at week six or week 12 after the last intervention (Jonas et al., 2016).

The use of blinding in acupuncture research may help eliminate the potential presence of placebo effects, however this procedure may not be feasible in acupuncture studies wherein the interventionist is also the investigator for the study. Utilizing treatment fidelity procedures to ensure the quality of acupuncture interventions is a promising alternative to blinding. Current studies reviewed did not perform blinding or treatment fidelity procedures.

It is difficult to generalize the study findings to active duty service members because the population studied had multiple co-morbid disorders including

posttraumatic stress disorder or traumatic brain injuries. These complex disorders may heavily influence participant responses to the acupuncture treatments. All studies with the exception of one ear acupuncture study by King et al. (2015) used a complex array of acupuncture points. Although the rationale for the use of these elaborate points is to effectively use the Traditional Chinese Acupuncture diagnostic and treatment concepts, such variations in treatment contribute to the challenges in generalizing and reproducing acupuncture research findings. Only one study used a qualitative approach in assessing the effective of acupuncture in service members. Answers gained from a qualitative study may better inform future research about the effects of acupuncture for sleep and the influence of expectations from treatment.

Synthesis of relevant literature

A standardized acupuncture treatment for SD has not been thoroughly investigated. Using standardized acupuncture points may be beneficial for busy practitioners and active duty patients with multiple military demands. Additionally, using an evidence-based sleep intervention has not been used as a control in existing studies. Investigating the effect of acupuncture as an adjunct to evidence-based interventions may help target both physiological as well psychological mechanisms of SD. Integrating holistic care to service members may provide clinicians with various tools to mitigate functional impairments that affect their quality of life and impact the military mission in general. Furthermore, it is unclear whether acupuncture is helpful in service members without co-morbid disorders. Understanding the effect of acupuncture in active duty service members without severe disorders may help establish treatments earlier as a

preventative approach to symptoms rather than delaying until disorders are more difficult to treat.

Service members are often faced with increasing military demands including operational duties in various austere locations which limit their engagement with the healthcare system. Additionally, despite their struggles and difficulty with symptoms such as SD, other service members do not seek care for fear of stigma or medication side effects. Integrating holistic treatments that are brief and pragmatic are needed in this population so that service members could continue their service in the military while maintaining their well-being and quality of life. Knowledge in how to treat service members using acupuncture may improve both psychological and physiological impairments before their symptoms become severe thus reducing unnecessary utilization of the healthcare system.

Theoretical Framework

SD are common among 2.5 million service members who served in Iraq and in Afghanistan in which up to two-thirds of these troops have complained of SD (Amin, Parisi, Morris, & Gold, 2010). Sleep problems are also prevalent among the older veterans who served in the previous wars (i.e., Vietnam and Korean wars) for which these veterans continue to suffer from, years after these wars have begun (Hughes et al., 2018). Despite the common and chronic problem of SD, their exact mechanisms have yet to be identified. Several possible theories are available in the literature which describe how the problem of SD contributes to its chronicity and negative physical and psychological outcomes. The theories highlighted below include the following categories

or mechanisms: neuroscience perspective, allostasis and allostatic load, sympathetic nervous system and hypothalamic-pituitary-adrenal axis, and the theory of unpleasant symptoms.

Neuroscience Perspective

The physiologic consequences of SD remain elusive but several postulations have been described in the sleep literature. Sleep plays a crucial role in cognitive functioning including consolidation of long term memory and synaptic plasticity (Schmitt, Holsboer-Trachsler, & Eckert, 2016). The protein brain-derived neurotrophic factor (BDNF) is involved in the plasticity of neurons in several brain regions (Schmitt et al., 2016). SD decreases BDNF, as such, a lack of neurotrophic support can lead to major depression (Schmitt et al., 2016). Robust evidence exists elucidating the bidirectional link between SD and depression for which insomnia is considered a predisposing factor for depression (Zaki et al., 2018). Authors propose several theories in the role of serotonin (5-HT) in regulating sleep. Increased release of 5-HT has been observed during the dark phase in a study protocol (Zaki et al., 2018). Depression may alter one's sleep architecture, disrupting the circadian rhythm, and alter the timing of the 5-HT release. Conversely, circadian disruption may be the antecedent and causal condition for the development of depression (Zaki et al., 2018).

Poor sleep quality is associated with changes in the brain in individuals with PTSD including: 1) decreased total cortical and regional frontal lobe regions, 2) low brain gamma-aminobutyric acid (GABA), 3) decreased gray matter volume in the hippocampus and entorhinal cortex, 4) increased rate of regional cerebral metabolic

rate of glucose during the rapid eye movement (REM) sleep as compared with those who do not have PTSD, 5) increased ventricular brain ratios which was associated with less stage four sleep, and 6) impaired shock reactivity/habituation (mediated by the brainstem) and consolidation of extinction (mediated by the ventromedial prefrontal cortex) (Chao, Mohlenhoff, Weiner, & Neylan, 2014; Ebdlahad et al., 2013; Mohlenhoff, Chao, Buckley, Weiner, & Neylan, 2014; Peters, Van Kammen, Van Kammen, & Neylan, 1990; Spoormaker et al., 2010).

Allostasis and Allostatic Load

A theoretical framework that aligns with this notion of complexity is McEwen's allostasis and allostatic load. Allostasis (i.e., maintaining stability during the change) refers to the process in which the organism adapts to a stressful stimulus or stressor in order to maintain homeostasis (McEwen, 2000) Consequently, allostatic load refers to the negative effects of the need for the organism to chronically adapt to the stressor or negative sequela of the stressor (McEwen, 2000). Allostatic load is an adverse response to an overwhelming stressor or the inefficiency of the stress response system (McEwen, 2000). Glucocorticosteroids and catecholamines are two stress mediators that are part of the stress response process (McEwen, 2000). These mediators have protective effects in the short term but with damaging effects in the long term (McEwen, 2000). Elevated levels of these mediators help increase an organism's locomotor activity during a stress response, but when this response is prolonged, elevated levels can result in adrenal overactivity (McEwen, 2000). This overactivity can result in inefficiency of the stress response, atrophy of pyramidal neurons in the hippocampus,

and shut down of the neurogenesis in the dentate gyrus (McEwen, 2000). SD may lead to allostatic load and result in increased evening cortisol, increased blood pressure, and decreased parasympathetic tone (McEwen & Karatsoreos, 2015).

The paradoxical effects of the release of adrenal hormones during the stress response may play a role in the posttraumatic stress symptomatology including SD. The major premise of the allostasis model is that the dynamics of the physiologic stress response system are also affected by one's unique predispositions, cognitive appraisal (i.e., the perception of stress), developmental experiences, genetics, environmental stressors, major life events, and behaviors (McEwen, 2000). In summary, the psychosomatic nature of posttraumatic stress (PTS) symptomatology may be explained by various perspectives including the following mechanisms: psychosocial, neuroscience, and biological. Interventions that target symptoms of stress and SD may help mitigate allostatic load in post-deployment service members. One of these interventions is acupuncture. Acupuncture has shown to prevent PTS, improve SD, and mitigate the complications of PTS (Eshkevari et al., 2012; Eshkevari, Mulroney, Egan, & Lao, 2015; King et al., 2015). Findings from previous research provide evidence that acupuncture could prevent allostatic load by maintaining homeostasis during the stress response process.

Sympathetic Nervous System (SNS) and Hypothalamic-Pituitary-Adrenal (HPA) Axis

Although not clearly established, the role of SNS and HPA in sleep has been explored. Delta sleep or slow wave sleep is known to play a role in sleep homeostasis and restorative function of sleep (Otte et al., 2005). In healthy individuals, delta sleep

activity is usually associated with non-rapid eye movement (NREM) sleep which peaks during the first half of one's total sleep hours (Otte et al., 2005). Veterans with SD had fewer minutes spent in delta sleep than healthy controls (Otte et al., 2005).

Sleep loss impairs the HPA axis' response to mitigate the increase in cortisol levels during stress which may promote further stress vulnerability (Schmitt et al., 2016). Levels of 24-hour urine cortisol/gram creatinine were significantly and negatively correlated with delta sleep in veterans with PTSD (Otte et al., 2005). Nocturnal levels of plasma adrenocorticotropic hormone and cortisol levels during the first half of the night were inversely related to slow wave sleep in veterans with PTSD (Otte et al., 2005).

Sleep is a neurochemical process orchestrated by various sleep-wake cycle hormones (Zisapel, 2018). The onset of endogenous melatonin production at night increases one's propensity for sleep (Zisapel, 2018). The circadian melatonin rhythm is associated with the sleep rhythm whereby diminished nocturnal production of melatonin is associated with SD (Zisapel, 2018).

As an intervention to mitigate the effects of the stress response, research provides evidence that acupuncture decreased the physiologic impact of stress and SD (King et al., 2015). The effects of acupuncture are mediated by the SNS and the HPA axis (Eshkevari et al., 2012; Eshkevari et al., 2015). By blocking the chronic stimulation of the HPA, acupuncture may reduce the physiologic effects of PTS including reducing problems of SD (Eshkevari et al., 2012; Eshkevari et al., 2015).

Theory of Unpleasant Symptoms (TUS)

According to the Theory of Unpleasant Symptoms (TUS) symptoms are of vital

importance in the diagnosis and treatment of disorders (Lenz, Suppe, Gift, Pugh, & Milligan, 1995). Symptoms are perceived experiences by patients that can occur in isolation from other symptoms or as part of a symptomatology that affect or worsen other symptoms. Patients often experience symptoms in a multiplicative or multidimensional manner rather than an additive process(Lenz et al., 1995). Symptoms are the antecedents that encourage individuals to seek health care and are important indicators during the diagnosis stage and the treatment phase(Lenz et al., 1995). Therefore, because each symptom catalyzes other symptoms in the occurrence or progression of the disease, symptom management is an important consideration for clinicians.

The major components of the TUS that impact the individual experiencing the symptoms include the following: intensity of the symptom, timing of the symptom, the level of distress that one may experience, and the quality of symptoms as perceived by the person (Lenz et al., 1995). Three categories impact these components: physiologic, psychologic, and situational factors. Sleep disturbance is considered as a symptom that influences other symptoms and a major contributing factor that maintains posttraumatic stress disorders in service members (Cox, Tuck, & Olatunji, 2017). In post-deployment military service members, sleep disturbance is an experience that affects other physiologic symptoms (e.g., decrease the level of energy, increase hyperarousability, and worsen cardiovascular response) (Fernandez-Mendoza & Vgontzas, 2013). Individuals who have problems with sleep also experience psychologic problems (e.g., vulnerability to stress, irritability, and anxiety) (Fernandez-Mendoza & Vgontzas, 2013). Finally, situational factors also contribute to symptom experience in which the social and

environmental factors may affect the reporting or exacerbation of SD (Lenz et al., 1995).

Sleep disturbance in the military is a consequence of: 1) situational factors that contribute to sleep problems (i.e., sleep disruptions and poor sleep practices in operational environments), 2) other symptoms of deployment exposure, and 3) attributes of insomnia (i.e., persistent sleep problems with staying asleep or falling asleep and shorter duration of sleep or insufficient sleep). Given the deployment stressors experienced by service members in austere operational theaters, poor sleep practices are common and could persist between and after completion of deployments (Luxton et al., 2011; Steele et al., 2017). These poor sleep practices could contribute to circadian misalignment, persistent short sleep duration, and inefficient sleep (Luxton et al., 2011).

Sleep disturbance in service members who were exposed to deployment stressors results in the following: disruption of the circadian rhythm and synchronicity, and an overconsolidation of the emotional component of memories (Amin et al., 2010; Koffel et al., 2013; Pace-Schott et al., 2015; Seelig et al., 2010). The elucidation above explains the mechanism of sleep disturbance and identifies areas where interventions (i.e., acupuncture and cognitive behavioral therapy) may potentially mitigate problems with sleep. Acupuncture may potentially target the physiologic responses as a result of the disruption of the circadian rhythm and synchronicity. CBT may target the psychologic responses as a result of overconsolidation of the emotional component of memories. The combination of acupuncture and CBT may help normalize sleep in service members who were deployed. Figure 1 depicts the theory that was used to guide this study and delineates the following constructs: antecedent (i.e., deployment

exposure), consequences of the deployment (i.e., physiologic and psychologic responses resulting in SD, interventions to target SD (i.e., acupuncture and cognitive behavioral therapy), and the potential outcome (i.e., improvement in sleep based on self-report measures).

In summary, brain structural changes, inflammatory processes, hormone production, and neurotransmitter dysfunctions occur among participants with SD. Sleep disturbance is a symptom that persist as a consequence of physiologic and psychologic responses from deployment exposure. Circadian rhythm disruption, overconsolidation, and TUS are theoretical perspectives that elucidate the mechanisms of sleep disturbance as a debilitating symptom. To mitigate SD, acupuncture and cognitive behavioral therapy are hypothesized to target the physiologic as well as psychologic symptoms of SD, respectively.

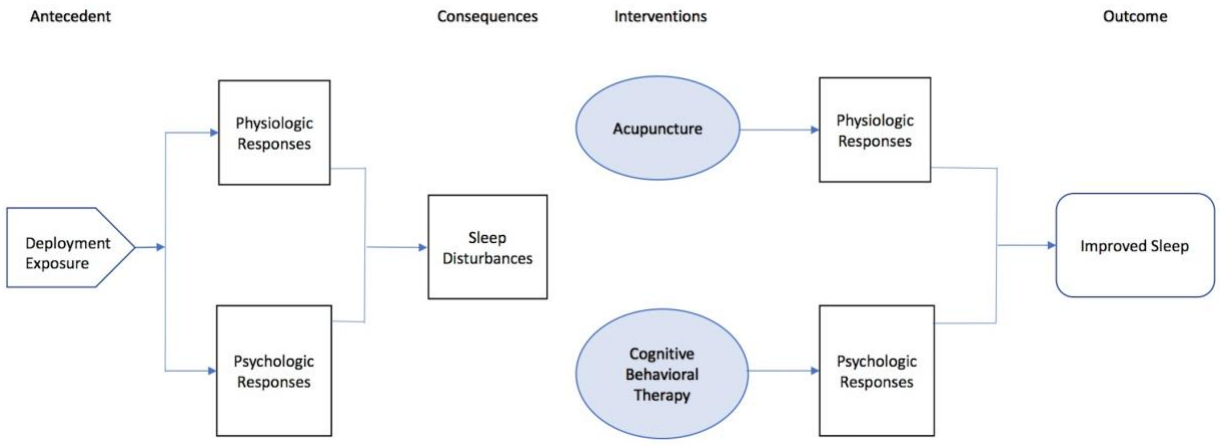

Figure 1

Hypothesized framework for understanding the effect of acupuncture in post-deployment service members

Key Concepts

Sleep Disturbances

Sleep disturbance is defined as experiencing insomnia, nightmares (i.e., distressing dreams), or fragmented rapid eye movement sleep (i.e., changes in REM sleep as a result of limbic system hyperarousal) (Pace-Schott et al., 2015). Insomnia is clinically defined as the problem with falling asleep, staying asleep, or having nonrestorative sleep for at least three nights a week (Perlis et al., 2006). The duration of insomnia is either acute (i.e., less than a month) or chronic (i.e., at least one month) and involves daytime distress or impairment (Perlis et al., 2006). In service members, insomnia has been operationalized in terms of the duration of the hours of sleep: short sleep duration (SSD) (i.e., having less than seven hours of sleep) and very short sleep duration (VSSD) (i.e., having less than six hours of sleep) (Luxton et al., 2011). Sleep disturbance is considered to be a subjective complaint (e.g., insomnia and nightmares) for which objective assessment (e.g., using polysomnography to assess REM disruption) is not required in order to treat the patient's symptom (Perlis et al., 2006).

Given the war stressors experienced by service members in these austere operational theaters, poor sleep practices are common and could persist between and after completion of deployments (Luxton et al., 2011). These poor sleep practices could contribute to circadian misalignment, persistent SSD, and inefficient sleep (Luxton et al., 2011). Service members who were exposed to deployment are more at risk for having SSD or VSSD compared with those who had no deployment experiences (Luxton et al., 2011). Despite the debilitating symptoms associated with SD in this population,

mitigating SD is a challenging task even years after deployment. Several interventions have been investigated in the treatment of SD such as pharmacotherapy, psychotherapy, and acupuncture.

Cognitive Behavioral Therapy

Cognitive Behavioral Therapy for insomnia (CBTi) is a highly structured intervention which includes behavioral sleep modifications, sleep restriction, sleep hygiene instructions, and cognitive interventions that target catastrophic beliefs and attitudes surrounding sleep (Talbot et al., 2014). CBTi has been the term most frequently used in targeting SD and has shown to be effective in targeting both insomnia and nightmares and consequently hyperarousal which may also alter REM disruption (Morgenthaler et al., 2018). CBT is an effective treatment for improving SD, as assessed by both objective (i.e., polysomnography) and subjective (i.e., self-report questionnaires) measures (Ho, Chan, & Tang, 2016; Talbot et al., 2014). Service members who perceive their symptoms as a consequence of a physiologic problem underuse their medication and are non-adherent with treatments (Spoont, Sayer, & Nelson, 2005). Those who perceive their symptoms as a consequence of psychosocial problem are more likely to engage in psychotherapy treatments (Spoont et al., 2005). Service members who perceived their symptoms to have a pervasive impact on their lives were more likely to pursue psychotherapy compared with pharmacotherapy to treat their symptoms (Spoont et al., 2005).

Acupuncture

Acupuncture is a procedure performed by inserting sterile needles to chosen acupuncture points based on the practitioner's assessment of the symptoms (Price, Long, Godfrey, & Thomas, 2011). The two types of theoretical approaches that have been delineated in the literature include the Traditional Acupuncture (i.e., grounded within the Chinese or Japanese traditional medicine theory) and the Medical Acupuncture (i.e., based on the biomedical approach) (Price et al., 2011). In general, acupuncture is a type of complementary or alternative therapy that has been examined as a treatment for SD and other disorders (King et al., 2015). This type of treatment is typically considered as non-conventional in Western medicine compared with pharmacotherapy and psychotherapy but is known to have fewer side effects when compared with medications, and less cumbersome when compared with psychotherapy (Lee et al., 2012).

