

Sleep: The Missing Link

Sleep Assessment and Interventions for Combat Veterans with Disrupted Sleep

Christiane O'Hara PhD and
Helen (Netta) Putnam, PA, OTR

Introduction

This article is a follow-up to the *Preventing Sleep Casualties: Studies, Statistics, and Solutions* (Mysliwiec et al., November 2014) issue of *Combat Stress*. It summarizes how sleep problems acquired or exacerbated during deployments can contribute to behavioral, interpersonal, relationship, and medical problems for veterans and their families; discusses ways to assess veterans with sleep issues and when to refer to sleep clinics for evaluation; and describes best practices in sleep interventions to assist veterans with correcting abnormal sleep patterns. This summary of sleep research and interventions with veterans serves as an introduction to the emerging recognition of sleep as a critical feature of health, and a frame of reference for the article in this issue of *Combat Stress* on the Dreampad® and CES.

Sleep and Military Service

Service members and veterans, particularly those with multiple deployments, often demonstrate significant disruptions in sleep cycles and patterns that may continue long after deployment. Most have little awareness of, or education regarding, normal sleep cycles and rhythms, how deployments can interfere with these cycles (establishing neurophysiological patterns acquired during deployments, but that become dysfunctional upon returning home), and how sleep disruption contributes to poor health and overall life disruption.

For combat veterans, both during and post-deployment, disrupted sleep and untreated sleep problems can exacerbate symptoms of combat stress, post-traumatic stress, and brain injuries. Prolonged sleep dysfunction can have catastrophic effects on health, work, security clearances, and family/community relationships. The impact of prolonged sleep disruption has been demonstrated to affect daytime cognition (attention, concentration, short-term memory, mental flexibility), mental health and interpersonal relationships (irritability, anxiety, and depression), and physiological systems (cardiac, digestive, sexual, and endocrine) (Castriotta et al., 2009; Castriotta & Murthy, 2011; Lucke-Wold et al., 2015; Institute of Medicine, 2006).

In addition, veterans who have sustained mild Traumatic Brain Injuries (mTBI) are even more at risk for sleep dysfunction. The research literature has tied sleep disorders with mTBI for decades:

“Sleep disruption is common following traumatic brain injury and the majority of patients develop a chronic sleep disorder. It appears that sleep disturbances may be influenced by the mechanism of injury in those with combat related traumatic brain injury, with blunt injury potentially predicting the development of OSAS (obstructive sleep apnea syndrome)” (Collen et al., 2012).

Additional sleep disorders within this population include insomnia, circadian rhythm sleep disturbances (Ayalon et al., 2007); post-traumatic hypersomnia, and narcolepsy (Collen et al., 2012; Lankford, Wellman, & O'Hara, 1994). In light of the significant corre-

lation of sleep disorders with mTBI, and the finding that over 97.4% of combat veterans with mild and moderate traumatic brain injuries report sleep complaints (Collen et al., 2012), it is essential that veterans with mTBI symptoms or diagnoses be screened for sleep problems and referred for an accurate sleep diagnosis and treatment.

Prevalence of Sleep Disorders in Combat Veterans with mild to moderate TBI*

In a group of 116 consecutive patients, all combat veterans w TBI, who underwent comprehensive sleep evaluations:

97.4% - had sleep complaints

82.5% - hypersomnia

55.2% - insomnia

54.3% - sleep fragmentation

34.5% - obstructive sleep apnea syndrome

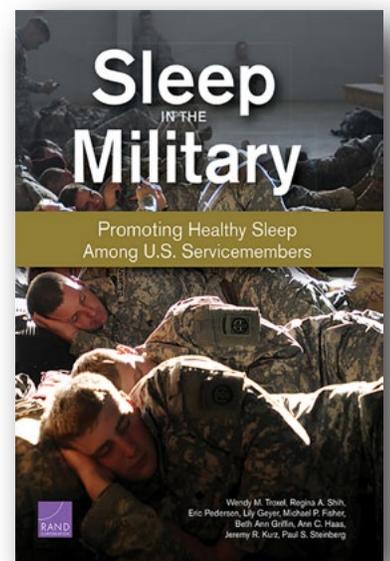
* Collen, J., Orr, N., Carter, K., & Holley, A. (2012). Sleep Disturbances among Soldiers with Combat-Related Traumatic Brain Injury. *Chest*, 142(3):622-630.

The Performance Triad and the DOD/Rand Collaboration

In 2013, Lieutenant General Patricia D. Horoho, US Army Surgeon General, responded to the growing recognition of sleep problems in the military by launching an organizational initiative to improve the health, readiness, and resilience of the Army family. The creation of the *Performance Triad* targeted the implementation of a comprehensive plan to promote the balance of sleep, activity, and nutrition among Army personnel and family members to improve wellness. The inclusion of sleep within a military health and wellness model was a remarkable shift in recognizing the huge toll that disrupted sleep takes on individual Service Members, on performance readiness, and on operational

safety. The Triad Model allows for individual Service Members and families to identify sleep problems and set targets to improve sleep via individualized online profiles. The Triad also monitors nutrition and activity (formerly described as exercise), both of which had been targeted as cornerstones of military fitness, long before sleep was included.

Following suit, the Department of Defense, concerned about the role of sleep disruption and deprivation across all branches of service, partnered with the Rand Corporation in 2014 to bring sleep researchers and clinicians together to study sleep patterns and their impact on mission and individual Service Member performance. The goals of this summit were to identify research and best practices to improve Service Member sleep, to address gaps in research, clinical management, and training settings, and to make recommendations in each of these areas. The results are available in *Sleep in the Military: Promoting Healthy Sleep Among U.S. Servicemembers* (Troxel, Smith, et al., 2015), available for free download (http://www.rand.org/pubs/research_reports/RR_739.html). This document represents the first collaborative effort among all service branches, researchers, and clinicians to review the sleep research related to Service Members. It identifies best research-based recommendations for practices in sleep, as well as gaps that need to be addressed by researchers and clinicians to continue building a compendium of effective sleep interventions for our Service Members.



Factors Disrupting Sleep

Several *external factors* can affect sleep that are not specific to military service or combat.