CHAPTER III

METHODOLOGY

Research Design and Assumptions

The primary goal of this study was to examine the effectiveness of a MSSA combined with ACBT, compared to ACBT alone, among post-deployment service members. MSSA was conducted weekly for four weeks and ACBT was a two-session treatment. The experimental group received both MSSA and ACBT and the control group received ACBT only for two weeks. The study protocol was five weeks for both groups.

Design. This study was a two-arm, single-center, mixed-methods, and randomized controlled trial in U.S. Naval Hospital, Okinawa (USNHO), Japan. Permutated block randomization was conducted by the primary investigator. Service members who met the study selection criteria and decided to participate were randomly assigned to either the experimental or control group: 1) *Experimental*: MSSA and ACBT, or 2) *Control:* ACBT only and waitlist for acupuncture (Figure 2). Participants in the control group was offered the acupuncture at the end of the study (i.e., within a three-month period after the last study assessment has been obtained). Because of the nature of the intervention and study logistics, it was impossible to blind the acupuncturist about who will receive the acupuncture. Therefore, no blinding was done in this study.

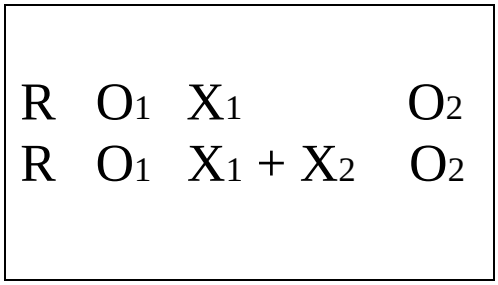

Figure 2
Study Design

Experimental and Control Group. Baseline measures were obtained shortly before the first ACBT session. Both the experimental and control groups received ACBT (Wagley et al., 2013). The ACBT was performed by the PI (a licensed, credentialed therapist at USNHO) and the psychiatric technician (assistant investigator trained in research). All participants received a two-session ACBT treatment: 1) one 60-minute group session, and 2) a follow-up individual session via telephone two weeks after the first session (Wagley et al., 2013). The first group therapy session had a maximum number of five participants and was held during the first week of the study. Service members were assigned to a psychotherapy group according to their availability during the week.

The first session consisted of the following components in a group setting: sleep restriction, stimulus control, sleep hygiene recommendations, and identification and restructuring of maladaptive cognitive beliefs and attitudes about sleep (Perlis et al., 2006). Two weeks after the first session, a follow-up session was conducted via telephone (Wagley et al., 2013). The second session focused on resolving any concerns about the recommendations from the first session (Wagley et al., 2013). To

match the non-specific treatment effects received from the acupuncture intervention in the experimental group, the control group received an additional four telephone sessions weekly from the PI to briefly inquire about their progress (Sedgwick & Greenwood, 2015). Two weeks after the second session, all participants completed the posttreatment measures in person (see Table 2). The control group was offered the opportunity to receive acupuncture at the end of the study within a period of three months, after the last assessment had been conducted for the study.

Table 2

Data Collection Schedule

Task	Baseline	Week 1	Week 2	Week 3	Week 4	Week 5
Demographic Data	x					
ISI/PSQI/PCL-5	x					x
Journal Log						x
Acupuncture Expectancy Scale/ Vital Signs (experimental group only)	x					x
Psychotherapy (both groups)		x (group session)		x (individual follow-up via telephone)		
Phone Check-in (control group only)			x	x	x	x
Acupuncture (experimental group only)			x	x	x	x

Experimental Group. The acupuncturist, who is also the PI, is a licensed, privileged Psychiatric Mental Health Practitioner (PMHNP) and trained acupuncturist with over eight years of experience as a PMHNP and acupuncturist. The acupuncturist is privileged to practice acupuncture at USNHO. Participants received an eight-point MSSA weekly treatment for a total of four consecutive weeks, starting the week after their group ACBT session (i.e., after the first session). Each session was 30 minutes in duration. The MSSA consisted of the following points: bilateral auricular (ear) *shen men*, GV- 20, GV-24.5 (*Yin Tang*), bilateral LI-4, and bilateral LR-3 (Koffman, 2011). The acupuncture protocol currently being used for clinical standard of care and for research purposes is the same (see Appendix for detailed acupuncture protocol).

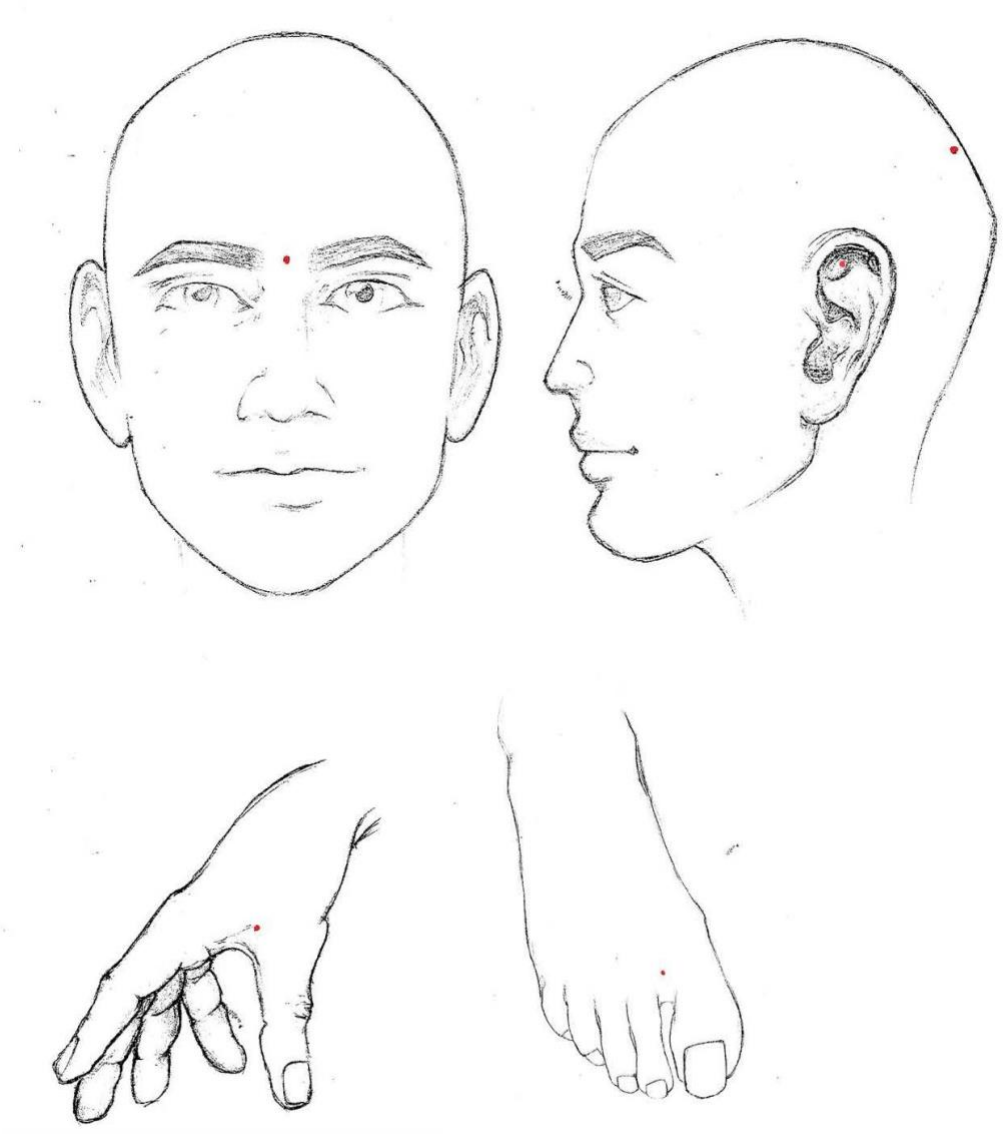

Figure 3

MSSA: GV-24.5 (*Yin Tang*), bilateral auricular (ear) *shen men*, GV- 20, bilateral LI-4, and bilateral LR-3

Assumptions. The following were the assumptions for this study: 1) Service members in this setting will be willing to participate in the study; 2) Participants will have a cellular telephone and be willing to receive the second session and posttreatment

assessments over the phone; and 3) Participants will be available to complete the acupuncture intervention weekly for four weeks.

Description of Research Setting

This study was conducted at USNHO. To this date, it is the largest hospital overseas and staffed by active duty Navy and Air Force personnel, civilians, contractors, and Japanese employees. The following facilities were used for this study: a private room where the acupuncture treatment was conducted, a private office where informed consents were performed, and a group room where the group therapy was conducted.

Sample and Sampling Plan

Nature and Size of Sample

The target population was service members who have deployment-related SD. To this date, about 15,000 Marines and Sailors are stationed in Okinawa, Japan. Many Marines and Sailors assigned in this location have been in support of Operation Enduring Freedom, Operation Iraqi Freedom, and other missions in the Pacific since 2004. The sampling strategy for this study was convenience sampling in which participants who are interested in the study, and met eligibility criteria, were recruited to participate. Active duty service members stationed in Okinawa, Japan are typically healthy adults, with ages 18 to 65, from diverse ethnic backgrounds, and predominantly male and female gender. Participants were enrolled in the study regardless of ethnic

background, marital status, rank, service type, race, or gender. Convenience sampling was used because of its advantages in cost and logistics.

An analysis sample of 30 participants per study group completing the study protocol was proposed (total n=60). To account for an expected 25% attrition rate (King et al., 2015), we planned to recruit, consent, and enroll a total of 80 (40 per research arm).

Criteria for Sample Selection, Criteria for Inclusion and Exclusion

Inclusion Criteria. Active duty service members were considered eligible upon meeting the following criteria: 1) 18 to 65 years of age who have been deployed to operational environments (combat zones, ship deployments, or other austere environments), 2) Self-report of deployment experience and insomnia symptoms for at least one month, 3) A score of 15 or above on the Insomnia Severity Index (ISI) (Bastien, Vallieres, & Morin, 2001), 4) A score of 5 or more on the Pittsburg Sleep Quality Index (PSQI) (Buysse et al., 1988), 5) Stable on psychiatric and other medications including blood pressure agents for at least three months, 6) Agreed to participate in a group psychotherapy for insomnia, 7) Agreed to conduct individual interview via the telephone, and 8) Agreed to discontinue sedative-hypnotics throughout the study (i.e., five weeks), and 9) Able to sign an informed consent.

Exclusion Criteria. Those who met the following criteria were excluded from the study: 1) Surgery within one month, 2) Substance use disorder diagnosis within one month, 3) Substance use disorder treatment within one month, 4) Pregnant women (acupuncture can result in an induction of labor and spontaneous abortion in rare

occasions(White, Cummings, & Filshie, 2008), 5) Has had acupuncture treatment or dry needling (i.e., physical therapy intervention typically utilized for musculoskeletal pain complaints) in the past month, and 5) Previous diagnosis of other sleep disorders or medical conditions that could impact sleep (e.g., obstructive sleep apnea).

Methods for Subject Recruitment

Recruitment. Upon research protocol approval from USNHO and Institutional Review Board approvals from Naval Medical Center, San Diego and Vanderbilt University, the PI and study staff recruited participants by posting advertisements and flyers in the USNHO, branch health clinic patient care areas and community notice boards. The study staff recruited 80 military personnel with a goal of obtaining a final sample of 60. Advertisements about the study were posted on the military base community notice boards and were sent via e-mail notifications to unit leaders. A recruitment table was set-up in the Air Force and Navy Exchange entrances on weekends throughout the study (see Appendix for recruitment flyer).

Identification of Participants. No PI/PHI was obtained during the eligibility screening. If interested in the study, participants were screened for eligibility by the PI or study staff (i.e., psychiatric technician). Eligibility screening was conducted via telephone or in-person in a private office by the PI or the study staff. For those who were eligible to participate, a written informed consent was obtained from the participants prior to conducting the study.

Strategies to Ensure Human Subjects Protection

In addition to Institutional Review Board approvals, study staff, including the PI and psychiatric technician, obtained a human subjects protection informed consent and a signature on an additional informed consent form for acupuncture procedure required by Bureau of Medicine and Surgery prior to the beginning of the study (BUMED, 2013). Upon eligibility, participants were instructed to come in-person to the mental health department or a designated private office to sign the informed consent. Participants read the consent document in its entirety by themselves prior to signing. The study staff discussed the protocol with each participant, individually, and in person. Signed consent forms were stored separately from the research records and were accessible only to the PI. The PI was available during the informed consent process should questions arise about the protocol.

Training. Upon IRB approval, the research team was trained by the PI on the following research activities: recruitment, screening of eligible participants, proper procedures when there are adverse events and psychological distress, informed consent process, follow-up tracking procedures, and administration of surveys and questionnaires. The study staff (i.e., psychiatric technician) working with the PI was required to undergo a special training prior to the beginning of the study to ensure consistency in study logistics and practices. The training included logistics about the study such as participant check-in, study questionnaires, and follow-up periods.

Monitoring. The PI assessed the study staff's research practices by enactment of skills and direct observation of these skills by the PI prior to study implementation. The PI monitored all research activities conducted by the study staff throughout the study. Unanticipated problems including risks to subjects were reported to the PI's

research mentor and to the IRB as appropriate. Log books and research data were kept in a locked file cabinet which only the PI could access.

HIPPA Compliance. The PI and study staff ensured adherence to confidentiality procedures during data collection, treatment fidelity, and data storage procedures. The PI had ongoing conversations with the HIPPA officer and IRB contact person at NMCSD prior to the submission of protocol. A waiver for informed consent was obtained during eligibility screening activities. No PII/PHI was obtained during eligibility screening. Only a government-issued electronic device was used for photography of randomly selected treatment fidelity procedures and were uploaded securely to a Department of Defense secure, encrypted e-mail system.

Confidentiality. All research documents were de-identified. Informed consent was obtained at a private office. All files were kept in a locked file cabinet that only the PI had access to.

Coercion/Volunteerism. Participation in this study was completely voluntary. The PI and study staff avoided the appearance of coercion or undue influence during the recruitment and throughout the study by 1) wearing civilian attire when recruiting outside work areas, and 2) refraining from directly recruiting patients in the mental health clinic. Participants were informed that they could voluntarily withdraw from the study at any time by notifying the PI or study staff. Dropouts and withdrawals from the study were recorded throughout the study.

Treatment Safety. A classification of mild, significant, and serious risk was used for this study (White et al., 2008). Minimization of risks were made by the study staff throughout the study (See Appendix for minimization of risks). Any adverse events

(AEs) (i.e., unanticipated problems or unintended side effects observed by the practitioner or experienced by the participant occurring after treatment) were monitored and evaluated by the practitioner during each treatment based on the National Cancer Institute's evaluation methods ("Common terminology criteria for adverse events (CTCAE)," 2010).

During the study, a potential AE (i.e., elevated Creatinine Kinase) was reported by one participant to the PI. The PI immediately discussed the AE with her advisor and reported the AE to the IRB team. The IRB deemed that the reported AE was unrelated to the study. The AE was documented by the PI in a log with date, type, grade, action taken, date reported to mentor, and date reported to VU and NMCSD IRB. The PI planned to report all AEs above grade 1, or above the level mild, to USNHO and NMCSD IRB immediately and for further action, but none occurred.

Throughout the study, the study staff assessed whether or not the participants were at imminent risk to self or others. If a participant was deemed at risk, the mental health clinic's risk protocol and treatment procedures at USNHO would have been implemented according to the participant's evaluation. During this study, no participants reported any safety concerns that were deemed imminent risk during the study.

Data Collection Methods

Procedures

Data collection for this study is described in Table 2. The study staff provided the paper questionnaires and retrieved participant data. The following data were collected

prior to any treatments: Demographics, sleep disorder questionnaire, journal log, and self-report questionnaires. Perceived benefits were assessed using the journal log during post treatment, at the end of the study (see Appendix for instruments and journal log questions).

Treatment Fidelity. 1) ACBT protocol: To assess adherence to the ACBT protocol, the therapist's delivery of the intervention was evaluated via a self-assessment checklist. The therapist of the ACBT protocol completed a self-assessment on the following components: practitioner's interaction style, incidence of treatment components that were omitted, incidence of treatment components that were added but were not specified in the protocol, length of intervention, and treatment differentiation (Borrelli, 2011). *2) MSSA protocol:* To assess adherence to the acupuncture protocol, the acupuncture practitioner's delivery of the intervention was evaluated via a peer review method by an expert licensed, privileged acupuncturist at a military treatment facility in Southern California as approved by the IRB. A random selection process was conducted using a free online software to generate random sessions for the peer review (Urbaniak & Plous, 2013). The picture was obtained using a password-protected, government-issued electronic device. Pictures were uploaded to the Department of Defense encrypted e-mail system and did not contain any PII.

The image of the acupuncture location and placement during the acupuncture sessions did not include the participant's full face and included only the following phases of the acupuncture session: 1) the location of the needles, and 2) the placement of the needles. Using photography of random sessions were included in the informed consent. These sessions were peer reviewed using a survey sent to the peer reviewer

via the Department of Defense secure e-mail. Surveys were sent back to the practitioner. An optimal level of treatment adherence for the interventions is meeting at least 80% of the adherence checklist (Borrelli, 2011). If the practitioner received 40% or lower in the adherence checklist, booster-training sessions would have been recommended until the practitioner reached the minimum optimal level of adherence to the treatment protocol.

Ten percent of the study's total therapy and acupuncture sessions were randomly selected and reviewed by the peer reviewer. The acupuncture practitioner took pictures of the placement of the needles and sent the image via an encrypted military e-mail to a peer reviewer. The peer reviewer provided necessary feedback to the practitioner based on the peer review survey and discussed the quality of treatment adherence with the practitioner. Peer review of random sessions that were implemented throughout the study received 100% adherence to the protocol.

Data Management. De-identified data were coded independently by the coders (i.e., PI and assistant investigator) using password-protected *Microsoft® Excel and Word* spreadsheets. The survey answers were stored in *Excel*® spreadsheets. Journal log entries were stored in *Word*® documents. These spreadsheets and documents were stored in the PI's password-protected personal laptop computer, and uploaded and shared between the coders via a password-protected document. After discussion and consensus between the coders, a final spreadsheet was created. This final spreadsheet was imported from *Excel*® into IBM SPSS Statistics software for the quantitative data analysis and into *Dedoose*® for the qualitative analysis. All de-

identified data were stored in the PI's password-protected personal laptop computer and kept indefinitely by the PI.