These can include:

- size and type of bed, mattress, and pillows
- sleeping patterns of bed partners
- noise, light, and room temperature
- pets and children
- using electronic devices while in bed.

Providing instruction in how best to manage these factors is a way to normalize the discussion of sleep with combat veterans and their partners. It is recommended that bedding types (firmness, foam vs. inner-spring, pillow, etc.) be sampled for the best individual and partner fit; that noise and light be reduced as much as possible, and that cool air be circulated while sleeping. Pets and children may disrupt sleep, and should not be in the room or in the bed. Partners should discuss sleep patterns and how to reduce awakening one another. All electronic devices (phone, TV, radio, video-games, music) should remain off, other than setting an alarm for a planned wakeup. For Service Members who are “permanently attached” to checking messages or who are conditioned to falling asleep with television or music on, turning off electronics can be a difficult but necessary transition.

Similarly, *internal factors* can affect sleep. Discussion of these factors with Service Members and partners initiates the conversation about how to manage them.

Each Service Member requires individualized assessment of which factor(s) contribute to sleep disruption and how to manage each one:

- 
- caffeine intake and volume
 - alcohol intake
 - medications, including prescribed, over the counter, and illegal
 - physical issues, including chronic pain (service-related pain can include skeletal injuries from carrying/wearing heavy equipment, falls, jumping/climbing, running)
 - tinnitus and/or hearing loss (from exposure to engines, mortars, rockets, RPG's, small arms fire, etc.)
 - worry and stress
 - undiagnosed/untreated sleep disorders
 - changes in circadian rhythm for Service Members working shifts, travelling across time zones or stationed in submarines or aboard other Naval vessels.

In addition, *deployments in combat zones* can add to and/or exacerbate sleep problems. It is helpful to distinguish deployment



Veterans need to know the combat-related experiences that may affect sleep, which include:

Exposure to:

- toxic smells and substances (smoke, fumes, burn pits, etc.)
- toxic/loud sounds (mortars, engines, gunfire, music, etc.)
- extremes in temperature (both cold and hot)
- extreme light (sun, flashes, flares, etc.)
- reduction in “down time” when sleep may be a lower priority than eating, emailing family and friends, and falling asleep may be elusive
- lack of privacy/control over external factors affecting sleep
- unpredictable length and timing of missions, leading to “catching naps” and missing regular sleep cycles around the mission
- variability in sleep location and bedding (including sleep on the ground, sharing a cot by shift, sleeping in a moving vehicle)
- experiencing atrocities of war (mutilation/death of peers, children, women, enemies)
- sleeping with “one eye open, weapon at the ready”
- increase in caffeine intake and substances to increase alertness
- managing escalation of pain and stress (physical, emotional)
- circadian rhythm disruption with every flight home, downrange, and across time zones
- blast injury/concussion
- autonomic hyperarousal

factors from those affecting all civilians and non-deployed Service Members, as deployment factors can disrupt sleep in ways that have the potential to significantly compromise normal sleep patterns. Examination of sleep patterns which were adaptive during deployment, but no longer functional post-deployment, can shift the perceptions from being “broke” and “disordered”, to having adapted to deployment sleep conditions that now require reconditioning or additional adaptations post-deployment. This move from the realm of psychiatric patient and a threat to one’s family, community, and the military allows for a significant shift in hope, particularly when combat veterans learn that there are interventions to restore sleep. This also allows combat veterans to separate combat-related sleep issues from other sleep issues that may not be related to combat, recognize that non-veterans also have sleep problems, and opens up discussion that all sleep problems have effective interventions to treat them.

These factors can affect the sleep physiology, quality, and quantity of every Service Member who has been deployed, and can have deleterious effects on conditions associated with PTSD (Worcester, 2012) and mTBI, including learning and memory consolidation (McDermott, LaHoste, Chen C, et al., 2003; Capaldi et al., 2011; Luxton et al., 2011).

The neurophysiology of sleep *shifts* over the course of each deployment to accommodate geographical and war-specific circumstances.

These include:

- adaptation for self-preservation (such as being aroused easily)
- sleeping through noise, light, and noxious smells that would normally wake one up
- adjusting to less sleep over time
- conditioning the autonomic system to a state of hyperarousal
- circadian rhythm changes, depending on assignment
- managing traumatic memories that emerge in nightmares

Most combat veterans have no training in the impact of combat on sleep, the need



to re-train the brain to reduce hyperarousal and re-adjust circadian rhythms and arousal states to stateside clocks and conditions, and the need to seek assistance for nightmare management/reduction and other sleep problems such as profuse night sweats. Nor are those with diagnoses of Post-Traumatic Stress Disorder (PTSD) or mTBI aware of how disrupted sleep contributes to some of the symptoms of these diagnoses (irritability, problems with memory and concentration, startle response, hypervigilance, nightmares, etc.) (Ayalon et al., 2007; Baumann et al., 2007; Castriotta et al., 2009).

One question asked in assessing Service Members for changes in sleep is whether they “check the perimeter” (locks, doors, and windows) of their home repeatedly before and during hours of sleep. This repetitive behavior is likely to be an excessive need for safety and security carried over from deployment and must be addressed along with other sleep disruptions. Similarly, repetitive and/or frequent nightmares with combat-related content and themes speak to unresolved memories, as well as sleep problems. These combat-specific factors warrant assessment and treatment beyond that of “sleep hygiene” information. The sleep of our combat veterans is in many ways the “last frontier” in helping them return home well.

Assessment of Sleep

Assessment includes administration of standardized sleep scales, such as the Epworth Sleepiness Scale (Johns, M. W., 1991), the Pittsburgh Sleep Quality Assessment (PSQI, Buysse et al., 1989), and the Insomnia Severity Index (Morin et al., 2011), and the completion of sleep logs (the latter kept by Service Members for up to two weeks to identify patterns of sleep, length, quality, etc.). When available, a roommate or sleep partner may provide corroborating observations of the Service Member’s sleep

disruptions, including restlessness, insomnia, night sweats, nightmares, snoring, etc. Assessment should also include the identification of prescribed medications, over the counter medications, substances such as alcohol, and medications prescribed to someone else.

Assessment of sleep can be done by the Service Member using the Performance Triad, Insomnia Severity Scale, or Epworth Sleepiness Scale. Sleep quality can also be assessed by clinicians who conduct interviews with veterans and their sleep partners and who have access to standardized assessment tools. It is recommended that assessment of sleep be included as part of the initial intake with combat veterans, and that changes in sleep quality be assessed

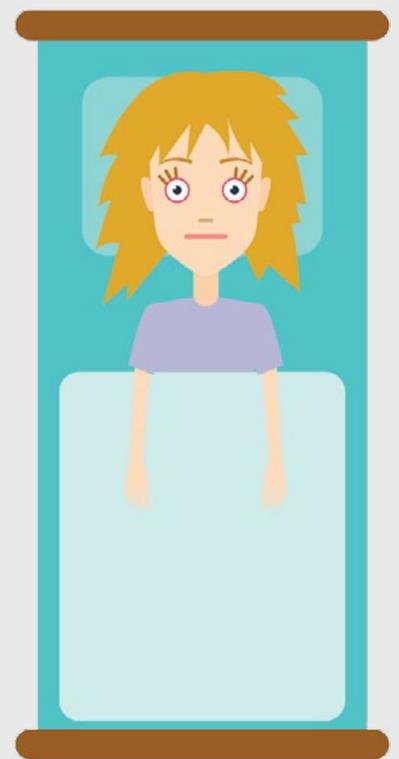
during each follow up visit. Referral to a sleep clinic for overnight study, and/or development of an individualized protocol for sleep restoration, however, requires more training on how and where to refer, and how to differentially treat the multitude of sleep disorders that are delineated in the International Classification of Sleep Disorders, Third Edition (ICSD-3) (American Academy of Sleep Medicine, 2014).

The Department of Defense and Veterans Administration are in great need of expanding clinician training to make appropriate referrals and to treat sleep disorders with a careful combination of medication and non-medication interventions.

When to Refer to a Certified* Sleep Clinic

- Falling asleep while driving or at traffic lights
- Gasping for breath when sleeping (3x+/week)
- Muscle weakness when someone tells a joke
- Frequent daytime sleepiness despite adequate nighttime sleep
- Violent nighttime behavior
- Atypical nighttime behavior
- Self-medicating to aid sleep
- Nightmares, if medication requested
- Score above 10 on Epworth Sleepiness Scale

*by the American Academy of Sleep Medicine



Referral to a sleep clinic (which should be certified by the American Academy of Sleep Medicine) should be made when the any of the following is present:

- a score greater than 10 on the Epworth Sleepiness Scale
- falling asleep while driving or at traffic lights
- violent night time or atypical night time behavior
- prolonged use of OTC, prescribed, “borrowed” medications or alcohol (including substance abuse) to aid sleep
- severe nightmares
- muscle weakness when someone tells a joke
- frequent daytime sleepiness despite adequate night time sleep, and/or
- gasping for breath when sleeping (three times a week or more)

Sleep Interventions

All *medications* have known side effects, but remain frontline interventions for sleep disturbances. Medications are specific to the type and severity of sleep disorders and other co-morbid conditions; for example, their use for insomnia and hyperarousal is to calm the brain’s overstimulation to allow for sleep, while medication for narcolepsy helps to stimulate daytime alertness. Medications for chronic, severe migraines, such as BOTOX injections, can provide combat veterans pain relief sufficient to allow for improvement in sleep (Botulinum Toxin and Headache Virtual Issue, July 2012; Khalil et al., 2014). Medication management for sleep and comorbid conditions continues to evolve as the mechanisms of mTBI, PTSD, and neurochemistry of medications are identified in research trials.

Additional interventions have been demonstrated to work in conjunction with medication, with the goal of reducing and eliminating sleep medications, while restoring sleep.



The goals of sleep restoration include:

- identification and instruction of the patient in effective sleep strategies
- improvement of the patient’s perception of and understanding of sleep health (e.g., Sleep Health, 2015)
- initiation of sleep restriction as needed, and adjustment of sleep restriction over time
- reduction in nightmares
- reduction of night sweats
- reduction of medications for sleep

Improvement of quality and quantity of sleep Interventions may include:

- medication
- education about normal sleep and internal, external, and combat-related factors disrupting sleep
- stimulus control
- sleep restriction
- the use of CBT-I (cognitive behavioral therapy for insomnia)
- sleep “hygiene” (a term describing good/practical decisions to maximize sleep)
- nightmare management

- adaptive technology
- complementary alternative medicine (CAM) interventions
- management of chronic pain including
 - migraine headaches (Mauser & Rosen, 2012)
 - tinnitus (Humes et al., 2006), and
 - other physical changes secondary to deployment that disrupt sleep
- referral to a sleep clinic to identify and treat specific sleep disorders (where additional interventions may be tailored to sleep diagnoses/disorders identified in an overnight or 24 hour sleep study).

Stimulus control includes using the bed for sleep and sex only, resisting the urge to look at a clock in bed, getting out of bed when unable to sleep for 20+ minutes (and doing sedentary, non-functional activities), and setting a pattern to get up within 10 minutes of the same time, seven days a week.

Sleep restriction facilitates the consolidation of sleep by restricting the “Time in Bed” each night to the average number of hours slept each night during the previous week. A sleep log is used to estimate the time asleep versus the time in bed. Sleep is never restricted to less than 4-5 hours. Each week that the veteran achieves at least 85% sleep efficiency (asleep at least 51 minutes out of each 60 minutes in bed), he or she rewards him/herself by going to bed 15 minutes earlier each night for the next week. This intervention allows for the graduated increase of sleep per night from what may be initially misperceived as “I never sleep” to an awareness of gradually increasing sleep length and sleep restoration (Vallieres et al., 2013).

Cognitive-Behavioral Therapy for Insomnia

The highest report of sleep disturbance among veterans is insomnia. Cognitive-behavioral (CBT) has a robust empirical evidence base (Butler et al., 2006), and the application of CBT to insomnia (CBT-I) has been demonstrated to be an effective treatment for insomnia (Morin & Benca, 2012; Ashworth et al., 2015) and endorsed by the VA’s Center for Integrated Health Care (Veterans Health Administration, 2011).