Storage of Patient Information. The informed consents were stored securely in a locked cabinet and separately from the research forms. The consent forms were accessible only to the PI. All data collection sheets had no identifiers, including initials, last 4 SSN, or Department of Defense numbers. The screening forms were stored in a locked cabinet in the PI's office and accessible only to the PI. These forms were kept until the end of the study and destroyed upon closure of the study via the Navy's IRB. All participants were assigned a study ID number for the purposes of statistical analysis and data interpretation. A master list, that linked identifying information with a subject ID number, was kept locked in a separate location from any clinical data associated with the subject ID number and only accessible to the PI. The list of ID numbers and all research forms were accessible only to the PI. All the hard copies of research forms were de-identified, kept until study closure, and destroyed after the study.

Study Instruments

The sleep disturbance instruments for this study are considered reliable and valid (Bastien et al., 2001; Buysse et al., 1988). All self-report measures are available for researchers to use without permission from authors except for the Acupuncture Expectation Scale (AES) which the PI has received permission to use via e-mail. The questionnaires were completed by participants which took on average 15 minutes to complete (see Appendix for questionnaires). Self-report measures were completed at

two time points: prior to initiation of the first treatment (i.e., week one) and at the conclusion of the treatment (i.e., week five).

Sleep Disturbance Measures. Insomnia is defined as having perceived difficulty with falling asleep, trouble maintaining sleep, less hours of sleep and an impairment in functioning (Bastien et al., 2001; Buysse et al., 1988). SD was measured with the Insomnia Severity Index (ISI) (Morin, 2017) and Pittsburg Sleep Quality Index (PSQI) (Buysse et al., 1988). The self-report questionnaires included in this study complement one another as the ISI predominantly measures the psychosocial aspects of sleep whereas the PSQI measures the quantitative aspects of sleep.

The ISI is a seven-item standardized self-report questionnaire that measures the subjective symptoms of SD (Morin, 2017). These subjective symptoms include the respondents' concerns and distress as a result of problems with sleep. The ISI measure contains seven items including perceived difficulty with sleep-onset, sleep maintenance, and early morning awakenings; satisfaction with sleep patterns; interference of sleep problems with daily functioning; impairment as a result of a sleep problem; and degree of distress or concern with the sleep problem (Bastien et al., 2001). Each item in the ISI is rated from 0 to 4 whereby the higher number indicates more difficulty. The scores are added to yield a range of total scores from 0 to 28 in which a higher score suggests more severe SD. This scale has good validity psychometrics and is widely used in research: sensitivity (78.1%), and specificity (100.0%) (Morin, 2017). The reliabilities of the scores in this study were .53 at baseline and .85 at post-assessment (Cronbach's alpha).

The PSQI is a 19-item questionnaire that includes seven areas of sleep quality and patterns in adults over the last month including the following components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, SD, use of sleeping medications, and daytime dysfunction (Buysse et al., 1988). Each item in the scale is scored from 0 to 3 scale (0 = no difficulty; 3 = severe difficulty). The scores are added to yield a global score ranging from 0 to 21 (0 = no difficulty; 21 = severe difficulties in all areas). This scale has good validity psychometrics and is widely used in research: sensitivity (89.6%), and specificity (86.5%) (Buysse et al., 1988). The reliabilities of the scores in this study were .43 at baseline and .70 at post-assessment (Cronbach's alpha).

Acupuncture Expectancy Measure. The participant's expectancy from acupuncture is defined as the expectation that acupuncture will improve the participant's stress, coping, and energy (Mao et al., 2010). The participant's expectations from acupuncture was measured with the Acupuncture Expectancy Scale (AES). The AES is a 4-item questionnaire that measures the participants' expected responses to acupuncture. Participants' expected improvement from acupuncture is rated in a 5-point Likert-type scale ranging from *not at all agree* to *completely agree* (Mao et al., 2010). The total possible scores for AES range from 4 to 20, with higher scores indicating greater expectancy. This instrument has good internal consistency and validity. The reliabilities of the scores in the study were .88 and .83 at baseline and post-assessment, respectively (Cronbach's alpha). This instrument is in the public domain. However, permission to use AES has been received from the author via e-mail.

Other Measures. 1) Demographics questionnaire. This questionnaire was kept and maintained by the PI and included demographics of participants including deployment history and lifestyle habits (e.g., smoking, alcohol use). *2) Recruitment, Retention and Risk Log*: Recruitment and retention log were kept and maintained by the PI throughout the study which included the following information: number of participants screened for eligibility, recruited for the study, completed follow-up, dropped-out of study, and withdrawn from the study. Any adverse event that occurred during the study were monitored and reported to the PI's advisors and/or NMCSD IRB staff as deemed necessary by PI and advisors (see Appendix for classification of risk). *3) Posttraumatic Stress Disorder Checklist (PCL-5):* The PCL-5 is a 20-item scale that examines the degree of how an individual has been bothered by symptoms associated with a distressing event (Wortmann et al., 2016). Each item is rated from 0 (not at all bothered) to 4 (extremely bothered). Scores are summed to yield a severity score. Permissions to use the PCL-5 are not required (Keane, 1989; Weathers et al., 2013). It is widely used in both clinical and research settings. The reliabilities of the scores in this study for the two times of assessments were .96 (Cronbach's alpha). 5*) Journal Log*: Journal log was kept and maintained by the PI which includes five open-ended questions about the participants' perceived benefits of acupuncture. Journal logs were completed by the participants at week five during the posttreatment assessment.

Data Analysis

De-identified study data were exported from *Microsoft Excel*® into IBM SPSS Statistics software for analyses. Effect sizes were the primary goals of the analyses yet

if conducted, tests of statistical significance were maintained at an alpha level of 0.05 ($p < 0.05$ for *Type I* error). Frequency distributions were used to summarize the number of individuals screened for the study versus the number of participants, and the number of participants who completed all visits versus the number of participants who withdrew from the study ("drop-out"). Frequency distributions were also used to summarize the nominal and ordinal demographic characteristics of the sample: mean (SD) were used for normally distributed continuous variables and median (IQR) for skewed distributions. Chi-square Tests were used to compare the characteristics of those who completed the study versus those who did not to inform future more targeted inclusion criteria. Given that missing data was not likely not be random, no imputation of missing data assessments was conducted. Randomly missing item responses within the study measures were handled via protocols established by the measure developers.

Statistical Analysis Specific to Each Aim

The following data analysis methods were used to examine each aim:

Aim 1a. To evaluate the *effectiveness* of MSSA as an adjunct treatment with ACBT, as compared to ACBT alone, for SD in post-deployment military service members.

Data Collection Measures*:* ISI=Insomnia Severity Scale; PSQI=Pittsburg Sleep Quality Index.

Method of Analysis: Change in each of the study continuous outcome measures from baseline to end-of-study were calculated. Descriptive statistical summaries of the measures scores at each time of assessment as well as the change in those scores were generated. One analysis approach for those measures was to use each change

value as the dependent variable in a linear regression analysis that tested the effect of study group on that change value controlling for the respective baseline score. The resulting beta coefficient for study group was transformed to the Cohen's *d* effect size index. Given measurement error inherent in psychosocial measures, reliable change indices (RCI) that took into account the reliability of the measures were also generated (Christensen & Mendoza, 1986; Jacobson, Follette, & Revenstorf, 1984; Jacobson & Truax, 1991). Each group's distributions of reliable change scores were examined to determine and compare the proportion of participants demonstrating clinically meaningful RCIs.

Aim 1b. To describe the *perceived benefit* of MSSA as an adjunct treatment with ACBT, as compared with ACBT alone, for SD in post-deployment military service members.
Data Collection Method: Journaling logs were obtained from each participant at the end-of-study. In this journal, service members were asked to provide, in their own words, any perceived psychological, physiological, and behavioral benefits after an acupuncture treatment. Open-ended questions were provided.
Method of Analysis: De-identified journal log entries were transcribed verbatim in the *Dedoose*® software and analyzed to develop codes and themes. The PI and a research mentor independently reviewed journal log entries. A thematic content analysis method was used to code emerging themes (Graneheim & Lundman, 2004). Emerging themes were compiled to verify the relationship between themes and the identified codes. The two coders discussed findings about the transcripts and addressed disagreements through a consensus to enhance credibility of findings. For

the final analysis of the data, a third independent reviewer was available to verify codes and themes to avoid bias. The dependability was ensured by performing ongoing coding checks of the data and their interpretation through an iterative process. Line by line analysis using *Dedoose*® were used to identify key phrases within the text. Data was analyzed using qualitative charts and code application in *Dedoose*®. Exemplar quotes that supported each theme were selected to include the participants' voices from the data.

Aim 2. To explore the influence of participant expectation on the effectiveness of acupuncture on stress in post-deployment military service members in the experimental group.

Data Collection Measures: AES was obtained from the experimental group at baseline and again at the end-of-study.

Method of Analysis: Wilcoxon Signed-Ranks test was used to evaluate the statistical significance of the change in scores in the AES measure. The RCI distribution was also generated for this measure.

Secondary Outcomes

1. Vital Signs (using the *Welch Allyn*® *Spot LXi*® vital signs device and self-report) were obtained from the experimental group at baseline and again at the end-of-study.

Data Collection Measures: Blood Pressure, Heart Rate, and Pain

Method of Analysis: Descriptive statistical summaries of the measures scores at each time of assessment as well as the change in those scores were generated.

2. Data Collection Measure: The Posttraumatic Stress Disorder Checklist (PCL5) was obtained from both groups at baseline and again at the end-of-study.

Method of Analysis: Descriptive statistical summaries of the measures scores at each time of assessment as well as the change in those scores were generated. One analysis approach for those measures was to use each change value as the dependent variable in a linear regression analysis that tested the effect of study group on that change value controlling for the respective baseline score. The resulting beta coefficient for study group was transformed to the Cohen's *d* effect size index. Each group's distributions of reliable change scores were examined to determine and compare the proportion of participants demonstrating clinically meaningful RCIs.

Sample Size Justification

The proposed sample size for this study was justified initially by a conservative estimate of the number of service personnel meeting the inclusion criteria that can be recruited, enrolled, and retained throughout the study period. The expected analysis sample (N=60, 30 per group completing the 5-week study protocol) provided 80% statistical power to detect a difference in between the groups in the amount of change in the outcomes of approximately 0.7 SD (Cohen's *d,* 2-tailed alpha). Prior published work in other populations have found smaller effect sizes or larger (Engel et al., 2014b).

Plans for Dissemination of Findings

Findings of this research will be disseminated through publication and national presentation activities. The following potential journals will be considered to disseminate the results of this research: 1) *Journal of Clinical Sleep Medicine* for the quantitative portion of the study and the 2) *Journal of Traumatic Stress* for the qualitative portion of the study. To present the study findings of this research in the national conference, the PI will submit the abstract to the *Council for the Advancement of Nursing Science Research*. The target audience will be clinical practitioners and researchers as well military providers and leaders.

CHAPTER IV

This chapter consists of four major sections: participant flow, sample characteristics, research aims, and secondary outcomes. The research aims section has six subsections: Aim1a and summary, Aim1b and summary, and Aim2 and summary. Aim1b has the following subsections: introduction, personal challenges in implementing the strategies, no improvement from treatment, perceived effectiveness of treatment, and summary.

RESULTS / FINDINGS

Participant Flow

The research staff screened a total of 123 potential participants for eligibility, 43 of whom were ineligible for the following reasons: scores of less than 15 on the ISI measure, diagnosis of Sleep Apnea, no deployment history, non-active duty (i.e., retired veteran or civilian), and receiving CBTi treatment at the time of recruitment (see Figure 4). Eighty participants were enrolled and randomized to two groups for the following interventions: 1) ACBT only, and 2) ACBT with acupuncture (MSSA). After 10 attrition, 70 participants completed the interventions and data from these participants were analyzed for the study.

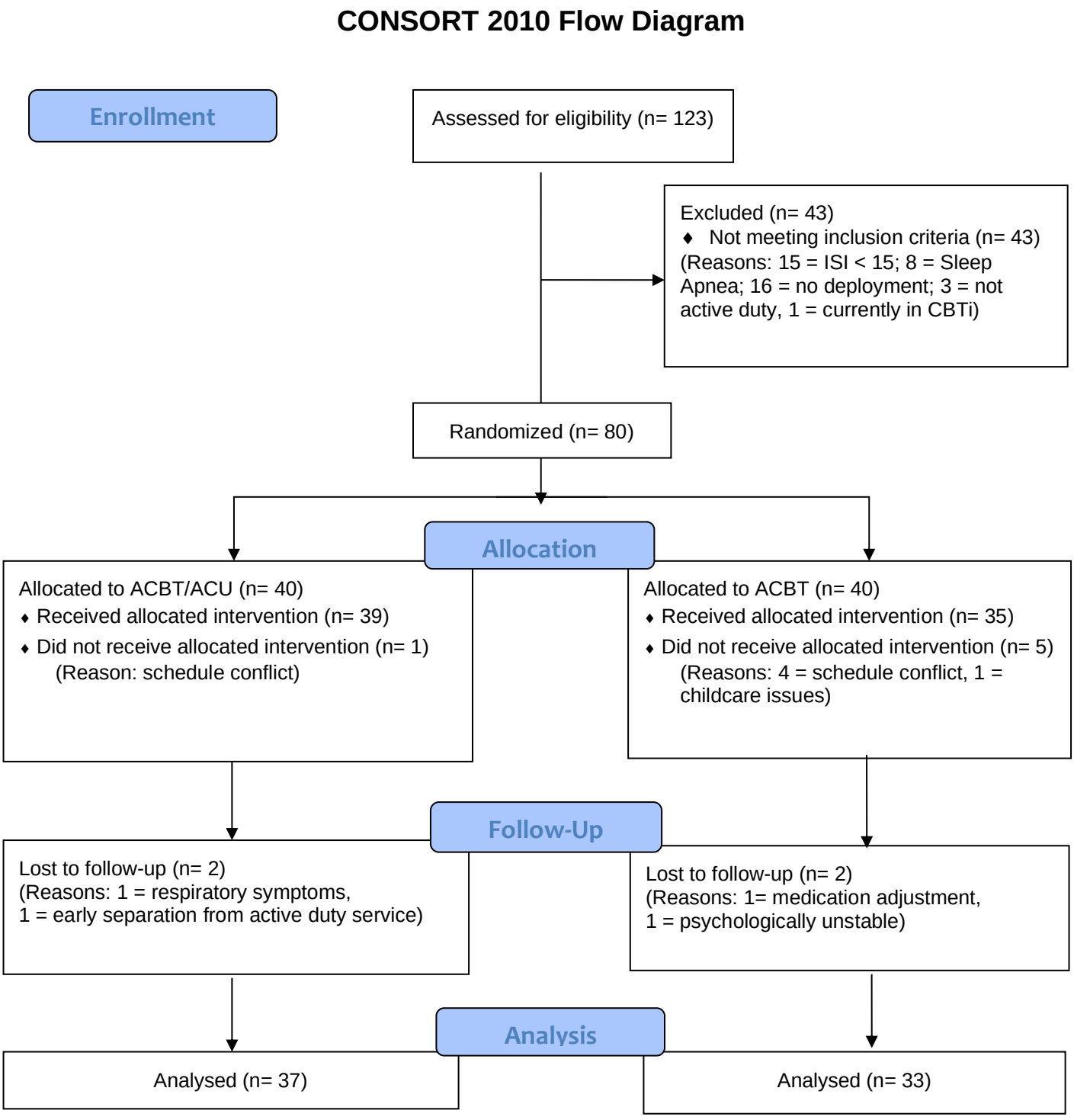

Figure 4

Participant Flowchart

Sample

Table 3 and 4 display summaries of the demographic, military, and deployment exposure characteristics of the participants who completed the study. The average age of the sample was 34 (SD=7.3) and had 14 years (SD=6.4) in military service. Four of the U.S. military branches (i.e., Marines, Navy, Army, Air Force) were represented in the sample, with half of the participants being Marines. The majority of the study participants were male (86%), married (64%), and high school graduates (70%). Thirty-nine percent of participants had four or more deployments, 44% were deployed to a combination of OIF/OEF and other deployments, and 43% has had combat experience. Compared with the ACBT only group, a statistically significant higher percentage of those in the acupuncture group had no prior violence exposure (51.4% vs. 21.2%, p = .030). No other statistically significant differences between groups were noted in the sample's demographic and deployment variables (see Tables 3 and 4).