CBT-I corrects misperceptions about insomnia (for example, “if I miss sleep tonight, I will never make it through work tomorrow; I will get fired; I will fall asleep on the job,” etc.) that are not likely to happen. It also corrects associations that perpetuate sleep problems and result in maladaptive habits, such as reading or watching TV in bed, and taking naps.

CBT-I incorporates numerous techniques, including sleep restriction, cognitive restructuring, and stimulus control. *CBT-i Coach* is an insomnia app published in 2013 by the Centers for Telehealth and Telemedicine (T2) for use in conjunction with CBT-I treatment. The app, designed for use by veteran patients, includes a sleep diary and options to calculate the total time in bed, total time asleep, and sleep efficiency. A summary of CBT-I in military populations is included in the Rand Sleep in the Military publication (Troxel et al., *Ibid.*). *CBT-i Coach*, and several other T2 apps that may indirectly assist with sleep, are available for free download on phones and androids (<http://t2health.dcoe.mil/apps/CBT-i>).



Sleep Hygiene

“Sleep hygiene” refers to a list of recommendations that were (and in many cases, are still) given to civilians and veterans as the standard first line of non-medication interventions to enhance sleep. Research studies have since indicated that it should not be the first line of therapy, although there are common sense changes in habits that should accompany research-based interventions.

These include:

- limiting caffeine and tobacco late in the day
- limiting exercise within two hours of bedtime
- sleeping in a cool, dark room
- sleeping without noise, electronics, pets, children in the room
- using relaxation techniques

For *combat veterans*, these recommendations may also include:

- providing *for the safety* of family, bed partners, and pets, particularly if nightmares, physical movements and thrashing, and startle responses with aggressive or guarding responses are present
- management of *night sweats*, such as changing to a dry set of clothing, lining the bed with a waterproof liner and/or towels, and reporting the frequency/intensity and duration of sweats and nightmares to the attending physician for further possible assessment
- management of tinnitus, chronic pain (head, neck, skeletal, etc.) and other injury related issues affecting sleep
- management of hyperarousal

Adaptive Technology

The most widely used and well-researched adaptive technology available to treat sleep

disordered breathing is a machine to assist breathing known as a CPAP (Continuous Positive Airway Pressure), which pushes regulated air into the nose and mouth while sleeping. Obstructive sleep apnea (OSA, or OSAS) and central sleep apnea (CSA) are types of these disorders that have been increasingly diagnosed in Service Members and veterans (Collen et al., 2012; Castriotta et al., 2011). CPAP or BIPAP (Biphasic Intermittent Airway Pressure) devices can be ordered by sleep specialists who first confirm a sleep disorder diagnosis (typically by overnight sleep study), then select and fit a mask and machine matching the diagnosis and the patient’s needs. In some cases, these devices are lifesaving.

Patients undergo training to use these machines nightly, however, compliance can decline over time and periodic check-ins with veterans using CPAPs and BIPAPs should be made.

Commercial devices that have been developed to track and/or enhance sleep have expanded as military (and national) interest in improving sleep has grown. One such aid, the Dreampad®, developed by Dr. Randall Redfield, is a pillow that integrates bone conduction technology (transducers) with music to enhance relaxation and sleep. In this issue, Dr Redfield’s article describes the Dreampad® technology and initial research studies with small sample sizes across ages and populations.

Personal Readiness Devices (PRDs) are adaptive aids that are typically worn on the wrist to track sleep and activity. One well known product is the FitBit®, a wristband with wireless tracking of activity and sleep that syncs with its own phone app that can set and track goals; Jawbone Up® and other wristband products offer similar sleep trackers. Commercial sleep tracker apps used on or near the bed, such as Sleepspace®, RestOn®,

and Relax Melodies® offer light, white noise, and/or multiple background sounds which can vary volume. Some devices include a clock and or alarm for automatic turn off, and the capacity to monitor and analyze sleep quality.

The major concern related to such apps and devices is the limitation (if not absence) of published peer reviewed research to support their efficacy in improving sleep quality and quantity. While they can provide daily feedback, they have not been demonstrated to correct sleep disorders. If this were to be undertaken, particularly with veterans as subjects, the wide use of smart phones and other electronic/technology devices would offer the potential to engage huge numbers of veterans in improving their sleep. A variety of *over-the-counter* nasal external removable devices and stick-on bandages purport to open nasal passages, improve breathing, and reduce snoring. Similarly, *over-the-counter* nasal sprays, sublingual drops, and creams have come on the market, several of which include melatonin, magnesium, valerian root, GABA, and other nutrients and herbs. Even products with these *natural sleep-enhancing agents* have insufficient well-controlled research to support their use for veterans (Kemp et al., 2004). One exception is a study of NFL players given supplements, exercise, and other lifestyle changes that yielded improvement in cognitive function and corresponding improvement on SPECT (single-photon emission computerized tomography) scans (Amen et al., 2011); these results warrant further study of supplements alone.

For Service Members and families unaware of best practice options available to correct sleep problems, the search for ways to improve sleep are often left to such hit or miss *over-the-counter* options that may prolong referrals for appropriate diagnosis and treatment.



SYMPTOMS OF SLEEP APNEA

- Snoring
- Periodic Choking or Gaspings
- Inability to Fall Asleep or Stay Asleep
- Disturbed Sleep
- Waking Up Frequently with a Dry or Sore Throat
- Weight Gain
- Feeling Sleepy/Falling Asleep During the Day
- Forgetfulness
- Mood Swings
- Lack of Interest in Sex

* <http://health.facty.com/ailments/sleep/10-symptoms-of-sleep-apnea>

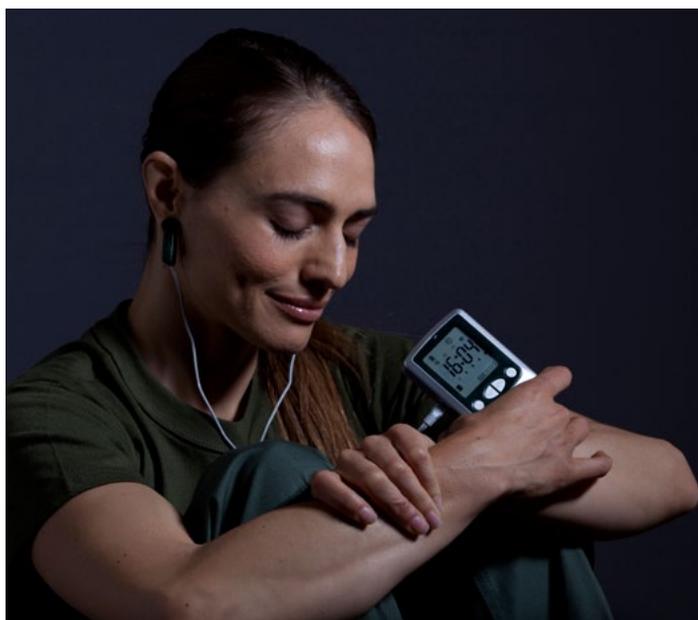
One adaptive technology intervention showing promising research is the use of *light therapy*, an intervention used in sleep medicine primarily to re-set circadian rhythm disorders, seasonal affective disorder, and dementia (Shirani & St. Louis, 2009). A recent study by Ponsford et al. (2012) suggests that morning bright light might improve fatigue in patients with TBI's. Additional studies are underway to assess the effects of both morning bright light, and other types of light such as near-infrared light (Morries, Cassano, & Henderson, 2015).

Finally, *Cranial Electrotherapy Stimulation* (CES) is one of the most promising interventions that is both an adaptive technology and a Complementary Alternative Medicine intervention (see next section). CES is a US Food and Drug Administration–approved, prescriptive, noninvasive electromedical treatment that can increase sleep time, reduce sleep disturbances, and improve overall sleep quality for those suffering from insomnia. The effects of treatment over several weeks have demonstrated significant physiological improvements, including an increase in alpha and decrease in delta and beta brainwave activity, and positive

effects on blood plasma and serum cortisol (Kirsch & Gilula, 2007). CES involves the administration of a miniscule electrical current from a transmitter through electrodes which are attached to clips placed on each earlobe of individuals suffering from depression, anxiety, and insomnia (Kirsch & Nichols, 2013). Lande & Gragnani (2013) have demonstrated positive effects in a small sample of active duty military personnel at Walter Reed, despite using a shortened length of treatment warranting further research on larger samples in longer trials.

Complementary and Alternative Medicine Interventions (CAMs)

Complementary and alternative medicine interventions (CAMs) have been demonstrated to be effective interventions in the civilian population, and among the military/veteran population with PTSD and other co-morbid disorders (Herman et al., 2017; Libby et al., 2013). Terminology has emerged over time from “adjunctive” treatments to “CAMs” as a body of research builds for interventions that include yoga (Spencer, 2013; Stoller et al., 2012), meditation (Hilton et al., 2016; Travis, 2010), Transcendental Meditation® (Barnes et al., 2013), Tai Chi, massage, acupuncture (Chang & Sommers, 2014, Grant et al., 2016; Shin et al., 2017), biofeedback, expressive arts therapies (Balfour et al., 2014; Kosygin & Lebedev, 2015; Lobban, 2014; Lovenbury, 1996), and cranial electrotherapy stimulation (CES, described in previous section), among others. Many of these interventions have been demonstrated to be effective, to reduce symptoms of PTSD, and to reduce psychotropic medication use (Barnes et al., 2013, 2016), but few studies specifically assess the impact of CAMs on veterans’ sleep.



Alpha-Stim CES Device

While CAM research studies on veterans’ sleep are small in number, they suggest that yoga and meditation reduce hyperarousal,



improve sleep quality, and reduce insomnia. Inadequate controls and small sample sizes warrant more systematic evaluation to demonstrate the efficacy of not only of yoga and meditation on sleep, but other CAMs as well, particularly as more veterans request these interventions as they try to avoid the side effects of medications for sleep (Troxel et al., 2015).

One problem with studying CAMs is that they are frequently used simultaneously with other interventions, such that studying their specific effects on sleep is difficult to quantify. One exception, *Cranial Electrotherapy Stimulation* (CES, introduced in previous section) has been researched for decades in treating insomnia (Kirsch & Gilula, 2007), with positive outcomes, minimal side-effects, and at low cost. Alpha-stim CES has been used in a combat operational setting in which video teleconference training was given to military clinicians on the ground, and individual devices supplied to Service Members. The intervention was summarized as a “helpful tool in conserving the strength of the fighting force” (Hare et

al., 2016). At this time, over 90 Veterans Administration Medical Centers offer this intervention to veterans.

As the cost of training veterans in CAMs is relatively inexpensive and show promise in improving sleep and reducing psychotropic medication (Barnes et al., 2016), they warrant further funding for research of specific CAMs, and for training clinicians to provide these therapies to our Service Members and veterans.

Nightmare Management

Nightmares disrupt sleep quantity and impair sleep quality (Harb et al., 2013). Combat veterans may have intense, repetitive nightmares about specific horrific incidents, with accompanying emotional arousal, which can lead to avoidance of sleep/dreaming or heavily self-medicating to avoid dreams. Imagery rehearsal therapy (IRT) is a type of cognitive behavioral treatment in which the patient describes a distressing dream/nightmare and its accompanying emotional content, then develops and rehearses a new dream with less distressing content and a more desirable outcome over several sessions (Kraków et al., 1995). The results of several studies of veterans with combat-related PTSD demonstrate that IRT can reduce nightmare intensity and frequency and recurring nightmares (Cook et al., 2010; Harb et al., 2013; Long et al., 2011). In addition, this intervention has been demonstrated to be effective and enduring in group as well as individual treatment delivery, although individual treatment shows a stronger overall effect (summarized in Troxel et al., 2015). In 2016, The Department of the Army began offering a course to military clinicians in “Cognitive Behavioral Therapy for Insomnia and Nightmares” (Davis, J., et al., 2016), sponsored by the Post Traumatic Stress and Resiliency Branch, AMEDD Center and School, Fort Sam Houston, TX, that

includes IRT training to increase its availability to our combat veterans, many of whom are still unaware of this effective intervention. Such training needs to be expanded within all branches of the Department of Defense and the Veterans Administration.