Table 3

Demographic Characteristics of Study Participants (N=70)

	Overall (N=70)	*ACBT* (N=33)	*ACBT/MSSA* (N=37)	*p*-value
	Mean (SD)			
Age (years)	34.4 (7.3)	33.4 (7.2)	35.2 (7.5)	.296
Years in Service	13.9 (6.4)	13.4 (6.4)	14.4 (6.5)	.513
Length of Longest Deployment (months)	7.3 (3.1)	7.4 (3.4)	7.2 (2.8)	.754
	N (%)			
Gender				.063
Female	10 (14.3)	2 (6.1)	8 (21.6)	
Male	60 (85.7)	31 (93.9)	29 (78.4)	
Education Level				.123
Less than High School/GED	2 (2.9)	1 (3.0)	1 (2.9)	

	Overall (N=70)	*ACBT* (N=33)	*ACBT/MSSA* (N=37)	*p*-value
High School	49 (70.0)	25 (75.8)	24 (64.9)	
Bachelors	9 (12.9)	1 (3.0)	8 (21.6)	
Masters or Doctorate	9 (12.9)	6 (18.2)	3 (8.1)	
Other	1 (1.4)	0 (0.0)	1 (2.7)	
Race/Ethnicity				.654
White Non-Hispanic	32 (45.7)	14 (42.4)	18 (48.6)	
Black Non-Hispanic	11 (15.7)	6 (18.2)	5 (13.5)	
Hispanic	12 (17.1)	6 (18.2)	6 (16.2)	
Asian/Pacific Islander	13 (18.6)	7 (21.2)	6 (16.2)	
Other	2 (2.9)	0 (0.0)	2 (2.9)	
Rank				.713
E1-E3	4 (5.7)	3 (9.1)	1 (2.7)	
E4-E6	29 (41.4)	12 (36.4)	17 (45.9)	
E7-E9	25 (35.7)	12 (36.4)	13 (35.1)	
CWO-O3	9 (12.9)	4 (12.1)	5 (13.5)	
O4-O6	3 (4.3)	2 (6.1)	1 (2.7)	
Branch of Service				.820
Marines	35 (50.0)	16 (48.5)	19 (51.4)	
Navy	20 (28.6)	11 (33.3)	9 (24.3)	
Army	2 (2.9)	1 (3.0)	1 (2.7)	
Air Force	13 (18.3)	5 (15.2)	8 (21.6)	
Marital Status				.914
Single	14 (20.0)	7 (21.2)	7 (18.9)	
Married	45 (64.3)	21 (63.6)	24 (64.9)	
Legally Separated	2 (2.9)	1 (3.0)	1 (2.7)	
Divorced	8 (11.4)	4 (12.1)	4 (10.8)	
Living with a Partner/Divorced	1 (1.4)	0 (0.0)	1 (2.7)	
Smoke Cigarettes				.843
Never	31 (44.3)	13 (39.4)	18 (48.6)	
Quit	26 (37.1)	14 (42.4)	12 (32.4)	
Less than 1 pack per pay (PPD)	11 (15.7)	5 (15.2)	6 (16.2)	
Equal to or more than 1 PPD	2 (2.9)	1 (3.0)	1 (2.7)	
Drink Alcohol				.212
No	13 (18.6)	9 (27.3)	4 (10.8)	
1-2 a month or less	31 (44.3)	12 (36.4)	19 (51.4)	
1-2 a week	11 (15.7)	4 (12.1)	7 (18.9)	
3-6 a week	12 (17.1)	6 (18.2)	6 (16.2)	
1-2 a day	1 (1.4)	0 (0.0)	1 (2.7)	
3-4 a day	2 (2.9)	2 (6.1)	0 (0.0)	

Table 4

Deployment Exposure and Other Characteristics of Study Participants (N=70)

	Overall (N=70)	*ACBT* (N=33)	*ACBT/MSSA* (N=37)	*p*-value
	N (%)			
Adverse Childhood Experiences				.679
None	32 (45.7)	16 (48.5)	16 (43.2)	
One	16 (22.9)	6 (18.2)	10 (27.0)	
Two or more	22 (31.4)	11 (33.3)	11 (29.7)	
Number of Prior Violence Exposure				.030
None	26 (37.1)	7 (21.2)	19 (51.4)	
One	13 (18.6)	7 (21.2)	6 (16.2)	
Two or more	31 (44.3)	19 (57.6)	12 (32.4)	
Number of Deployments				.663
One	21 (30.0)	8 (24.2)	13 (35.1)	
Two	14 (20.0)	6 (18.2)	8 (21.6)	
Three	8 (11.4)	4 (12.1)	4 (10.8)	
Four or more	27 (38.6)	15 (45.5)	12 (32.4)	
Name of Deployment				.624
Operation Enduring Freedom (OEF)	6 (8.8)	3 (9.1)	3 (8.1)	
Operation Iraqi Freedom (OIF)	4 (5.7)	2 (6.1)	2 (5.4)	
Other	29 (41.4)	11 (33.3)	18 (48.6)	
Multiple Deployments (OEF/OIF/Other)	31 (44.3)	17 (51.5)	14 (37.8)	
Combat Exposure				.678
No	40 (57.1)	18 (54.5)	22 (59.5)	
Yes	30 (42.9)	15 (45.5)	15 40.5)	
Discharged a Weapon while Deployed				.790
No	52 (74.3)	25 (75.8)	27 (73.0)	
Yes	18 (25.7)	8 (24.2)	10 (27.0)	
Shot or Seriously Injured During Deployment				.624
No	67 (95.7)	32 (97)	35 (94.6)	
Yes	3 (4.3)	1 (3.0)	2 (5.4)	
Felt in Danger of Being Killed or in Danger				.347
Never	27 (38.6)	11 (33.3)	16 (43.2)	
Once	5 (7.1)	1 (3.0)	4 (10.8)	
Few Times	20 (28.6)	12 (36.4)	8 (21.6)	
Very Often	18 (25.7)	9 (27.3)	9 (24.3)	
Exposed to Chemical, Biological, or Other Agents				.906
No	66 (94.3)	31 (93.9)	35 (94.6)	
Yes	4 (5.7)	2 (6.1)	2 (5.4)	

	Overall (N=70)	*ACBT* (N=33)	*ACBT/MSSA* (N=37)	*p*-value
Experienced Blast, Firefight, or Improvised Explosive Device				.660
No	38 (54.3)	17 (51.5)	21 (56.8)	
Yes	32 (45.7)	16 (48.5)	16 (43.2)	
Witnessed Death				.622
No	36 (51.4)	18 (54.5)	18 (48.6)	
Yes	34 (48.6)	15 (45.5)	19 (51.4)	
Other Trauma Type while Deployed				.778
No	52 (74.3)	24 (72.7)	28 (75.7)	
Yes	18 (25.7)	9 (27.3)	9 (24.3)	

Research Aims

Aim 1a: To evaluate the *effectiveness* of MSSA as an adjunct treatment with ACBT, as compared to ACBT alone, for SD using the *Insomnia Severity Index (ISI)* (Morin, 2017) and *Pittsburg Sleep Quality Index (PSQI)* (Buysse et al., 1988) in post-deployment military service members.

Primary Outcomes (ISI and PSQI). As shown in Table 5, both groups demonstrated very similar improvement in the ISI scores at the end of treatment (p = .480). Approximately 50% of the participants in each group demonstrated a reliable decrease in those scores (Cohen's d = 0.18) (Table 5). Compared to the participants in the ACBT only group, while not statistically significant, a higher percentage of those in the ACBT/MSSA group showed a reliable decrease in the PSQI score (60% vs. 46%, p = .241, Table 6).

Table 5

Summaries of the Primary Outcomes (ISI, PSQI) and Measure Scores (*N* = 70)

ISI

Measure	*Pre*	*Post*	*Change*	*p-value*	*Cohen's d*
		Mean (SD)			
ISI				.480	0.18
ACBT	19.9 (3.4)	13.9 (6.8)	-6.1 (6.6)		
ACBT/MSSA	18.5 (2.9)	11.9 (5.0)	-6.6 (4.5)		
		Reliable Change			
	Decrease n (%)	*No change N (%)*	*Increase n (%)*	.430	
ACBT	18 (54.5%)	14 (42.4%)	1 (3.0%)		
ACBT/MSSA	19 (51.4%)	18 (48.6%)	0 (0.0%)		

Table 6

PSQI

Measure	*Pre*	*Post*	*Change*	*p-value*	*Cohen's d*
		Mean (SD)			
PSQI				.116	0.36
ACBT	14.6 (2.3)	9.2 (3.7)	-5.4 (3.2)		
ACBT/MSSA	14.1 (2.8)	7.9 (2.4)	-6.2 (3.0)		
		Reliable Change			
	Decrease n (%)	*No Change N (%)*	*Increase n (%)*	.241	
ACBT	15 (45.5%)	18 (54.4%)	0 (0.0%)		
ACBT/MSSA	22 (59.5%)	15 (40.5%)	0 (0.0%)		

As shown in Table 7, both groups demonstrated similar improvement in the PSQI Component scores 2 (Sleep Latency), 5 (Sleep Disturbance), and 7 (Sleep Dysfunction) at the end of treatment. In Component 1 (Subjective Sleep Quality), a higher percentage of those in the ACBT/MSSA group demonstrated a one point decrease in scores compared with those in ACBT only group (approximately 60% vs 52%). In

Component 3 (Sleep Duration), a slightly higher percentage of those in the ACBT/MSSA group demonstrated a one point decrease in scores compared with those in ACBT only group (approximately 60% vs 55%). In Component 4 (Sleep Efficiency), there were twice as many participants in the ACBT/MSSA group who showed a two-point decrease in scores compared with those in ACBT only group (approximately 43% vs 21%). Finally, Component 6 (Use of Sleep Medication) indicated that a higher percentage of those in the ACBT/MSSA group had a three-point decrease in their usage of sleep medication compared with those in ACBT only group (35% vs. 15%, see Table 7).

Table 7

Summaries of the PSQI Component Scores

PSQI – Component 1 (Subjective Sleep Quality)

	Overall N (%)	*ACBT N (%)*	*ACBT/MSSA N (%)*	*p-value*	*Cohen's d*
Pre				.528	
1	2 (2.9%)	1 (2.7%)	1 (2.9%)		
2	43 (61.4%)	18 (54.5%)	25 (67.6%)		
3	25 (35.7%)	14 (42.4%)	11 (29.7%)		
Change				.521	-0.12
-3	1 (1.4%)	1 (3.0%)	0		
-2	11 (15.7%)	5 (15.2%)	6 (16.2%)		
-1	39 (55.7%)	17 (51.5%)	22 (59.5%)		
0	16 (22.9%)	8 (24.2%)	8 (21.6%)		
1	3 (4.3%)	2 (2.1%)	1 (2.7%)		
2	0	0	0		

PSQI – Component 2 (Sleep Latency)

	Overall N (%)	*ACBT N (%)*	*ACBT/MSSA N (%)*	*p-value*	*Cohen's d*
Pre				.541	
0	4 (5.7%)	2 (6.1%)	2 (5.4%)		

	Overall N (%)	*ACBT N (%)*	*ACBT/MSSA N (%)*	*p-value*	*Cohen's d*
1	6 (8.6%)	2 (6.1%)	4 (10.8%)		
2	17 (24.3%)	6 (18.2%)	11 (29.7%)		
3	43 (61.4%)	23 (69.7%)	20 (54.1%)		
Change				.514	-0.12
-3	5 (7.1%)	3 (9.1%)	2 (5.4%)		
-2	13 (18.6%)	6 (18.2%)	7 (18.9%)		
-1	25 (35.7%)	11 (33.3%)	14 (37.8%)		
0	25 (35.75)	11 (33.3%)	14 (37.8%)		
1	2 (2.9%)	2 (6.1%)	0		
2	0	0	0		

PSQI – Component 3 (Sleep Duration)

	Overall N (%)	*ACBT N (%)*	*ACBT/MSSA N (%)*	*p-value*	*Cohen's d*
Pre				.099	
1	1 (1.4%)	1 (3.0%)	0		
2	20 (28.6%)	6 (18.2%)	14 (37.8%)		
3	49 (70.0%)	26 (78.8%)	23 (62.2%)		
Change				.338	-.012
-3	1 (1.4%)	1 (3.0%)	0		
-2	3 (4.3%)	1 (3.0%)	2 (5.4%)		
-1	40 (57.1%)	18 (54.5%)	22 (59.5%)		
0	24 (34.3%)	12 (36.4%)	12 (32.4%)		
1	2 (2.9%)	1 (3.0%)	1 (2.7%)		
2	0	0	0		

PSQI – Component 4 (Sleep Efficiency)

	Overall N (%)	*ACBT N (%)*	*ACBT/MSSA N (%)*	*p-value*	*Cohen's d*
Pre				.415	
0	3 (4.3%)	1 (3.0%)	2 (5.4%)		
1	9 (12.9%)	6 (18.2%)	3 (8.1%)		
2	15 (21.4%)	5 (15.2%	10 (27%)		
3	43 (61.4%)	21 (63.2%)	22 (59.7%)		
Change				.903	-0.11
-3	19 (27.1%)	10 (30.3%)	9 (24.3%)		
-2	23 (32.9%)	7 (21.2%)	16 (43.2%)		
-1	17 (24.3%)	10 (30.3%)	7 (18.9%)		
0	10 (14.3%)	6 (18.2%)	4 (10.8%)		
1	1 (1.4%)	0	1 (2.7%)		
2	0	0	0		

PSQI – Component 5 (Sleep Disturbance)

	Overall N (%)	*ACBT N (%)*	*ACBT/MSSA N (%)*	*p-value*	*Cohen's d*
Pre				.428	
1	22 (31.4%)	8 (24.2%)	14 (37.8%)		
2	43 (61.4%)	22 (66.7%)	21 (56.8%)		
3	5 (7.1%)	3 (9.1%)	2 (5.4%)		
Change				.414	-0.22
-3	0	0	0		
-2	1 (1.4%)	0	1 (2.7%)		
-1	21 (30.0%)	11 (33.3%)	10 (27.0%)		
0	40 (57.1%)	17 (51.5%)	23 (62.2%)		
1	8 (11.4%)	5 (15.2%)	3 (8.1%)		
2	0	0	0		

PSQI – Component 6 (Use of Sleep Medication)

	Overall N (%)	*ACBT N (%)*	*ACBT/MSSA N (%)*	*p-value*	*Cohen's d*
Pre				.086	
0	38 (54.3%)	19 (57.6%)	19 (51.4%)		
1	9 (12.9%)	7 (21.2%)	2 (5.4%)		
2	5 (7.1%)	2 (6.1%)	3 (8.1%)		
3	18 (25.7%)	5 (15.2%)	13 (35.1%)		
Change				.993	-0.02
-3	18 (25.7%)	5 (15.2%)	13 (35.1%)		
-2	5 (7.1%)	2 (6.1%)	3 (8.1%)		
-1	8 (11.4%)	6 (18.2%)	2 (5.4%)		
0	39 (55.7%)	20 (60.6%)	19 (51.4%)		
1	0	0	0		
2	0	0	0		

PSQI – Component 7 (Daytime Dysfunction)

	Overall N (%)	*ACBT N (%)*	*ACBT/MSSA N (%)*	*p-value*	*Cohen's d*
Pre				.089	
0	4 (5.7%)	0	4 (10.8%)		
1	24 (34.3%)	10 (30.3%)	14 (37.8%)		
2	32 (45.7%)	17 (51.5%)	15 (40.5%)		
3	10 (14.3%)	6 (18.2%)	4 (10.8%)		
Change				.129	-0.34
-3	0	0	0		
-2	5 (7.1%)	2 (6.1%)	3 (8.1%)		

	Overall N (%)	*ACBT N (%)*	*ACBT/MSSA N (%)*	*p-value*	*Cohen's d*
-1	29 (41.4%)	15 (45.5%)	14 (37.8%)		
0	27 (38.6%)	10 (30.3%)	17 (45.9%)		
1	9 (12.9%)	6 (18.2%)	3 (8.1%)		
2	0	0	0		

Summary

With the exception of prior violence exposure in which the acupuncture group had less violence exposure prior to service compared with the ACBT group, the demographic and deployment exposure characteristics were not statistically significant between the two groups. The sleep outcomes yielded no statistically significant difference between the two groups. The two groups showed very similar improvements in the ISI scores. However, in the PSQI, there was a higher percentage of participants in the acupuncture group that showed a reliable decrease in total scores (60% versus 46%). In the PSQI component scores (four out of seven component scores), a higher percentage of those in the acupuncture group had a reliable decrease in the following component scores: sleep quality, sleep duration, sleep efficiency, and the use of sleep medications.

Aim 1b: To describe the *perceived benefit* of MSSA as an adjunct treatment with ACBT, as compared with ACBT alone, for SD using *journal log entries* in post-deployment military service members.

Three overarching categories were found from the qualitative data: personal challenges in implementing the ACBT sleep strategies, no perception of improvement from treatment, and perceived benefits of treatment. Personal challenges in

implementing the ACBT sleep strategies are defined as participant barriers and hindrances in implementing the treatment recommendations such as stimulus control approaches, sleep hygiene techniques, and sleep restrictions. These challenges also encompass individual and occupational influences. Two themes emerged related to the personal challenges in successfully implementing the ACBT sleep strategies: 1) difficult start and maintenance of recommended strategies, and 2) needed more time to adjust to the new schedule.

The second category that emerged from the data was no perception of improvement from treatment. Two themes were extracted from the second category: 1) no changes in sleep, and 2) no changes in other areas such as mood, physical, and social functioning. The third category that emerged from the data was the participant's perceived benefit of treatment. Perceived benefit is defined as participant perception of how helpful the treatment had been to the participant either intrapersonally or interpersonally. A total of six themes were extracted that described the perceived benefits of treatment among participants: helpful treatment, better sleep, improved mood, enabled lifestyle and behavioral changes, improved physical health and functioning, and enriched work and social life. Subthemes (i.e. most frequently mentioned specific benefits of treatment under each theme) were extracted under the following themes: helpful treatment had two subthemes (i.e., increased knowledge about sleep, and sleep restriction helpful), better sleep had three subthemes (i.e., fell asleep faster, increased sleep quality, stayed asleep longer), improved mood had two subthemes (i.e., decreased irritability, and reduced stress), improved physical health and functioning had four subthemes (i.e., more productive, increased energy, increased

relaxation, and feel more rested), and enriched work and social life had two subthemes (i.e., improved quality of life, and ability to have more enjoyable time with others). The categories, themes and subthemes, based on group participation, are presented in Table 8.

Table 8

Categories, Themes, and Subthemes by Group (N=70)

	ACBT (N=33) N (%)	*ACBT/MSSA (N=37) N (%)*	*Total N*
1. Challenges in Implementing the ACBT Sleep Strategies Themes			
1.1 Difficult Start and Maintenance of Recommended Strategies	10 (30)	5 (14)	15
1.2 Needed More Time to Adjust to the New Schedule	7 (21)	4 (11)	11
2. No Perception of Improvement Themes			
2.1 No Changes in Sleep	11 (33)	1 (3)	12
2.2 No Changes in Other Areas (Mood, Physical, or Social Functioning)	24 (73)	19 (51)	43
3. Perceived Benefits of Treatment Themes			
3.1 Positive Experience	14 (42)	32 (86)	46
3.1.1 Increased Knowledge About Sleep	13 (39)	10 (27)	23
3.1.2 Sleep Restriction Helpful	9 (27)	14 (38)	23
3.2 Overall Better Sleep	21 (64)	36 (97)	57
3.2.1 Fell Asleep Faster	7 (21)	16 (43)	23
3.2.2 Increased Sleep Quality	6 (18)	12 (32)	18
3.2.3 Stayed Asleep Longer	5 (15)	12 (32)	17
3.3 Improved Mood	14 (42)	31 (84)	45
3.3.1 Decreased Irritability	0	7 (19)	7
3.3.2 Reduced Stress	3 (9)	12 (32)	15
3.4 Enabled Lifestyle and Behavioral Changes	10 (30)	17 (46)	27
3.5 Improved Physical Health and Functioning	6 (18)	17 (46)	23
3.5.1 More Productive	7 (21)	7 (19)	14

	ACBT (N=33) *N (%)*	*ACBT/MSSA (N=37)* *N (%)*	*Total* *N*
3.5.2 Increased Energy	8 (24)	15 (41)	23
3.5.3 Increased Relaxation	2 (6)	11 (30)	13
3.5.4 Feel More Rested	4 (12)	13 (35)	17
3.6 Enriched Work and Social Life	13 (39)	25 (68)	38
3.6.1 Improved Quality of Life	2 (6)	4 (11)	6
3.6.2 Ability to Have More Enjoyable Time with Others	0	7 (19)	7

Personal Challenges in Implementing the ACBT Sleep Strategies

Theme 1.1 Difficult Start and Maintenance of Recommended Strategies

Some of the participants indicated that the restriction in sleep schedule was difficult initially (30% in ACBT and 14% in the ACBT/MSSA) (see Table 8). Participants mentioned that breaking old habits and routines were challenging. Some of the barriers in maintaining the recommended sleep strategies and mindfulness practices included the following: unpredictable nature of their military schedule, complex family dynamics, barracks-style living, military mission's operational up-tempo, and military housing's physical constraints. For some participants, these challenges were extremely difficult to manage which made sleep problems ongoing (see Table 9).