Summary

There are a number of promising interventions and technology to improve the sleep of our Service Members and veterans, particularly those with significant sleep disruption. Progress in assessment and treatment is moving forward, but requires closure of significant gaps between sleep assessment and treatment guidelines, scientific studies, and current practices within the Department of Defense and VA (Troxel et al., 2015). More robust research is needed in each of the areas described above.

In addition, there are effective cognitive behavioral and CAM interventions that are unknown and unavailable to many Service Members and veterans. The dissemination of the information in this summary and the Rand Report, as well as directives on how to find clinicians offering these treatments, is urgently needed in order for our veterans to correct and improve their sleep and as a result, the subsequent quality of daytime function.

Finally, researchers and clinicians need to keep testing new interventions. We are in an emerging field with huge numbers of veterans in need of interventions to improve and restore their sleep, and hence, their quality of life.

Disclosure: While the authors work with military Service Members, the materials presented in this article represent the compilation of materials and opinions of the authors. They do not reflect the official policy or position of the Department of Defense or the Veterans Administration. The authors neither endorse nor have any financial relationship with any sleep devices described in this article.

About the Authors

Christiane O'Hara, PhD has served as a Red Cross volunteer clinical psychologist for 8 years at Eisenhower Army Medical Center, Fort Gordon, GA, where, with Netta Putnam, she has trained service members about sleep in the TBI Clinic's Functional Recovery Program. She is a contributor to the Rand/DoD collaboration's Sleep in the Military: Promoting Health Sleep among U.S. Servicemembers (2015). She serves as an Advisor to Women Veteran Social Justice Network (WVSJ) and to GratitudeAmerica, Inc., two national nonprofits providing resources for Service Members and veterans, including retreats. She is co-author of Rehabilitation with Brain Injury Survivors: An Empowerment Approach (1991); "ArtReach Project America and other Innovative Civilian-Military Partnering" chapter in War Trauma and its Wake: Expanding the Circle of Healing (2012); and "Veterans and the Arts as Healing Interventions" in Combat Stress (2014). She completed postdoctoral training in Neuropsychology and Rehabilitation Medicine at the Atlanta Veterans Administration Medical

Center and Emory University Center for Rehabilitation. She is the daughter of a Navy veteran, and mother of a Service Member in the U.S. Army.

Helen N. (Netta) Putnam, PA, OTR has served as the Physician Assistant in the Neuroscience and Rehabilitation Center TBI Clinic at Eisenhower Army Medical Center, Fort Gordon, GA and as an Occupational Therapist in Acute Care at Doctors Hospital, Augusta GA for the last 8 years. She graduated from Converse College, Spartanburg, SC in 1973 with majors in Behavioral Psychology and Comprehensive Science. She completed her graduate studies in Occupational Therapy from the University of Pennsylvania School of Allied Health in 1981 and graduate studies in Medical Science from the Emory University Physician Assistant Program in 2006. Prior to working with the military, she worked as an Orthopedic Surgical PA in private practice. In addition, she has worked as an occupational therapist in acute care, rehabilitation, public schools and early intervention. She has completed post graduate training in CBT-I from the University of Pennsylvania, the Sleep Medicine Course for PAs from the Atlanta School of Sleep Medicine and Cognitive Behavioral Therapy for Insomnia and Nightmares, AMEDD Center and School. She frequently attends the International Sleep conference, which is the joint meeting of the American Academy of Sleep Medicine and the Sleep Research Society. Ms. Putnam is the descendent of American veterans, beginning with the Revolutionary War. She is the daughter of a Naval Officer, sister of Navy and National Guard vets and the mother of an Army veteran.

References

Amen, D.G., Wu, J.C., Taylor, D. & Willeumier, K. (2011). Reversing brain damage in former NFL players: Implications for traumatic brain injury and substance abuse rehabilitation. *Journal of Psychoactive Drugs*, 43(1): 1-5.

American Academy of Sleep Medicine. (2014). International Classification of Sleep Disorders – Third Edition (ICSD-3) Online. www.aasmnet.org; <http://www.aasmnet.org/store/product.aspx?pid=849>;

Ashworth, D., Sletten, T., Junge, M., Rajaratnam, S., (2015). A Randomized Controlled Trial of Cognitive Behavioral Therapy for Insomnia: An Effective Treatment for Comorbid Insomnia and Depression. *Journal of Counseling Psychology*, 62(2):115-123.

Ayalon, L., Borodkin, K., Dishon, L., Kanety, H., & Dagan, Y. (2007). Circadian rhythm sleep disorders following mild traumatic brain injury. *Neurology*, 68(14), 1136-1140.

Barnes, V.A., Rigg, J.L., & Williams, J.J. (2013). Clinical Case Series: Treatment of PTSD with Transcendental Meditation in Active Duty Military Personnel. *Military Medicine*, 178, 7:e836-40.

Barnes, V.A., Monto, A., Williams, J. J., & Rigg, J.L. (2016). Transcendental Meditation® and Psychotropic Medication Use among Active Duty Military Service Members with Anxiety and PTSD. *Psychosomatic Medicine*, 77(3), A54.

Balfour, M., Westwood, M., Buchanan, M. (2014). Protecting into Emotion: Therapeutic Enactments with Military Veterans Transitioning Back into Civilian Life. *Research in Drama Education: The Journal of Applied Theatre and Performance*, 19(2), 165-181.

Baumann, C.R., Werth, E., Stocker, R., Ludwig, S., & Bassetti, C.L. (2007). Sleep-wake disturbances 6 months after traumatic brain injury: a prospective study. *Brain*, 130(7), 1873-1883.

Botulinum Toxin and Headache, Virtual Issue. (July, 2012). Guest Editors E.D. Mauser & N.L. Rosen, Headache: The Journal of Head and Face Pain, American Headache Society.

Buysse, D.J., Reynolds, C.F., Monk, T.H., Berman, S.R., & Kupfer, D.J. (1989). The Pittsburgh Sleep Quality Index (PSQI): A new instrument for psychiatric research and practice. *Psychiatry Research*, 28(2), 193-213.

Capaldi, V.F., Guerrero, M.F., Killgore, W.D.S. (2011). Sleep disruption among returning combat veterans from Iraq and Afghanistan. *Military Medicine*, 176 (8), 879-878.

Castriotta, R.J., Atanasov, S., Wilde, M.C., Masel, B.E., Lai, J.M., Kuna, S.T. (2009). Treatment of sleep disorders after traumatic brain injury. *Journal of Clinical Sleep Medicine*, 5(2), 137-144.

- Castriotta, R.J. & Murthy, J.N. (2011). Sleep disorders in patients with traumatic brain injury: a review. *CNS Drugs*, 25(3):175-85.
- Chang, B.H. & Sommers, E. (2014). Acupuncture and relaxation response for craving and anxiety reduction among military veterans in recovery from substance use disorder. *The American Journal on Addictions*, 23(2), 129-136.
- Collen, J., Orr, N., Carter, K., & Holley, A. (2012). Sleep Disturbances among Soldiers with Combat-Related Traumatic Brain Injury. *Chest*, 142(3):622-630. doi:10.1378/chest.11-1603.
- Cook, J.M., Harb, G.C., Gehrman, P.R., Cary, M.S., Gamble, G.M., Forbes, D., & Ross, R.J. (2010). Imagery Rehearsal for Posttraumatic Nightmares: A Randomized Controlled Trial. *Journal of Traumatic Stress*, 23(5), 553-563.
- Davis, J.L., Balliette, N., Friedlander, J.N., Pruiksma, K.E., & Miller, K.E. (2016). Exposure, Relaxation, and Rescripting Therapy for Military and Veterans (ERRT-M) for Chronic Trauma-Related Nightmares and Sleep Disturbances: A Treatment Workbook. ERRT Workgroup (unpublished).
- Grant, S., Kandrack, R., Motala, A., Shanman, R., Booth, M., Miles, J., Sorbero, M., & Susanne Hempel, S. (2016). Acupuncture for substance use disorders: a systematic review and meta-analysis. *Drug and Alcohol Dependence*, 163, 1-15.
- Harb, G.C., Phelps, A.J., Forbes, D., Ross, R.J., Gehrman, P.R., & Cook, J.M. (2013). A Critical Review of Evidence Base of Imagery Rehearsal for Posttraumatic Nightmares: Pointing the Way to Future Research. *Journal of Traumatic Stress*, 26(10), 570-579.
- Hare, J. P., Misialek, L. H., Palis, K. & Wong, C. (2016). Using Cranial Electrotherapy Stimulation Therapy to Treat Behavioral Health Symptoms in a Combat Operational Setting. *Military Medicine*, 181(11):1410-1412.
- Healthy Sleep: Concussion and Mild Traumatic Brain Injury. (June 2014). Dvbic.dcoe.mil
- Herman, P.H., Lorenz, K., Taylor, S.L. (January 2017). The Use of Complementary and Alternative Health in the OEF/OIF/OND Veteran Population, VA Health Cyber-Seminar.
- Hilton, L., Maher, A. R., Colaiaco, B., Apaydin, E., Sorbero, M. E., Booth, M., Shanman, R. M., & Hempel, S. (2016, August 18). Meditation for Posttraumatic Stress: Systematic Review and Meta-analysis. *Psychological Trauma: Theory, Research, Practice, and Policy*. <http://dx.doi.org/10.1037/tra0000180>
- Humes, L.E., Joellenbeck, L.M., Durch, J.S., Eds. (2006). Tinnitus, Noise and Military Service: Implications for Hearing Loss and Tinnitus Associated with Military Service from World War II to the Present. National Academies Press, 116-145.
- Institute of Medicine (US) Committee on Sleep Medicine and Research. (2006). Extent and Health Consequences of Chronic Sleep Loss and Sleep Disorders. Chapter 3 in *Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem*. Colten, H.R. & Altevogt, B.M. (Eds.). Washington DC: National Academies Press. <https://www.ncbi.nlm.nih.gov/books/NBK19961/>
- Johns, M.W. (1991). A new method for measuring daytime sleepiness: the Epworth Sleepiness Scale. *Sleep*, 14, 540-545.
- Kemp S., Biswas, R., Neumann, V., & Coughlan, A. (2004). The value of melatonin for sleep disorders occurring post-head injury: a pilot RCT. *Brain Injury*, 18(9):911-919.
- Khalil, M., Zafar, H.W., Quarshie, V., & Ahmed, F. (2014). Prospective analysis of the use of OnabotulinumtoxinA (BOTOX) in the treatment of chronic migraine. *The Journal of Headache and Pain*, 15(54). DOI:10.1186/1129-2377-15-54.
- Kirsch, D.L. & Nichols, F. (2013). Cranial electrotherapy stimulation for treatment of anxiety, depression and insomnia. *Psychiatric Clinics of North America*, 36(1):169-176.
- Kirsch, D.L. & Gilula, M. (2007). CES in the Treatment of Insomnia: A Review and Meta-Analysis. *Practical Pain Management*, 7(7):28-39.
- Kosygin, A. & Lebedev, A. (2015). Therapeutic Functions of Humour in Group Art Therapy with War Veterans. *International Journal of Art Therapy*, 20(2), 40-53.
- Lande, R. G. & Gagnani, C. (2013). Efficacy of cranial electric stimulation for the treatment of insomnia: A randomized pilot study. *Complementary Therapies in Medicine*, 21(1):8-13.
- Lankford, D.A., Wellman, J.J., & O'Hara, C. (1994). Post-traumatic narcolepsy in mild to moderate closed head injury. *Sleep*, 17(8), 25-28.
- Libby, D.J., Corey, E.P., & Rani, D. (2013). Complementary and alternative medicine use among individuals with post-traumatic stress disorder. *Psychological Trauma: Theory, Research, Practice, and Policy*, 5(3), 277-285.
- Lobban, J. (2014). The Invisible Wound: Veterans Art Therapy. *International Journal of Art Therapy*, 19(1), 3-18.
- Long, M.E., Hammons, M.E., Davis, J.L., Frueh, B.C., Khan, M.M., Elhai, J.D. & Teng, E.J. (2011). Imagery Rescripting and Exposure Group Treatment of Posttraumatic Nightmares in Veterans with PTSD. *Journal of Anxiety Disorders*, 25(4), 531-535.