Theme 1.2 Needed More Time to Adjust to the New Schedule

Many of the participants commented that their sleep improved in general and will continue to apply the methods learned from treatment (64% in ACBT versus 97% in ACBT/MSSA). Participants mentioned that a month's worth of treatment was not adequate to completely fix their daytime and sleep habits because of the following

reasons: work distractions or demands, and years of having sleep problems (21% in ACBT and 11% in ACBT/MSSA). Two participants mentioned that the Corona Virus 2019 had an impact in the way they progressed with treatment, and one participant wished that there are more psychotherapy groups conducted to continue to target their issues. Despite the challenges, eleven participants commented that they are on the right path and are hopeful that in time their sleep will get better (see Table 9).

No Perception of Improvement from Treatment

Theme 2.1 No Changes in Sleep

A higher percentage of the participants in the ACBT only group reported no changes in sleep after treatment compared with those in the acupuncture group (33% versus 3%). Respondents in the ACBT only group mentioned that their sleep amount was inadequate. Others endorsed that their “sleep patterns” remained the same throughout the study.

Theme 2.2 No Change in Other Areas Such as Mood, Physical, and Social Functioning

A higher percentage in the ACBT only group (73%) endorsed no change in mood, physical health, functioning, work ability, and social life aspects compared with those who received the acupuncture treatment (51%) (see Table 8). Some participants reported that “tiredness” persisted during treatment. One participant in the acupuncture group reported feeling “exhausted” at the end of the day.

Perceived Benefits of Treatment

Theme 3.1 Helpful Treatment

A high percentage of participants in the acupuncture group (86%) reported having a positive experience compared with the participants in the ACBT only group (42%) (see Table 8). Many participants who received the acupuncture reported that they never had this treatment before. Four respondents in the acupuncture group were surprised by how painless the needles were, and six of them reported that the acupuncture was an "enjoyable" experience. During the acupuncture treatment, two participants mentioned feeling "as if pressure is being released" from their bodies. Others mentioned "falling asleep, feeling jumpy, feeling disconnected from their body, feeling off balance, and feeling that their body is floating" during the acupuncture treatment. Several other participants mentioned the following experience after acupuncture: "feeling disconnected from their body and feeling like having a new body." Two other subthemes were extracted from this theme which delineate the two most frequently mentioned benefits of treatment (see Table 8).

Theme 3.2 Better Sleep

The majority of participants in the acupuncture group reported overall better sleep at the end of the study (97%) compared with those in the ACBT only group (64%). Those in the acupuncture group had improved SD as demonstrated by their ability to fall asleep sooner, have increased sleep quality, and stay asleep longer (see Table 8). Participants from both groups mentioned that the consistent implementation of the

recommended sleep schedule has helped normalize their sleep. Overall, a higher percentage of participants who received the combination of ACBT and acupuncture has endorsed improvement in sleep latency, quality, and duration.

Theme 3.3 Improved Mood

A higher percentage of participants in the acupuncture group expressed improvement in overall mood (84%) compared with those who received the ACBT only (42%) (see Table 8). After receiving treatment, participants in both groups endorsed increased motivation, being less moody, a sense of calmness, and feelings of relaxation. Participants who received acupuncture reported experiencing a sense of happiness, feeling less angry or worried, and being more in control. A higher percentage of participants in the acupuncture group endorsed reduced stress (32% versus 9%). Nine participants who received the ACBT only, reported the following improvements: increased empathy, heightened awareness, improved reasoning, and mental sharpness. Moreover, only those who received acupuncture endorsed decreased irritability (n=7) (see Table 8).

Theme 3.4 Enabled Lifestyle and Behavioral Changes

Participants mentioned that the treatment has enabled lifestyle and behavioral changes (30% in the ACBT versus 46% in the ACBT/MSSA group). Participants in both groups endorsed decreasing their alcohol and caffeine intake. Because of improved sleep and pain reduction, participants stated that they were able to do more physical activities (e.g., exercising and getting back to the gym), eat more healthfully, and

decrease use of sleep medications. For a few participants in both groups, time management was a key factor in maintaining their sleep schedule. Four participants in the acupuncture group and two participants in the ACBT only group mentioned that the study has "opened a door" for them to seek help for "behavioral health issues."

Theme 3.5 Improved Physical Health and Functioning

A higher percentage of participants who received the acupuncture endorsed improved physical health and functioning including increased energy, increased relaxation, and feeling more rested (see Table 8). Respondents in both groups endorsed increased productivity after treatment (21% in the ACBT group and 19% in the ACBT/MSSA group). Three participants in the acupuncture group endorsed pain reduction at the end of the study.

Theme 3.6 Enriched Work and Social Life

The majority of participants in the acupuncture group (68% versus 39%) reported improvement in both their work and social lives. Two subthemes were extracted from this theme (see Table 8). Only those participants in the acupuncture group endorsed having the ability to have more enjoyable time with others (n=7). Representative quotes for all themes separated by group are included in Table 9.

Table 9

Participant Quotes Organized by Themes (N=32)

	Representative Quotes *ACBT (N=14)*	*ACBT/MSSA (N=18)*
1. Personal Challenges in Implementing the ACBT Sleep Strategies Themes		
1.1 Difficult Start and Maintenance of Recommended Strategies 1.2 Needed More Time to Adjust to the New Schedule	"The first week was the hardest, but once I was able to get in a routine, it was easier to keep up with the treatment." "It helped me to talk about my sleep. I don't see much change, but I know for me especially that it takes a while for me to adjust to something new like this."	"Still not 100% but far better than when I started. But this has put me on the right path."
2. No Perception of Improvement from Treatment Themes		
2.1 No Changes in Sleep	"It didn't affect much. Still having the same issues." "So far I am still struggling to get enough sleep at night. I am working on methods that work best for me to properly get a good night sleep." "Not greatly impacted. My sleep patterns have remained moderately stagnant with slight improvement at times."	"I'm still having a problem waking up in the middle of the night."
2.2 No Changes in Other Areas Such as Mood, Physical, or Social Functioning	"No change. Work tempo/stress has increased. Social life, home and work seven days a week. No desire to be sociable. I only spend time with family members."	"No major effects with work or social life. The treatment was helpful just for sleep."

	Representative Quotes *ACBT (N=14)*	*ACBT/MSSA (N=18)* "I still struggle with going out and socializing, but I don't think that's related to the treatment; it's something I have to work on."
3. Perceived Benefits of Treatment Themes		
3.1 Positive Experience 3.1.1 Increased Knowledge About Sleep 3.1.2 Sleep Restriction Helpful	"Once I set a schedule/plan and stuck with it, I noticed improved results sleep-wise. I retained the information that was given on the presentation and tried to keep the bed as a place for sleep only."	"It was a very good experience. I learned a lot of techniques that I will continue to use." "Acupuncture coupled with sleep restriction therapy is a life changer. Upon treatment ending I recall on multiple occasions having vivid dreams, leg twitches, and the sense the pressure was being relieved from my body. It was almost as if by having the acupuncture, relieving the pressure allowed for some of the anxiety I experienced to fade away to allow more restful, deeper and calmer sleep."
3.2 Overall Better Sleep 3.2.1 Fell Asleep Faster 3.2.2 Increased Sleep Quality	"I am getting deeper sleep. It is great to fall asleep in less than 10 minutes."	"Acupuncture was an interesting experience, every time I left my appointment, I felt relaxed and in a good

	Representative Quotes	
	ACBT (N=14)	*ACBT/MSSA (N=18)*
3.2.3 Stayed Asleep Longer	"Greatly increased the quality. Went from 2.5 hours per night to 7.5 hours per night." "I can get better sleep at night, without having to rely on medication and external factors."	mood. Changing the time that I went to bed feels like I fall asleep quicker and get more quality sleep." "Trying to stick to the sleep schedule has made a difference. No naps and finding the sleep time definitely helped in me not waking up so many times throughout the night. I also fall asleep faster and deeper."
3.3 Improved Mood 3.3.1 Decreased Irritability 3.3.2 Reduced Stress	"Improved definitely! It has given me the rest I need to have the strength of mind and body to better cope with everyday life."	"With the combination of sleep and acupuncture, I find that I am not as irritable at work and can cope with stress better." "During the month, my general mood has seemed to improve. There has been a noticeable decrease in my irritability, anxiety, and depressed feelings. Also, I have noticed my ability to deal with stress has improved." "My mood has improved significantly among severe stress at work. With current workload in the past, I would experience much higher stress and anxiety."
3.4 Enabled Lifestyle and Behavioral Changes	"I am only making half a pot of coffee now! Down to two cups a day and working out four to six times a week! Less wine. More mindfulness." "Maybe a secondary action, I never ever considered talking to anyone about my	"I am able to make it through my work day without the lunch time nap, I have decreased my caffeine intake to two cups of coffee or one energy drink before noon and have had the energy to do physical training on a more consistent basis."

	Representative Quotes *ACBT (N=14)*	*ACBT/MSSA (N=18)*
	behavioral health. It's like a new door is opening to make me better."	"Treatment has helped me significantly. Before treatment I felt fatigue, tiredness and lethargy. I couldn't lose weight and my self-care was severely lacking. During treatment and classes, I began to sleep better, eat better and feel much more energetic. Overall, I lost about 8 lbs. which I had attempted to lose and was unsuccessful. Due to improving my sleep, my body has responded so well. Sleep truly is the most crucial function our body needs in order to heal and recharge."
3.5 Improved Physical Health and Functioning 3.5.1 More Productive 3.5.2 Increased Energy 3.5.3 Increased Relaxation 3.5.4 Feel More Rested	"I am definitely more productive at work and am able to get more work completed on time."	"Before starting acupuncture, I would wake up at night for no reason. After starting treatment, I was able to sleep straight through. I also noticed a difference in my pain level. I have had chronic shoulder pain, but the acupuncture helped reduce the pain level." "Feel more energized, feel better about myself." "My body physically feels much better, like sleep is actually healing my body and I'm able to perform better physically."
3.6 Enriched Work and Social Life 3.6.1 Improved Quality of Life	"I feel better knowing that there are resources like this and additional studies going on about sleep and ways to help cure sleep deprivation.	"I'm not as short fused at work. Not that I would fly off the handle all the time, I just don't get so irritated with the dumb stuff as

	Representative Quotes	
	ACBT (N=14)	*ACBT/MSSA (N=18)*
3.6.2 Ability to Have More Enjoyable Time with Others	I have spoken to a few others that I know that are going through the same to get them to reach out for assistance. There are many that just don't want to reach out."	easy. Feel a lot better and awake first thing in the morning which is awesome. Since I feel as though I have more energy I've cycling again. It's been years since I've been back on the saddle so that's exciting." "Using the journal brought awareness to how much I was/am waking up at night. Also, making the effort to sleep less during the day has helped increase my quality of life by accomplishing tasks, which helped me feel better at the end of the day." "Due to my increased energy levels and improved over all mood, I am better equipped to deal with the stress of work and have noticed an increase in my ability to focus. Regarding my social life, I have increased my social activities to include doing things that I did in the past but have not considered doing in a long time." "I have more energy during the day. I am less angry and less anxious at work. At home, I am not as quick to get mad at my kids and will handle situation more calmly."

Summary

Three categories were obtained from the qualitative data: personal challenges in implementing the ACBT sleep strategies, no perception of improvement from treatment, and perceived benefits of treatment. Overall, ten themes were extracted from the data that delineate the effect of ACBT only versus ACBT and acupuncture for service members with post-deployment SD. A higher percentage of participants in the ACBT only group endorsed no improvement from treatment (33% versus 3%). Meanwhile, a higher percentage of participants in the ACBT plus acupuncture group, compared with ACBT only group reported effectiveness in sleep and in other life areas [i.e., mental health (84% versus 42%), physical health (46% versus 18%), occupational and social engagement (68% versus 39%) with the exception of productivity in which both groups reported increased productivity (19% versus 21%).

Aim 2: To explore the influence of participant expectation on the effectiveness of acupuncture on stress using the *Acupuncture Expectancy Scale (AES) (Mao et al., 2007)* in post-deployment military service members in the experimental group.

Acupuncture Expectancy

Secondary Outcome (AES). Summaries of the AES scores at baseline, end-of-study, as well as changes in those scores are shown in Table 8. Acupuncture expectation scores at baseline were in the middle of possible range of scores and the change in those scores was minimal at end-of-study (mean = .03 points, p = .965). Fifty-seven percent of the participants had no reliable change in expectations from acupuncture and

21.6% had a clinically meaningful increase in expectations in the effect of acupuncture for stress (see Table 10).

Table 10

AES (N=37)

Measure	*Pre*	*Post*	*Change*	*p-value*	*Cohen's d*
		Mean (SD)			
AES	11.3 (3.3)	11.3 (2.9)	-0.03 (3.7)	.965	-0.01
		Reliable Change			
	Decrease N (%) 8 (21.6%)	No Change N (%) 21 (56.8%)	Increase N (%) 8 (21.6%)		

Secondary Outcomes

Vital Signs

Secondary Outcome (VS). Summaries of the vital signs assessed prior to and after the last treatment of the acupuncture protocol are shown in Table 11. There were no statistically significant changes observed in any of those measures ($p > 0.05$). The strongest effect was observed on diastolic blood pressure (Cohen's $d = 0.25$, see Table 11).

Table 11

Vital Signs in the Experimental Group (N=37)

Measure	*Pre*	*Post*	*Change*	*p-value*	*Cohen's d*
		Mean (SD)			
Systolic Blood Pressure	123.8 (9.4)	123.2 (11.2)	0.6 (8.0)	.656	-0.06

Heart Rate	70.7 (12.8)	72.9 (10.6)	2.1 (13.2)	.344	0.18
		Median (IQR)			
Diastolic Blood Pressure	80 (76, 84)	80 (73.5, 84.5)	0 (-5.5, 3.0)	.447	-0.25
Pain	0 (0, 3.5)	0 (0, 4.0)	0 (-05, 0.5)	.705	-0.13

Posttraumatic Stress Disorder Checklist

Secondary Outcome (PCL-5). Approximately 40% (n = 29 of 70) of all participants demonstrated both statistically reliable and clinically meaningful improvement in the overall PCL score. Eighteen percent (n=6) and approximately 30% (n=11) in the ACBT only and ACBT/MSSA group, respectively, showed clinically meaningful decreases on this measure over the course of the study (see Table 12). A drill-down within each of the PCL cluster scores revealed that the acupuncture group had a higher percentage of participants who experienced clinically meaningful decreases in all four of the symptom clusters of PTSD compared to the percentage observed in the control group. The largest effect sizes were observed for Cluster D (Negative Alterations in Cognition and Mood) and Cluster E (Alterations in Arousal and Reactivity) (Cohen's *d* = 1.39 and 1.17, respectively) (see Table 13).

Table 12

PCL-5

Measure	*Pre*	*Post*	*Change*	*p-value*	*Cohen's d*
		Median (IQR)			
PCL Total Score				.140	1.84
ACBT	28.0 (5.0, 42.5)	15.0 (7.5, 40.5)	-3.0 (-8.5, 2.5)		
ACBT/MSSA	18.0 (10.5, 37.5)	15.0 (7.0, 26.5)	-4.0 (-15.0, 1.0)		
		Reliable Change			

	Clinical Decrease N (%)	*Reliable Decrease N (%)*	*No Change N (%)*	*Reliable Increase N (%)*	*Clinical Increase N (%)*	.801
ACBT	6 (18.2%)	6 (18.2%)	15 (45.5%)	2 (6.1%)	4 (12.1%)	
ACBT/MSSA	11 (29.7%)	6 (16.2%)	14 (37.8%)	3 (8.1%)	3 (8.1%)	

Table 13

PCL-5 Clusters

	Pre	*Post*	*Change*	*p-value*	*Cohen's d*
		Median (IQR)			
PCL Cluster B (Intrusions)				.257	1.05
ACBT	6.0 (0.0, 10.5)	5.0 (1.0, 10.0)	0.0 (-1.5, 1.5)		
ACBT/MSSA	5.0 (1.5, 9.0)	4.0 (2.0, 5.0)	0.0 (-3.0, 1.0)		
		Reliability Change			
	Decrease N (%)	*No Change N (%)*	*Increase N (%)*		
PCL Cluster B (Intrusions)				.234	
ACBT	1 (3.0%)	29 (87.9%)	3 (9.1%)		
ACBT/MSSA	5 (13.5%)	30 (81.1%)	2 (5.4%)		
		Median (IQR)			
PCL Cluster C (Avoidance)				.704	.584
ACBT	4.0 (0.5, 5.5)	2.0 (0.0, 5.0)	0.0 (-1.0, 0.0)		
ACBT/MSSA	2.0 (0.5, 4.0)	2.0 (0.0, 3.0)	0.0 (-2.5, 0.0)		
		Reliability Change			
	Decrease N (%)	*No Change N (%)*	*Increase N (%)*		
PCL Cluster C (Avoidance)				.340	
ACBT	4 (12.1%)	28 (84.8%)	1 (3.0%)		
ACBT/MSSA	9 (24.3%)	26 (70.3%)	2 (5.4%)		
		Median (IQR)			
PCL Cluster D (Negative Alterations in Cognition and Mood)				.130	1.39
ACBT	6.0 (0.0, 14.5)	5.0 (0.5, 11.0)	0.0 (-3.0, 1.0)		

ACBT/MSSA	5.0 (2.0, 14.0)	4.0 (1.0, 10.0)	-1.0 (-5.5, 1.5)		
		Reliability Change			
	Decrease N (%)	*No Change N (%)*	*Increase N (%)*		
PCL Cluster D (Negative Alterations in Cognition and Mood)				.183	
ACBT	4 (12.1%)	27 (81.8%)	2 (6.1%)		
ACBT/MSSA	9 (24.3%)	23 (62.2%)	5 (13.5%)		
		Median (IQR)			
PCL Cluster E (Alterations in Arousal and Reactivity)				.311	1.17
ACBT	11.0 (4.0, 15.5)	7.0 (2.5, 14.5)	-1.0 (-4.0, 0.5)		
ACBT/MSSA	7.0 (5.0, 13.5)	6.0 (2.0, 9.5)	-3.0 (-5.0, 0.0)		
		Reliability Change			
	Decrease N (%)	*No Change N (%)*	*Increase N (%)*		
PCL Cluster E (Alterations in Arousal and Reactivity)				.613	
ACBT	3 (9.1%)	29 (87.9%)	1 (3.0%)		
ACBT/MSSA	4 (10.8%)	30 (81.1%)	3 (8.1%)		

Summary

In the secondary outcomes (i.e., AES, VS, and PCL), the following results were obtained from this study: The AES demonstrated that 21.6% had a clinically meaningful increase in expectations in the effect of acupuncture for stress from baseline score. No statistically significant difference was observed in the VS assessment (SBP, DBP, HR, and pain) from baseline to post-assessment. In the total PCL score, participants in both groups demonstrated statistically reliable and clinically meaningful improvement. A higher percentage of participants in the acupuncture group showed clinically meaningful

decreases in the overall PCL score as well as all the symptom clusters of PTSD over the course of the study (Weathers et al., 2013).

CHAPTER V

DISCUSSION

Sample Characteristics

The average age of this study's sample was 34.4 years which was similar to King et al.'s (2015) and Jonas et al.'s (2016) reported sample but is different from Garner et al.'s (2018) and Huang et al.'s (2019) sample who had an average age of 45 and 39.4, respectively. The younger mean age (i.e., 34.4 years) may represent the majority of active duty service members currently serving in the Armed Forces as compared with the reported veterans with a higher mean age (45 years) (Garner et al., 2018; King et al., 2015). Participants in this study were predominantly male which were similar to the studies reported by Huang et al. (2019), and Jonas et al. (2016), but with the exception of the study reported by Garner et al. (2018) which had females as the predominant gender. Similar to King et al.'s (2015) study, the majority of participants were Marines and received a high school education. The majority of the participants in this study were married and enlisted which were similar to the studies reported by Jonas et al. (2016), Garner et al. (2018), and King et al.'s (2015). Among the studies in the literature described, this study presented the specific rank of the participants instead of simply categorizing them between being enlisted or officers, and the majority of whom were at the rank of E4 to E6 (41%) and E7 to E9 (36%) (enlisted rank). This study and the study by Jonas et al. (2016) and King et al. (2015) enrolled active duty service members which are different from the other studies that included family members

(Garner et al., 2018) and veterans (Garner et al., 2018; Huang et al., 2019) as their participants. Additionally, this study is unique among the other studies as it represented four service affiliations including Marines (50%), Navy (29%), Army (3%), and Air Force (18%) compared with King et al.'s (2015) study which had no Air Force representation. Jonas et al. (2016) did not describe the branches with which the participants were affiliated. The service members in this study had an average of 14 years of active duty service which is similar to that of King et al.'s (2015) sample of 13 years in service duration. The demographic characteristics of this study's sample had a more diverse ethnic background [Caucasian (46%), Black Non-Hispanic (16%), Hispanic (17%), Asian/Pacific Islander (19%), and Other (3%)] compared with the other studies which had predominantly Caucasian, African American, or Hispanic (Garner et al., 2018; Huang et al., 2018; Jonas et al., 2016; King et al., 2015). Although better study representation among Sailors, Soldiers, and Airmen are needed, the participation from four service branches and diversity of various ethnic groups contribute to the generalizability of its findings to the target population (i.e., post-deployed service members) compared with the studies reviewed.

This study along with Huang et al. (2019) reported whether or not participants regularly smoked cigarettes or consumed alcohol. This study specifically described the number of cigarettes and alcoholic drinks that participants consumed while participating in the study, and the majority of participants were non-smokers (approximately 80%) and non-alcohol drinkers (19%) or consumed one to two alcohol drinks a month or less (44%). Compared with the studies that had service members as their sample, authors reported only the following deployment information: the number of times deployed

(Jonas et al., 2016; King et al., 2015) and the length of total deployment (Jonas et al., 2016). In contrast, this study reported adverse childhood experiences, prior violence exposure, and deployment characteristics of the participants. Many of the participants in this study had at least one or more adverse childhood experiences (approximately 54%) and had been exposed to violence prior to service at least once (approximately 63%). The majority of the participants in this study had deployed four or more times (approximately 39%) which is similar to the sample reported by King et al. (2015) (i.e., approximately four times).

The sample for this study had deployed to a combination of operations and other deployments and many of whom had reported that they had felt being in danger or were in actual danger of being killed at least once (approximately 60%) and have experienced a blast, firefight, or improvised explosive device (approximately 46%), combat exposure (approximately 43%), and witnessed death (approximately 49%) during deployment. Other studies in the literature that were reviewed did not survey this information in their sample. Findings from this study extend the results elucidated by Quartana, Wilk, Balkin, and Hoge (2015) which described the evidence that combat exposure and deployment-related stressors have direct effects on PTSD symptoms, insomnia, short sleep duration, and SD. These important findings have implications for clinicians and researchers who could address the well-being of service members, with combat exposure and other deployment-related stressors, by providing and investigating preventative holistic approaches in mitigating SD and other sequelae.

Research Aims

Aim 1a: To evaluate the *effectiveness* of MSSA as an adjunct treatment with ACBT, as compared to ACBT alone, for SD using the *Insomnia Severity Index (ISI)* (Morin, 2017) and *Pittsburg Sleep Quality Index (PSQI)* (Buysse et al., 1988) in post-deployment military service members.

Before this study, it was unknown if MSSA as an adjunct treatment with ACBT is an effective treatment for SD. The quantitative analysis in this RCT demonstrated that ACBT alone was as effective as ACBT with MSSA for SD in post-deployment service members. CBTi is considered to be the first-line treatment for SD and was shown to be an effective treatment in veterans with SD (Talbot et al., 2014; Ulmer, Edinger, & Calhoun, 2011). However, despite the evidence to support CBTi as the first-line treatment for SD, sedative-hypnotics remain the primary treatment recommendation from clinicians particularly in veterans with PTSD (Bramoweth et al., 2017). One of the barriers to implementing CBTi is the cumbersome application of this treatment in the clinical setting for both the clinician and the patient. Six to eight weeks of weekly CBTi consisting of individual sessions are typically provided among veterans with insomnia to establish effectiveness (Talbot et al., 2014; Ulmer et al., 2011). This duration and continued engagement may not be a feasible approach among service members with demanding schedules. Before this study, a brief CBTi has not been investigated in service members with SD. What this study adds to the literature is the evidence that ACBT (i.e., one group therapy and one phone therapy) is a feasible yet effective intervention in targeting SD in those who were deployed or had combat exposure. Both groups in this RCT showed similar improvements in SD from baseline. This result is

aligned with the study conducted by Wagley et al. (2012) which investigated 60-minute group psychotherapy and a telephone follow-up in long-term psychiatric patients in the treatment of insomnia.

In this study, although there were no statistically significant differences between groups based on the ISI, the PSQI revealed that a higher percentage of participants in the acupuncture group reported a reliable decrease in total scores and the following component scores: sleep quality, sleep duration, sleep efficiency, and the use of sleep medications compared with those in the ACBT only. The study by Garner et al. (2018) showed that auricular acupuncture (AA) improved insomnia in a sample of service members, veterans, and family members. Similarly, King et al. (2015) reported that AA improved the sleep quality and daytime dysfunction in PSQI components among service members in a 10-week combat-related PTSD residential program. Given the heterogeneity of their sample and the type of acupuncture protocol (i.e., AA) used, it is difficult to compare their results with this study. In this study, both groups showed similar improvement in the following PSQI component scores: sleep latency, SD, and daytime functioning. The sleep disturbance component of the PSQI includes physiologic symptoms (i.e., wake up in the middle of the night or early morning, get up to use the bathroom, cannot breathe comfortably, cough or snore loudly, feel too cold, feel too hot, have bad dreams, have pain, and other reasons) that may require other medical interventions to effectively treat. Both groups showed similar improvements in the PSQI's daytime dysfunction component. The quantitative analysis was in line with this study's qualitative data wherein participants in the acupuncture group endorsed

feeling tired or relaxed after an acupuncture session which may influence their perception of having daytime dysfunction after the acupuncture treatment.

One of the goals of this study was to assess the efficacy of a feasible and pragmatic approach to acupuncture while considering the busy schedules of both the practitioner and service members. Several aspects of the brief acupuncture treatment may have influenced the outcome of this study. A pilot study that examined the effect of four weekly acupuncture sessions for stress in service members showed a statistically significant decrease in perceived stress in service members (Abanes et al., 2019). In this study, four weekly sessions of acupuncture were also implemented in addition to ACBT in targeting SD. Huang et al. (2019) examined the effects of acupuncture for SD using the following procedures and found these protocols to be effective: Huang et al. (2019) used approximately up to 33 needles, 50 to 60 minutes per session, and six to 10 sessions over a five-week duration. Future investigators would benefit from exploring a longer duration of acupuncture sessions (e.g., longer than 30 minutes), using other acupuncture points for sleep, and having more frequent acupuncture sessions (i.e., greater than four weekly sessions). Another element of the study that may have had an influence on the primary outcome was the reliabilities of the ISI and PSQI scores. For this study, the ISI had a Cronbach's alpha of .53 at baseline and .85 at post-assessment, and the PSQI had a Cronbach's alpha of .43 at baseline and .70 at post-assessment. It is unclear why the reliability scores of these sleep questionnaires were not optimal at baseline compared with the post-assessment in this population. Given the inherently subjective nature of these questionnaires, perhaps using a more

objective assessment of the participants' sleep data would be beneficial for future studies such as using a wrist actigraphy or polysomnography.

Aim 1b: To describe the *perceived benefit* of MSSA as an adjunct treatment with ACBT, as compared with ACBT alone, for SD using *journal log entries* in post-deployment military service members.

The information gleaned from the qualitative data provided a useful understanding of the participants' experiences from their treatments. Participants described perceived barriers and benefits from ACBT and acupuncture. Contrary to a civilian sample's perceptions whereby the hindering factors in the implementation of CBTi techniques focused on internal barriers (i.e., annoyance, boredom, and discomfort), service members reported external barriers (i.e., military demands, increased operational tempo, shift work, and military housing restrictions) (Vincent, Lewycky, & Finnegan, 2008). Overall, service members in both the study groups reported having a positive and helpful experience from the interventions. A majority of participants in the ACBT only group reported that while the recommended sleep strategies were helpful, it will take much longer than a month to "fix" their long-term sleep problems. Nonetheless, a few of the participants expressed optimism that with consistent practice of the knowledge learned from ACBT, they will eventually achieve their goal of having better sleep. Given the unpredictable nature of their military duties, the participants' expectations were realistic yet highly optimistic. These comments may signify gaining agency on their sleep or having a strong locus of control in that if

participants decide to continue to apply the techniques learned in ACBT, they will eventually gain the anticipated benefits.

Those who were in the acupuncture group reported that taking the time to relax during the acupuncture sessions had created a way for them to focus on themselves and decompress from a hard day's work. These breaks from their demanding schedule were reminders for them to accomplish self-care which an idea that many service members have neglected during deployment and in garrison. Performing self-care may be perceived as being lazy or weak among military personnel. An unexpected finding from this study was the change in participants' lifestyle habits in the areas of diet, exercise, and leisure activities involving personal goals or spending time with family.

A few participants in both groups reported that this study had opened an opportunity for them to address their mental health problems while worrying less about the stigma. Stigma in the military remains a major concern for service members in seeking help for mental health problems (Clement et al., 2015). Using the group psychotherapy approach in conducting ACBT may have allowed the participants to share other service members' struggles and realize the universality of their psychological problems. Sleep as a problem may be a more acceptable reason to seek help compared with other psychological symptoms (e.g., posttraumatic stress or depression). Additionally, by offering a holistic treatment (e.g., acupuncture instead of psychotropic medication) that is perceived as more acceptable, service members may have less apprehension for seeking help and potential career repercussions. This is an important consideration given how pain complaints and SD are common reasons for healthcare utilization within this population (Rhon, O'Hagan, Mysliwiec, & Lentz, 2019).

Unpredictably, a few of the participants decided to receive further mental health treatment to address their psychological symptoms.

In this study, participants provided a rich description of how the treatment affected not only their sleep but also their physical, mental, occupational, and social health. A biopsychosocial approach was used as an underpinning for the open-ended questions in assessing the perceived barriers and benefits of treatment (Heinzelmann et al., 2014; McEwen, 2000). Interestingly, a higher percentage of participants in the acupuncture group compared with the ACBT only group endorsed benefits of treatment in targeting their SD and improving their aforementioned health aspects. In the quantitative data, a higher percentage of participants in the acupuncture group endorsed increased sleep quality, sleep duration, and sleep efficiency, and decreased use of sleep medications. These improvements were well-aligned with the qualitative data whereby a higher percentage of participants in the acupuncture group had described having deeper sleep, increased sleep quality, and decreased use of sleep medications. This study affirmed the findings of King et al.'s (2016) in their qualitative study that service members reported "loving/ liking" the treatment, improved sleep, increased relaxation, and decreased pain after receiving AA. In this study's qualitative data, a higher percentage of participants in the acupuncture group also reported improved sleep latency and daytime functioning. This is in contrast with the quantitative data whereby both groups equally improved in these component scores.

The main purpose of this interventional study was to improve the sleep of participants, however, the qualitative data included a wide range of benefits from the treatments, particularly from the acupuncture treatment. In addition to enhanced sleep

quality, a higher percentage of participants in the acupuncture group reported improvement in the following areas: decreased irritability, decreased anger, decreased stress, decreased depression, decreased anxiety, decreased alcohol and caffeine intake, decreased pain, improved diet, improved overall mental health, increased coping, increased quality of life, enhanced work functioning, increased physical activity, increased energy, increased help-seeking behaviors, and increased enjoyable time with family. An interesting finding was that only those who received acupuncture (19%) reported having a more enjoyable time with family. Heinzelmann et al. (2014) asserted, which this study confirmed, that sleep restoration improved health-related quality of life, emotional and psychological well-being, social functioning, physical functioning, and anti-inflammatory process in post-deployment military personnel.

Albeit the physiologic mechanisms of acupuncture are complex, authors have purported that acupuncture decreases stress hormone levels and increases endogenous melatonin secretion thereby preventing and decreasing chronic stress and improving insomnia, respectively (Eshkevari et al., 2012; Eshkevari et al., 2015; Spence et al., 2004). Our pilot study has shown that MSSA decreased perceived stress in service members using a validated questionnaire; i.e., Perceived Stress Scale (Abanes et al., 2019). In a bench science study using a PTSD animal model and Fluoxetine as a control, acupuncture was shown to have equivalent antidepressant and anxiolytic effects as that of the medication (Oh et al., 2018). The physiologic effects (e.g., anti-inflammatory process, stress hormone after-effects, or melatonin changes) of how acupuncture improved sleep and other functional areas in service members were not explored in this study, and research studies that explore this topic remain scant.

Therefore, future research that examines the mechanisms of acupuncture using biomarkers and other physiologic methods are needed in this population.

Aim 2: To explore the influence of participant expectation on the effectiveness of acupuncture on stress using the *Acupuncture Expectancy Scale (AES) (Mao et al., 2007)* in post-deployment military service members in the experimental group.

Authors have hypothesized that expectations and beliefs from acupuncture may influence the outcomes of the acupuncture treatment (Enck, Klosterhalfen, & Zipfel, 2010). In this study, a higher percentage of participants endorsed similar expectations from the acupuncture treatment at baseline and post-assessment. These results confirmed the feasibility study in service members which showed that acupuncture was effective for stress as demonstrated by the improvement in scores from baseline using the perceived-stress scale (Abanes et al., 2019). Sherman et al. (2010) reported that pre-treatment expectations were not predictive of treatment outcomes for patients with low back pain. In contrast, Zheng et al. (2015) found that higher post-treatment expectations rather than at baseline were associated with better long-term improvement for patients with migraine. The mixed results in these studies portray the complex relationship between expectations and outcomes. Further investigation in the physiologic changes in the body may provide a better understanding of the role of expectation, placebo, or nocebo effect in the effectiveness of acupuncture. Interestingly, a placebo analgesic response from an analgesic and analgesic response from acupuncture are posited to be dissimilar phenomena (Enck et al., 2010). Future

research in the potential influence of expectations in treatment outcomes is warranted in service members.

Secondary Outcomes

Vital Signs

Covassin et al. (2011) preliminary finding suggested that individuals with insomnia exhibit increased cardiovascular arousal as evidenced by increased HR and BP. This study investigated whether or not acupuncture had some effect on cardiovascular arousal among participants with insomnia. Results from this study showed that acupuncture did not produce statistically significant changes in HR and BP from baseline to post-assessment. These findings are consistent with the current literature which described that acupuncture did not have clear evidence on its specific effects on HR and BP measures (Chen, Shen, Tan, Jiang, & Gu, 2018; Lee et al., 2010). In the area of pain, the current literature is replete with evidence that acupuncture decreased musculoskeletal pain, headache, and low back pain in a heterogeneous sample (Vickers & Linde, 2014; Yuan et al., 2016). Although this study's results did not show statistically significant changes in overall pain ratings from baseline, it is worth noting that half of the participants (51%) in the acupuncture group reported no pain at baseline and remained pain-free at the end of treatment. In this study, 32% of participants in the acupuncture group had back pain. Sixteen percent who had minimal to moderate pain (2 to 6 out of 10 pain level) at the beginning of the study endorsed no pain at the end of the study. These findings are consistent with other

studies that reported a reduction in pain in service members after AA (Garner et al., 2018; King et al., 2016a). Future research that investigates standardized acupuncture for pain is needed in this population.