- Lovenbury, K. (1996). *Soldiers Heart: Survivors' Views of Combat Trauma*. *Art Therapy: Journal of the American Art Therapy Association*, 13(3), 213-214.
- Lucke-Wold, B.P., Smith, K.E., Nguyen, L., Turner, R.C., Logsdon, A.F., Jackson, G.J., et al. (2015). Sleep disruption and the sequelae associated with traumatic brain injury. *Neuroscience & Biobehavioral Review*, 55:68–77. PubMed PMID: 25956251.
- Lucke-Wold, B.P., Logsdon, A.F., Nguyen, L., Eltanahay, A., Turner, R.C., Bonasso, P., Knotts, C., Moeck, A., Maroon, J., Bailes, J. & Rosen, C. (2016). Supplements, nutrition, and alternative therapies for the treatment of traumatic brain injury, *Nutritional Neuroscience*, DOI:10.1080/1028415X.2016.1236174
- Luxton D.D., Greenburg D., Ryan J., Niven A., Wheeler G., Mysliwicz V. (2011). Prevalence and impact of short sleep duration in redeployed OIF soldiers. *Sleep*, 34(9), 1189-1195.
- McDermott, C.M., LaHoste, G.J, Chen, C., Musto, A., Bazan, N.G., & Magee, J.C. (2003). Sleep deprivation causes behavioral, synaptic, and membrane excitability alterations in hippocampal neurons. *Journal of Neuroscience*, Oct 22; 23(29), 9687-95.
- Morin, C. M., Belleville, G., Bélanger, L., & Ivers, H. (2011). The Insomnia Severity Index: Psychometric Indicators to Detect Insomnia Cases and Evaluate Treatment Response. *Sleep*, 34(5), 601–608.
- Morin, C.M. & Benca, R. (2012). Chronic insomnia, *The Lancet*, 379(9821) 1129–1141.
- Morries, L.D., Cassano, P., Henderson, T.A. (2015). Treatments for traumatic brain injury with emphasis on transcranial near-infrared laser phototherapy. *Neuropsychiatric Disease and Treatment*, 11, 2159-75.
- Mysliwicz, V., Williams, S., Baxter, T., Germain, A., O'Reilly, B., & Luxton, D. (2014). Preventing Sleep Casualties: Understanding the unique aspects of sleep and sleep disorders in active duty service members. *Combat Stress e-magazine, The American Institute of Stress*, 3(4), 8-25.
- Ponsford, J.L., Ziino, C., Parcell, D.L., Shekleton, J.A., Roper, M., Redman, J., Phipps-Nelson, J, & Rajaratnam, S. (2012). Fatigue and sleep disturbance following traumatic brain injury--their nature, causes, and potential treatments. *Journal of Head Trauma Rehabilitation*, 27: 224-233.
- Shin, N.Y., Lim, Y.J., Yang, C.H., & Kim, C. (2017). Acupuncture for Alcohol Use Disorder: A Meta-Analysis. *Evidence-Based Complementary and Alternative Medicine*, Article ID 7823278, doi:10.1155/2017/7823278
- Shirani, A. & St. Louis, E.K. (2009). Illuminating rationale and uses for light therapy. *Journal of Clinical Sleep Medicine*, 5(2), 155-163.
- Sleep Health. (2015). *Journal of the National Sleep Foundation*. 1(1), 40-43. [http://www.sleephealthjournal.org/article/S2352-7218\(15\)00015-7/fulltext](http://www.sleephealthjournal.org/article/S2352-7218(15)00015-7/fulltext)
- Spencer, M. (2013). *B.A.G.H.D.A.D. Yoga: A Shift in Consciousness: Fear to Love, War to Peace*. Live4Love LLC, Rancho Murieta CA.
- Stoller, C.C., Greuel, J.H., Cimini, L.S., Fowler, M. & Koomar, J. (2012). Effects of Sensory-Enhanced Yoga on Symptoms of Combat Stress in Deployed Military Personnel, *American Journal of Occupational Therapy*, 66(1), 59-68. doi:10.5014/ajot.2012.001230
- T2 Telehealth Defense Centers of Excellence Mobile Apps <http://t2health.dcoe.mil/search/node/app%20download>
- Travis, F. & Shear, J. (2010). Focused Attention, Open Monitoring and Automatic Self-Transcending: Categories to Organize Meditations from Vedic, Buddhist and Chinese Tradition, *Consciousness and Cognition*, 19(4), 1110–1118.
- Troxel, W.M., Shih, R.A., Pedersen, E., Geyer, L., Fisher, P., Griffin, B.A., Haas, A.C., Kurz, J.R, & Steinberg, P.S. (2015). Sleep in the Military: Promoting Health Sleep among U.S. Servicemembers. *Rand National Defense Research Institute, Rand Corporation, Santa Monica CA.* http://www.rand.org/pubs/research_reports/RR739.html
- Vallières, A., Ceklic, T., Bastien. C.H., & Espie, C. (2013). A Preliminary Evaluation of the Physiological Mechanisms of Action for Sleep Restriction Therapy. *Sleep Disorders*, Article ID 726372. doi:10.1155/2013/726372 <http://dx.doi.org/10.1155/2013/726372>
- Veterans Health Administration, Office of the Assistant Deputy Under Secretary for Health for Policy and Planning. (2011). *Complementary and Alternative Medicine Survey*, U.S. Department of Veterans Affairs. As of April 16, 2016: http://www.research.va.gov/research_topics/2011cam_finalreport.pdf
- Worcester, S. (2012). Sleep deprivation predicts PTSD in soldiers. *Clinical Psychiatry News*, 40 (1), 35, doi: 10.1016/S0270-6644(12)70024-3.