Posttraumatic Stress Disorder Checklist

In this study's sample, deployment history of participants ranged from training in the field in the U.S. or overseas, ship deployments, military missions in austere environments overseas, OIF, OEF, other overseas deployments, to a combination of deployments formerly mentioned (approximately 44% of participants reported multiple deployments and 43% of the participants had been exposed to combat). The duration of deployments ranged from one month to 12 months. In service members, deployment-related traumatic stress significantly predicted a PTSD diagnosis, therefore assessing deployment history exposures is an important undertaking in this population (Brownlow, Zitnik, McLean, & Gehrman, 2018).

In this study, eighteen percent of participants in the ACBT only showed a clinically meaningful decrease (i.e., 10 to 20 point change in scores from baselines) in PCL5 scores over the course of the study (Weathers et al., 2013). An unexpected finding in this study showed that a higher percentage of participants in the acupuncture group (30% versus 18%) endorsed a clinically meaningful decrease in the PCL5 scores over the course of the study. Moreover, a higher percentage of participants in the acupuncture group compared with the ACBT only group had endorsed clinically meaningful decrease in all of the PCL5 symptom cluster scores [i.e., intrusions (approximately 14% versus 3%), avoidance (approximately 24% versus 12%), negative

alterations in cognition and mood (approximately 24% versus 12%), and alterations in arousal and reactivity (approximately 11% versus 9%)] over the course of the study. This study suggests that acupuncture as an adjunct therapy to ACBT improved PTSD symptoms. This finding adds to the limited research that acupuncture decreased PTSD symptoms in service members (Engel et al., 2014b). Authors posited that sleep is a hallmark symptom of PTSD, therefore improving sleep with a CBT approach may have contributed to the decrease in psychological sequelae associated with PTSD (Germain, 2013).

Evidence suggests that psychological stress is strongly related to physiological stress as measured by quantitative electroencephalogram and quantitative electrocardiogram measures in those with insomnia (Hall et al., 2007). Research has shown that acupuncture modulates the parasympathetic and sympathetic nervous systems and regulates various neurotransmitters and hormonal factors (e.g., endorphins, serotonin, norepinephrine, gamma-aminobutyric acid (GABA), adrenocorticotrophic hormone (ACTH), cortisol, acetylcholine, melatonin, and substance-P (Eshkevari et al., 2012; Eshkevari et al., 2015; Huang, Kutner, & Bliwise, 2011; White et al., 2008). This study did not address the mechanisms of acupuncture and why acupuncture as an adjunct therapy appeared to be more effective in ACBT alone. Future studies that investigate these phenomena may provide an in-depth understanding of the mechanisms of acupuncture in targeting PTSD in this population.

Strengths and Limitations

Strengths

This study was the first known acupuncture study to investigate an abbreviated form of CBTi in the treatment of SD in both the control and experimental group. Other reported acupuncture studies in service members used sham or usual care in the control only. CBTi has shown to have durable gains in improving sleep in those with PTSD (Talbot et al., 2014). It is the ethical responsibility of the investigator to provide treatment that would be the most beneficial to all the participants and conducting a treatment that is considered a gold standard is certainly a strength of this study. An added advantage of conducting ACBT in both groups is that it provided another layer of rigor in examining the relationship between the intervention and the outcome. An additional strength of this study was controlling for the use of sleep medications among participants during the study period. Otherwise, not controlling for the use of sleep medications may have made it difficult to evaluate if it was indeed the study intervention that had influenced the sleep improvement rather than the sleep medication.

Another strength of this study was the use of a mixed-methods approach in answering the research question. Combining both quantitative and qualitative methods in one study optimized available research resources including study staff, equipment, time, and participants. Using mixed methods was a synergistic way of analyzing the quantitative and qualitative data while examining the various information obtained from these data from different viewpoints (Green et al., 2015). An integral strength of this study was the use of a treatment fidelity procedure using a peer-review approach. The

treatment fidelity procedures ensured that the quality of the acupuncture treatment remained intact throughout the study.

Perhaps the focal strength of this study was the brief and pragmatic approach of how the interventions have been conducted, particularly in this population with potentially demanding schedules and elevated mental health stigma. The standardized approach to the acupuncture and the additional phone interventions, instead of face-to-face, for the ACBT, may have made it more convenient for the participants to complete all the scheduled interventions. Authors have shown that convenience is one of the key factors for participants to adhere to acupuncture trials (Cao et al., 2020). This study had a low attrition rate compared with other reported studies, (approximately 13% versus 20% to 67%) (Jonas et al., 2016; King et al., 2015). The low attrition rate may be partly associated with the brief duration of intervention, telephone method for providing the ACBT, and phone reminders given to each participant prior to the next scheduled intervention. This study had a considerable sample size (n=70) compared with other acupuncture studies conducted in active duty service members and completed within about five months.

Limitations

Although four branches of the U.S. military service were represented in this study, the Army was underrepresented with only two Soldiers who completed the study, therefore this study may not be generalizable to all military personnel. Service members stationed in the region may be different from those in other areas. Operational environments may vastly differ depending on the service member's duty

station (e.g., ship, ground, military hospital or clinic, or combat). Stressors and work demands may vary based on the service member's military occupational specialty code (e.g., aviation, combat support, combat infantry, logistics, counterintelligence, cybersecurity, military police, cook, or medical). The Marines were overrepresented in this study (50%). A study with a larger sample size and more Soldiers, Sailors, and Airmen representation is needed to make the findings more generalizable to other military personnel. In addition, while this study attained a reasonable enrollment and retention rate, a larger and adequately powered study is needed to better evaluate sleep outcomes in service members. This study did not evaluate the outcomes at a later time point, therefore it is unknown whether the effects of the interventions were long-term past the treatment period. Longitudinal studies that examine the effect of ACBT and MSSA for sleep and other outcomes are needed to decipher if the effects of these interventions were enduring after the four weekly treatments. Nonetheless, the brief course of the study may have added to the feasibility and affordability of this study.

It is noteworthy to mention that during the latter half of the course of the study, the Coronavirus-19 (COVID-19) had started to peak in Asia which was where this study had been completed. Although it is unknown if the participants' reactions to the COVID-19 pandemic affected the study outcomes, it is plausible that the pandemic influenced the stress level and sleep of study participants. Moreover, extending the study to a longer duration may have affected the overall outcome of the study.

Given that the main objective of this study was to conduct a simple, more pragmatic acupuncture protocol that may be applied more conveniently within the military setting, this study used manual acupuncture instead of electroacupuncture. In

the study by Yeung et al. (2009), electroacupuncture was more effective than placebo in a civilian community. For this study, using electroacupuncture may have enhanced the beneficial effects of acupuncture compared to manual acupuncture.

Implications for Nursing

Deployment-related stress could disrupt one's physiologic homeostasis, and this disruption can alter the life of a service member for years. Moreover, this disruption could extend to the community and society given the resources and costs that are associated with caring for this population and their families. Nurse practitioners (NPs) have the opportunity to improve current practice in the area of SD and PTSD (two disorders that are complex and are resistant to treatment). NPs have the capacity to care for service members before an environmental stressor (i.e. deployment) happens (primary level of care), treat the service member during an acute stress reaction (secondary level of care), and facilitate the service member's recovery during a chronic illness such as PTSD (tertiary level of care). Psychiatric Mental Health Nurse Practitioners (PMHNPs) possess the unique capacity to engage with the individual at all levels of care. The feasible interventions used in this study (ACBT and MSSA) may help improve the well-being of service members at all levels of care in the areas of sleep and stress.

PMHNPs provide therapeutic interventions including psychoeducation, pharmacotherapy, and psychotherapy in various settings such as outpatient clinics, inpatient facilities, and community dwellings. However, despite the provision of these therapeutic interventions, service members remain vulnerable to psychological and

physiological sequelae from long-term PTSD. This anomaly (i.e., PTSD's resistance to treatment) has created a shift in paradigm and created an opportunity for PMHNPs to use psychotherapy (originally conducted by psychologists or psychiatrists) and medical acupuncture (initially privileged for physicians only) to stabilize one's homeostasis and improve the well-being of service members at all levels.

Research has shown that NPs and nurses have successfully implemented CBTi in practice (Fields, Schutte-Rodin, Perlis, & Myers, 2013; Van der Zweerde et al., 2020). However, despite available evidence about sleep treatments (i.e., CBTi improves sleep problems; sedative-hypnotics have lasting side effects and potential for dependency) practitioners continue to use pharmacotherapy as the first-line of treatment. Reasons for this preference warrants further research, however, burn-out and convenience of prescribing may provide explanations for current practice. Given findings from this study, a pragmatic approach to CBTi (i.e., ACBT with two sessions) should be utilized by PMHNPs to minimize the potential risks involved with over usage of sedative-hypnotics.

Although the quantitative results of this study did not show statistically significant differences between the two groups, the qualitative findings showed robust results in the positive effect of ACBT with MSSA in various domains including sleep, mental health, physical health, occupational and social functioning. The implication of this findings is important for clinicians, particularly nurses and advanced practice nurses. The combination of ACBT and MSSA interventions may help mitigate the decline in the well-being of post-deployed service members. Given the treatment and consequential complexity involved with SD, other mental health outcomes, physical health, and PTSD,

a biopsychosocial and holistic approach should be considered in addressing these issues. In addition to ACBT, nurses may improve the well-being of service members by recommending acupuncture to service members in targeting SD and PTSD. Medical acupuncture which involves a scientific prescriptive theory offers a unique perspective in targeting SD and PTSD (Walling, 2006b). This therapeutic intervention is promising as it has the potential to target homeostatic functions of the body at all levels of care (i.e., primary, secondary, and tertiary levels). The findings of this study showed that MSSA in addition to ACBT improved sleep and other life areas such as mental health, physical performance, and social functioning in service members. Nurses and NPs should consider these two treatments in practice through education or referral services.

Moreover, healthcare policy has provided guidance in allowing NPs to perform medical acupuncture if within their scope of practice (Commission, 2017). PMHNPs are well-positioned to care for service members who experience the enduring effects of deployment-related stress. The paradigm is slowly shifting in the area of medical acupuncture, however, unless PMHNPs extend their learning beyond prescription, this shift may not be fully realized. Pursuing further education in medical acupuncture may be considered by advanced practice nurses. Finally, nurse researchers possess the ability to conduct research in the area of SD, PTSD, deployment-related stress, and holistic interventions such as acupuncture. The advocacy that nurse researchers could provide, through research, leadership, and policy-making, is essential in order to advance the science in SD, PTSD, and holistic interventions. Nurse researchers may further investigate how feasible forms of acupuncture and CBTi therapies may affect sleep outcomes and PTSD in service members with deployment-related experiences.

Recommendations for Future Research

Following this study, several gaps remain in the area of acupuncture research among service members. Although the demographics of this study had represented four service branches, it is difficult to generalize this study to all military personnel. Larger sample size with more Soldiers, Sailors, and Airmen is needed for future studies in order to make this study more generalizable to military service members. Additionally, in this study, there was a statistically significant difference between groups in violence exposure prior to service wherein those who were in the experimental group had less violence exposure that those in the control group. Evidence showed that childhood trauma is an important determinant of post-deployment disorder (i.e., depression, PTSD, and alcohol use disorder) among the Australian defense force (Syed Sheriff, Van Hooff, Malhi, Grace, & McFarlane, 2020). Perhaps the lack of statistically significant difference in sleep outcomes between the two groups in this study is a result of the added complexity of the history of childhood adverse psychological trauma in the control group. Further studies in U.S. service members are needed to confirm this hypothesis.

In this study, the acupuncture intervention did not produce statistically significant changes in vital signs from baseline to post-assessment. The dosing of acupuncture in this study (i.e., weekly thirty-minute acupunctures session) may not be adequate in improving the vital signs measure of the participants. Investigating longer and more frequent acupuncture sessions is warranted in future studies. This study assessed the vital signs of the participants only in the experimental group. Assessing vital signs measures in both the control and experimental groups may provide more information on

the effect of psychotherapy versus acupuncture on these measures. Finally, this study assessed physiologic measures using only BP, HR, and self-report pain outcomes. Alternative ways to robustly measure one's cardiac output and pain are warranted for future research (e.g., heart rate variability measures and other valid pain measures instead of using a self-report of pain from zero to 10).

This study assessed SD using ISI and PSQI with baseline Cronbach's alpha of .53 and .43, respectively. The reliability of these questionnaires at baseline was not optimal compared to the post-assessment which had Cronbach's alpha of .85 for ISI and .70 for PSQI. The ISI was initially validated among clinical patients who were predominantly women (54%), with a mean age of 41.4 years, and in a community residential facility (Bastien et al., 2001). The PSQI was initially validated among civilian psychiatric patients with a mean age of 59.9 years (Buysse et al., 1988). The service members' lifestyle, unpredictable occupational demands, and night shift duties may be much different from the sample described by Bastien and Buysse et al. Service members' initial interpretation of the questionnaire items may be different than the samples included in the original validation of these instruments. Future studies that investigate the psychometric properties of ISI and PSQI in post-deployment service members are needed to confirm their validity in this population.

Future studies that use more objective sleep measurements (e.g., wrist actigraphy or polysomnography) in retrieving and evaluating sleep data would be beneficial for service members with deployment experiences. This study primarily focused on sleep, however, participants have endorsed a multifaceted response on how they perceived the treatments. Future research should explore the effects of

acupuncture on pain, depression, anxiety, physical health, and social functioning using more robust quantitative measures (e.g., assessing biomarkers and other validated psychosocial instruments).

The qualitative findings of this study showed greater improvements in participants' sleep, mood, physical health, as well as occupational and social functioning after receiving the combination of ACBT and MSSA. Expanding on the qualitative findings from this research, a theoretical framework that delineates the effects of ACBT and MSSA is needed. In this study, it was theorized that acupuncture targets the physiological aspect of the person while ACBT targets the psychological aspect. However, it appears that acupuncture had improved the following domains: mood, perception of stress, reaction to one's occupational environment, lifestyle habits, help-seeking, and social engagement which are aspects that are considered to be psychosocial rather than physiological. Similarly, ACBT may target the physiological domain in addition to the psychological; however, there is limited research that investigates the direct physiological outcomes of this therapy. Future research that investigates the effect of ACBT in targeting physiological symptoms (e.g., BP, HR, pain, inflammatory processes, and stress hormones) is needed among post-deployment service members.

The findings of this study provide evidence that ACBT and MSSA improved help-seeking behaviors (e.g., participant's willingness to seek mental health treatment to alleviate sleep problems and other symptoms) and holistic lifestyle changes (e.g., decreased alcohol use, increased exercise, and improved eating habits). Future qualitative research using a grounded theory approach may provide a further

understanding of how holistic interventions improve service members' help-seeking behaviors and lifestyle habits. This study had a considerable number of military service members who participated in the study while stationed in Okinawa, Japan (n = 70). In order to confirm this study's successful recruitment strategies (e.g., obtaining leadership buy-in, communicating with clinicians about the study, and posting numerous flyers to various military camps in the area), examining the perceived barriers and facilitators in participating in clinical trials among researchers, practitioners, and patients may be worth evaluating in other service members stationed elsewhere.

Future research that examines the role of expectations in acupuncture treatment outcomes may provide useful information on the placebo analgesic response of acupuncture in service members. The influence of acupuncture expectation is an important research exploration because one's expectation may affect treatment outcomes. This study used the AES to assess the participant 's expectation from MSSA at baseline and then at post-assessment and found that approximately 22% of participants had an increase in their expectation that acupuncture can alleviate their stress. Perhaps using other methods or procedures of acupuncture (e.g., electroacupuncture or more frequent sessions per week) may have had a different influence on treatment outcomes. Further research is needed in the area of acupuncture expectation and placebo effect to glean the influence of these phenomena on physiological and psychological outcomes.

Future research should consider comparing various acupuncture methods such as AA, manual acupuncture, and electroacupuncture in evaluating sleep, pain, and PTSD. Investigating the dosing of acupuncture (i.e., duration and frequency of the

acupuncture sessions and the use of other specific acupuncture points) could help establish treatment efficacy for sleep and other deployment-related symptoms. Obtaining physiologic biomarkers (e.g., cortisol or melatonin) could provide a more in-depth understanding of the mechanisms of treatments (i.e., ACBT and acupuncture) in targeting sleep and post-deployment stress in service members. Investigations in the mechanism of acupuncture may provide information on how acupuncture could improve SD and other physiological as well as psychological symptoms. Finally, in order to gain a better understanding of the long-term effects of ACBT and MSSA, longitudinal studies are needed. Service members could redeploy to combat environments and re-experience multiple deployment stressors which could exacerbate negative sequelae. Future research that investigates holistic interventions mitigating the negative outcomes from redeployment could provide more information on how to sustain the effects of ACBT and MSSA for SD and other deployment-related symptoms.

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APPENDICES

Acupuncture Treatment Protocol

Treatment Location. The intervention will take place in a designated, private acupuncture/exam room in Naval Hospital Okinawa. The acupuncture room has a sink to wash and dry hands before and after treating each participant.

Treatment Supply. Standard acupuncture supply will be used such as the following:

Ancillary Equipment:

1) Standard massage table with head rest.

2) Disposable table covers.

3) Pillows, with disposable pillow covers, placed under knees.

4) Clean blankets will be available as needed as per participant's request.

5) Ambient sound machine to drown outside noise surrounding the clinic.

6) Heat lamp.

7) Disposable alcohol wipes.

8) Latex-free gloves.

9) Cotton wool pad to press on the acupuncture point after needle removal.

10) Disposable basins for used needle, alcohol wipes, and cotton pads.

11) Sharps container for used needles.

Acupuncture Needles:

1) SEIRIN® J-Type Sj.20x30 will be used for auricular (ear) *shen men*, GV-20, and GV-24.5.

2) SEIRIN® L-Type Lc.20x40 will be used for LI-4 and LR-3.

Treatment Protocol. Participants will receive an eight-point manual standardized stress acupuncture (MSSA) treatment once a week for 4 weeks. The MSSA consists of bilateral auricular *shen men,* GV- 20, GV-24.5 (*Yin Tang*), bilateral LI-4, and bilateral LR-3. This acupuncture protocol has been used as an effective treatment for stress-related symptoms in the operational theater (Koffman, 2011).

Basic Acupuncture Procedures(White et al., 2008):

Research Assistant or Practitioner: The research assistant or practitioner will perform the following items:

1) Check that the setting and equipment are satisfactory.

2) Instruct the participant to remove shoes/boots and socks, if worn.

3) Instruct the participant to lay supine on the table and comfortably arrange the pillow under knees.

4) Discard used disposable equipment to waste bin and used needles to sharp container after each treatment.

5) Replace equipment and all apparatus for next acupuncture session.

Acupuncturist: The acupuncturist will perform the following procedures at each session in a step-by-step fashion:

1) Wash hands with soap and water before start of treatment.

2) Clean the acupuncture area with alcohol wipe.

3) Briefly and gently palpate the area where the needle will be placed.

4) Insert each needle through skin with a guide tube using the following techniques:

a) *Insertion of Needles:* Needles in the auricular *shen men* will be inserted perpendicularly using a tube guide in the depth of 0.3-0.5 inch. The needles in

the ears will not be manipulated after insertion. Needles in GV-20 and GV-24.5 will be inserted subcutaneously in the depth of 0.3-0.5 inch (Lian, Chen, Hammes, & Kolster, 2011). The needle in GV-24.5 will be inserted with one hand in a lateral direction and while pinching the skin over the point with the fingers of the other hand. Needles in LI-4 and LR-3 will be inserted perpendicularly in the depth of 0.5-0.8 inch and 0.3–0.5 inch, respectively, to the participant's skin, manipulated and rotated about 90º in alternate directions using index finger and thumb (White et al., 2008).

b) *Manipulation of Needles*: The goal of manipulation is to produce a sensation that the Chinese called *de qi*. *De qi* may be described by the participant as one of the following sensations: numbness, fullness, heaviness, and achy or a feeling of muscle fatigue (White et al., 2008). The practitioner may also achieve *de qi* when the practitioner feels that the tissues grip the needle (White et al., 2008). If the manipulation becomes painful, the practitioner will stop the manipulation, assess the participant's comfort level, and proceed to the next acupuncture point if the participant allows (White et al., 2008).

5) Wash hands.

6) Leave the room and retain the needle in situ for a duration of 30 minutes (White et al., 2008). Set an alarm for 30 minutes.

7) Using latex-free gloves, remove each needle from head to feet. During removal of each needle, pull the needle straight out, and press briefly on the acupuncture point with a cotton wool pad to stem any small bleeding (White et al., 2008).

8) Inspect that the needle is intact.

9) Check that all needles have been removed (i.e., a total of six needles).

10) Safely discard needles in a sharps container.

11) Account for guide tubes and discard all disposable apparatus in waste bin.

12) Wash hands.

13) Instruct the participant to slowly get up, have a seat in the waiting area for at least 10 minutes, and check out with the mental health staff upon leaving the clinic, to ensure participant is not experiencing any adverse reactions.

14) Instruct participants to limit, or if possible avoid, strenuous activities for at least 24 hours after each acupuncture treatment.

Acupuncture Points Location (Lian et al., 2011):

1) Auricular (ear) *shen men*: at the center of the triangular fossa where the anti-helix splits.

2) GV-20: on the dorsal midline of the head, 5 cun (approximately 4 fingers breadth) above the midpoint of the anterior hairline, and midpoint of the line connecting the apices of the ears.

3) GV-24.5 (*Yin Tang*): on the ventral midline, at the midpoint between the medial side of the eyebrows.

4) Bilateral LI-4: on the dorsum of the hand, between first and second metacarpal bones, near the radial side, in the adductor pollicis muscle.

5) Bilateral LR-3: on the dorsum of the foot, distal to the junction between first and second metatarsal bones.

Recruitment Flyer

U.S. Naval Hospital
Okinawa, Japan

Sleep Research

Are you having problems with *sleep*? If you answered 'yes' & are active duty personnel, call 646-1913/1916 or walk-in at the Mental Health clinic to see if you qualify for a treatment study at U.S. Naval Hospital, Okinawa.

Purpose of the Research:

To evaluate the effectiveness of psychotherapy and acupuncture in the treatment of sleep problems.

Length of Study:

6 weeks

**There will be no compensation for study participation.*

Eligibility Criteria:

- Active duty with any deployment experience,
- Problems with sleep for at least 1 month,
- Meet certain scores on eligibility questionnaires,
- Stable on any medications for at least 3 months,
- Able to participate in a group psychotherapy and individual interviews via the telephone,
- Agrees to abstain from sedative-hypnotics and sleep aids including over-the-counter drugs throughout the study, and
- Able to sign an informed consent.

CDR Jane Abanes, Principal Investigator
HN Jeric Leones, Assistant Investigator
Phone: 646-1913/1916

DoD
IRB NUMBER: NHOK.2019.0055
IRB APPROVAL DATE: 8/21/2019

Eligibility Screening Guide

In-Person Script:

As part of the eligibility process, you will be required to complete a questionnaire. If you meet a certain score on the questionnaire, then you will be invited to participate in the study. Do you provide permission to complete the questionnaire to know if you are eligible to participate in the study? Please answer *Yes* or *No*.

Via Phone Call Script:

As part of the eligibility process, I need to ask you specific questions from a questionnaire. If you meet a certain score on the questionnaire, then you will be invited to participate in the study. Do you provide me permission to ask you these questions to know if you are eligible to participate in the study? Please answer *Yes* or *No*.

Minimization of Potential Risks to Participants

1) Questionnaires: Answering the questionnaires may be boring or trigger psychological or emotional distress.

Minimization of risk: Participants will be given an adequate amount of time to answer the questionnaires and may take breaks in between if the questionnaires become cumbersome to complete. The participants will be informed to let the acupuncturist or study staff know about psychological symptoms and will be assessed for further treatment at the mental health clinic.

2) Acupuncture Needles: The needles may be uncomfortable and may cause bruising, bleeding, faintness, or rarely, infection. Some people may experience soreness, dizziness, fatigue, malaise, fainting, or peripheral nerve injury (e.g., foot drop) after the acupuncture treatment.

Minimization of risk: The practitioner will perform the following procedures: 1) use appropriate handwashing techniques before and after treatments; 2) use unexpired alcohol wipes on acupuncture sites before each procedure; 3) use sterile, disposable needles and disposable guide tubes for each acupuncture point; 4) adhere to the depth of needle insertion and other treatment protocol; 5) allow participants to sit down for about 10 minutes after each treatment; and 6) instruct participants to limit, or if possible avoid, strenuous activities for at least 24 hours after each acupuncture treatment.

3) Psychological symptoms: Symptoms such as anxiety, restlessness, or difficulty sleeping can get worse. Symptoms of psychological or emotional distress that trigger suicidal or homicidal ideation can occur.

Minimization of risk: Psychological symptoms, as a result of acupuncture, are usually a good sign and typically do not last for more than a week (King et al., 2016a). The participants will be informed to let the acupuncturist or study staff know about psychological symptoms and will be assessed for further treatment at the mental health clinic.

4) Disclosure: Collection of participant information has an inherent risk of accidental disclosure of personal identifying information. Participants who express imminent safety risk of suicidal or homicidal ideation may be reported to the Commanding Officer of the participant's unit.

Minimization of risk: All efforts will be made to keep the participant's personal information confidential but total confidentiality cannot be guaranteed. All the information on paper will be kept locked in a secure location. Only members of the research team will be able to see any of the information that would identify participants.

A classification of mild, significant, and serious risk will be used for this study as defined below: (White et al., 2008)

Type of Risk	Definition	Likelihood
Mild	Short term in duration and does not significantly or seriously inconvenience the participant.	Likely
Significant	Needs immediate medical attention by the medical officer or interferes with the patient's normal activities beyond seven days.	Unlikely
Serious	Requires admission to the hospital or results in persistent or significant disability or death.	Unlikely

Potential Risks:

Study Activity	Potential Mild/Minimal Risk	Potential Significant Risk
Questionnaires	Answering the questionnaires may be boring.	Answering the questionnaires may trigger psychological or emotional distress.
Acupuncture Needles	The needles may be uncomfortable and may cause bruising or bleeding (not more than a small drop). Some people may experience soreness, dizziness, fatigue, or malaise after the acupuncture treatment.	The needles may cause faintness, or rarely, infection. Some people may experience peripheral nerve injury (e.g., foot drop) after an acupuncture treatment. However, peripheral nerve injury, after an acupuncture, is an extremely rare occurrence.
Psychological symptoms	Symptoms such as anxiety, restlessness, or difficulty sleeping can get worse.	Symptoms of psychological or emotional distress that trigger suicidal or homicidal ideation can occur.
Disclosure	Collection of participant information has an inherent risk of accidental disclosure of personal identifying information.	Participants who express imminent safety risk of suicidal or homicidal ideation may be reported to the Commanding Officer of the participant's unit.

Questionnaires

Global Sleep Assessment Questionnaire (GSAQ)

1. Did you have difficulty falling asleep, staying asleep, or did you feel poorly rested in the morning?
2. Did you fall asleep unintentionally or did you have to fight to stay awake during the day?
3. Did sleep difficulties or daytime sleepiness interfere with your daily activities?
4. Did work or other activities prevent you from getting enough sleep?
5. Did you snore loudly?
6. Did you hold your breath, have breathing pauses, or stop breathing in your sleep?
7. Did you have restless or "crawling" feelings in your legs at night that went away if you moved your legs?
8. Did you have repeated rhythmic leg jerks or leg twitches during your sleep?
9. Did you have nightmares, or did you scream, walk, punch, or kick in your sleep?
10. Did the following things disturb you in your sleep: pain, other physical symptoms, worries, medications, or other (specify)?
11. Did you feel sad or anxious?

Insomnia Severity Index (ISI)

The Insomnia Severity Index has seven questions. The seven answers are added up to get a total score. When you have your total score, look at the 'Guidelines for Scoring/Interpretation' below to see where your sleep difficulty fits.

For each question, please CIRCLE the number that best describes your answer.

Please rate the CURRENT (i.e. LAST 2 WEEKS) SEVERITY of your insomnia problem(s).

4. How SATISFIED/DISSATISFIED are you with your CURRENT sleep pattern?
Very Satisfied Satisfied Moderately Satisfied Dissatisfied Very Dissatisfied

01234

5. How NOTICEABLE to others do you think your sleep problem is in terms of impairing the quality of your life? Not at all

Noticeable A Little Somewhat Much Very Much Noticeable 01234

6. How WORRIED/DISTRESSED are you about your current sleep problem? Not at all

Worried A Little Somewhat Much Very Much Worried 01234

7. To what extent do you consider your sleep problem to INTERFERE with your daily functioning (e.g. daytime fatigue, mood, ability to function at work/daily chores, concentration, memory, mood, etc.) CURRENTLY?

Not at all
Interfering A Little Somewhat Much Very Much Interfering

01234

Guidelines for Scoring/Interpretation:

Add the scores for all seven items (questions 1 + 2 + 3 + 4 + 5 +6 + 7) = _____ your total score

Total score categories:
0–7 = No clinically significant insomnia
8–14 = Subthreshold insomnia
15–21 = Clinical insomnia (moderate severity) 22–28 = Clinical insomnia (severe)

Insomnia Problem	**None**	**Mild**	**Moderate**	**Severe**	**Very Severe**
1. Difficulty falling asleep	0	1	2	3	4
2. Difficulty staying asleep	0	1	2	3	4
3. Problems waking up too early	0	1	2	3	4

Used via courtesy of www.myhealth.va.gov with permission from Charles M. Morin, Ph.D., Université Laval

Pittsburg Sleep Quality Index (PSQI)

Name_____
Date_____

Sleep Quality Assessment

What is PSQI, and what is it measuring?

The Pittsburgh Sleep Quality Index (PSQI) is an effective instrument used to measure the quality and patterns of sleep in adults. It differentiates “poor” from “good” sleep quality by measuring seven areas (components): subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction over the last month.

INSTRUCTIONS:

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

During the past month,

1. When have you usually gone to bed?
2. How long (in minutes) has it taken you to fall asleep each night?
3. What time have you usually gotten up in the morning?
4. A. How many hours of actual sleep did you get at night?

   B. How many hours were you in bed?

_____
_____
_____
_____
_____

5. During the past month, how often have you had trouble sleeping because you	Not during the past month (0)	Less than once a week (1)	Once or twice a week (2)	Three or more times a week (3)
A. Cannot get to sleep within 30 minutes				
B. Wake up in the middle of the night or early morning				
C. Have to get up to use the bathroom				
D. Cannot breathe comfortably				
E. Cough or snore loudly				
F. Feel too cold				
G. Feel too hot				
H. Have bad dreams				

I. Have pain				
J. Other reason (s), please describe, including how often you have had trouble sleeping because of this reason (s):				
6. During the past month, how often have you taken medicine (prescribed or “over the counter”) to help you sleep?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
8. During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?				
9. During the past month, how would you rate your sleep quality overall?	Very good (0)	Fairly good (1)	Fairly bad (2)	Very bad (3)

Component 1 Component 2

Component 3 Component 4

Component 5 Component 6 Component 7

Scoring

#9 Score
#2 Score (<15min (0), 16-30min (1), 31-60 min (2), >60min (3)) + #5a Score (if sum is equal 0=0; 1-2=1; 3-4=2; 5-6=3)
#4 Score (>7(0), 6-7 (1), 5-6 (2), <5 (3)
(total # of hours asleep) / (total # of hours in bed) x 100 >85%=0, 75%-84%=!, 65%-74%=2, <65%=3
sum of scores 5b to 5j (0=0; 1-9=1; 10-18=2; 19-27=3)
#6 Score
#7 Score + #8 score (0=0; 1-2=1; 3-4=2; 5-6=3)

C1 _____

C2 _____ C3 _____

C4 _____ C5 _____ C6 _____ C7 _____

Global PSQI _____

Add the seven component scores together _____

A total score of “5” or greater is indicative of poor sleep quality.
If you scored “5” or more it is suggested that you discuss your sleep habits with a healthcare provider

Acupuncture Expectancy Scale

Every individual may have different expectation for the effects of acupuncture. If we use the following sentences to describe your expectation of acupuncture's effect on your stress symptoms - after the entire course of acupuncture therapy, how much do you agree? For each statement, please choose the closest answer.

	(1) Not at All	(2) A Little	(3) Moderately	(4) Mostly	(5) Completely
▪ My stress symptoms will improve a lot					
▪ I will be able to cope with my stress better					
▪ The symptoms of my stress will disappear					
▪ My energy level will increase					

Posttraumatic Stress Disorder Checklist (PCL-5)

Instructions: Below is a list of problems that people sometimes have in response to a very stressful experience. Please read each problem carefully and then circle one of the numbers to the right to indicate how much you have been bothered by that problem in the past month.

In the past month, how much were you bothered by:	**Not at all**	**A little bit**	**Moderately**	**Quite a bit**	**Extremely**
1. Repeated, disturbing, and unwanted memories of the stressful experience?	0	1	2	3	4
2. Repeated, disturbing dreams of the stressful experience?	0	1	2	3	4
3. Suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)?	0	1	2	3	4
4. Feeling very upset when something reminded you of the stressful experience?	0	1	2	3	4
5. Having strong physical reactions when something reminded you of the stressful experience (for example, heart pounding, trouble breathing, sweating)?	0	1	2	3	4
6. Avoiding memories, thoughts, or feelings related to the stressful experience?	0	1	2	3	4
7. Avoiding external reminders of the stressful experience (for example, people, places, conversations, activities, objects, or situations)?	0	1	2	3	4
8. Trouble remembering important parts of the stressful experience?	0	1	2	3	4
9. Having strong negative beliefs about yourself, other people, or the world (for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)?	0	1	2	3	4
10. Blaming yourself or someone else for the stressful experience or what happened after it?	0	1	2	3	4
11. Having strong negative feelings such as fear, horror, anger, guilt, or shame?	0	1	2	3	4
12. Loss of interest in activities that you used to enjoy?	0	1	2	3	4
13. Feeling distant or cut o from other people?	0	1	2	3	4
14. Trouble experiencing positive feelings (for example, being unable to feel happiness or have loving feelings for people close to you)?	0	1	2	3	4
15. Irritable behavior, angry outbursts, or acting aggressively?	0	1	2	3	4
16. Taking too many risks or doing things that could cause you harm?	0	1	2	3	4
17. Being “superalert” or watchful or on guard?	0	1	2	3	4
18. Feeling jumpy or easily startled?	0	1	2	3	4
19. Having di culty concentrating?	0	1	2	3	4
20. Trouble falling or staying asleep?	0	1	2	3	4

Demographics and Deployment Characteristics

Please check a response for each category below

Age, years
17-20 ___ 21-31 ___ 32 or older ___
Education
Less than high school/GED ___
High School ___
Bachelors ___
Masters or Doctorate ___
Race/ethnicity
White non-Hispanic ___
Black non-Hispanic ___
Hispanic ____
Asian/Pacific Islander ___
Other ___
Rank
E1-E3 ___ E4-E6 ___ E7-E9 ___
CWO-O3 ___ O4-O6 ___
Years in service
1-2 ___ 3-5 ___
6-10 ___ greater than 10 ___
Marital Status
Single ___ Living with a partner ___
Married ___ Legally Separated ___
Divorced ___
Smoke cigarettes
Never ___ Quit ___
Less than 1 pack per day ___
Equal to or more than 1 pack a day ___
Drink alcohol
No ___
1-2 a month or less ___
1-2 a week ___
3-6 a week ___
7 or more a week ___
1-2 a day ___
3-4 a day ___
more than 4 a day ___
Adverse childhood experiences
0 ___ 1 ___ 2 or more ___
Number of prior violence exposures
0 ___ 1 ___ 2 or more ___
Number of deployments
1 ___
2 ___
3 ___
more than 3 ___
Name of deployment
OEF ___
OIF ___
Other _____
Length of last deployment
1-120 days ___
121-240 days ___
> 240 days ___
Combat exposure
No ___ Yes ___
Discharged a weapon while deployed
No ___ Yes ___
Shot or seriously injured while deployed
No ___ Yes ___
Felt in great danger of being killed or injured during deployment
Never ___
Once ___
Few times ___
Very often ___
Exposed to any chemical, biological, or radiological warfare agents
No ___ Yes ___
Experienced blast, firefight, IED, or mortars
No ___ Yes ___
Witnessed death
No ___ Yes ___
Other trauma type while deployed
No ___ Yes ___
Number of trauma exposure types
0-1 ___
2-3 ___
4-6 ___

Journal Log Questions

1. Tell me about your experiences with your treatment.
2. How has your treatment affected your physical health and functioning?
3. How has your treatment affected your sleep?
4. How has your treatment affected your mood and other mental health symptoms?
5. How has your treatment affected your work or social life?