

Insomnia in the Military: Application and Effectiveness of Cognitive and Pharmacologic Therapies

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Abstract Insomnia is one of the most common complaints of US armed service members. Diagnosis and treatment of insomnia in active duty and veteran populations are often complicated by comorbid disorders experienced by military personnel, such as post-traumatic stress disorder (PTSD) and traumatic brain injury (TBI). Cognitive behavioral therapy for insomnia (CBTi), pharmacologic interventions, and alternative therapies are discussed as relevant to their applications within military populations. Future directions in research are suggested.

Keywords Insomnia · Military · Cognitive behavioral therapy for insomnia · Sleep

Introduction

Characterized by poor sleep quality, reduced sleep time per night, increased sleep latency, difficulty with sleep maintenance, and daytime impairment, the symptoms of insomnia are associated with significant physical and psychological morbidity and mortality. The prevalence of insomnia is estimated to be 6–10 % in the general civilian population [1] and almost 50 % in uniformed service members [2]. In 2013, it was estimated that insomnia affects 24–54 % of veterans who

served in Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), and Operation New Dawn (OND) [3]. This is likely due to military culture, comprised of shift work and vigorous conditioning, which may necessitate sleep restriction and erratic sleep patterns over the course of training or deployment (lasting up to 12–18 months) [2]. In addition, awakenings may be increased due to auditory disturbances or anxiety during the allotted sleep time while deployed.

It is estimated that over 60 % of service members sleep 6 h or less per night [2]. The National Sleep Foundation recommends 7–9 h of sleep per night for individuals ages 18–25, the average age of vulnerable military recruits [4]. The degree of sleep disruption among service members is underscored by the volume of hypnotic medications prescribed to 15–20 % of all deployed service members. In an effort to address the need for insomnia treatment, emerging therapies, like cognitive behavioral therapy for insomnia (CBTi) and brief behavioral therapy for insomnia (BBTi), have been developed and can be combined with alternative treatments like meditation and relaxation. These treatments will be analyzed with respect to background, efficacy, and application in active duty and retired populations, considering the wide range of variables that can contribute to insomnia in the field.

Factors Contributing to Insomnia in the Military

Using the Spielman Model of Insomnia as a framework, there are several factors which make service members susceptible to chronic insomnia. The three components of this model are predisposing, precipitating, and perpetuating factors. Predisposing factors include sex, age, ethnicity, and family history [5, 6]. For example, women are almost twice as likely to be diagnosed with insomnia compared to men; the reasons for this difference are not completely substantiated yet [1, 7]. Young adults also have a propensity for delayed sleep phase

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disorder (DSPD), which may initially present like insomnia, causing difficulty sleeping before 0200 hours and waking earlier than 0600 hours [8].

Several stress-related factors may be responsible for precipitating insomnia. Typically, insomnia is triggered by an acute event, which then becomes the nidus of persistent maladaptive sleep patterns [8, 9]. Consider sleeping in a makeshift plywood shelter, when alarms go off indicating incoming rockets or mortars. Once awakened, the rush of catecholamines and stress hormones can make it difficult for a service member to return to sleep or sleep well during subsequent nights. Likewise, living next to an airfield, a bunkmate with sleep apnea, or a fellow soldier on a different work schedule may precipitate insomnia symptoms in deployed service members, and these symptoms may persist for decades.

The third aspect, perpetuating factors, contributes to the insidious nature of chronic insomnia symptoms. Combat operations, shift work, and multiple overseas deployments have necessitated significant and long-term changes in the sleep habits of service members. These changes begin during pre-deployment activities and last long after returning home [3]. The biological, psychological, and social stressors associated with deployment, including exposure to trauma, lead to an increased risk of sleep disruption. In a 14-month longitudinal survey, Air Force service members, who were deployed and experienced trauma, reported more physical and emotional fatigue and were at higher risk for burnout [10].

Insomnia results in increased medical costs and decrements in combat readiness and work performance. From 2001 to 2010, veteran prescriptions for quetiapine, an anti-psychotic medication used off-label to treat insomnia, increased sevenfold, becoming the second largest drug expenditure for the Veterans Administration (VA) [11]. In a recent study of active duty service members, 50 % of pilots reported falling asleep in the cockpit at least once, and over 50 % of all soldiers attribute mistakes made in the field to sleepiness [11]. In addition, insomnia decreases the immune system's ability to protect against infection and reduces vaccination efficacy, a primary method of disease prevention for the military [12]. Especially when exacerbated by comorbid disorders, insomnia can be a lingering hurdle for veterans.

Comorbidity

Service members are subject to a unique array of stressors, while in garrison or deployment, which make them vulnerable to developing disorders such as post-traumatic stress disorder (PTSD), anxiety, and depression. As discussed previously, service members frequently experience poor, interrupted sleep as well as dangerous, life-threatening situations. These stressors precipitate poor sleep habits and insomnia, which may, in turn, function as a precipitating factor for the development of psychiatric disorders [13]. In a study of recent

combat veterans, 74 % of the cohort met the clinical criteria for persistent insomnia. Those with insomnia at the baseline had significantly higher levels of PTSD and depression compared to those without; this finding was consistent at the 6-month time point [14]. This study also highlights the ongoing and persistent nature of insomnia symptoms and comorbid psychiatric disorders in veterans. In a 2011 study, researchers proposed that insomnia may prevent normal emotional memory consolidation, thought to be crucial in the progression of PTSD [15].

Sleep disturbance, specifically insomnia, can be a principal symptom in many disorders, most notably in PTSD, depression, and mild traumatic brain injury (mTBI). In a study of service members with combat-related head injuries, 55.2 % were experiencing insomnia symptoms, and 90.5 % had at least one comorbid psychiatric condition [16]. In a more recent study of veterans, 51.8 % presented with a combination of PTSD, insomnia, and pain. Researchers concluded that insomnia functions as a predictor for PTSD and pain syndromes [17].

In individuals with comorbid psychiatric disorders, treatment can be complicated. For instance, in a 2012 study of service members with obstructive sleep apnea, twice as many subjects showed symptoms of insomnia comorbid with PTSD than subjects affected by insomnia symptoms alone. Poor CPAP adherence was associated with increased PTSD symptoms, perhaps indicating a potential relationship [18]. This underscores the importance of identifying comorbid conditions so that treatment may be tailored to the individual.

Diagnosing Insomnia in Service Members

It is difficult for a provider to parse out an organic sleep disorder, such as insomnia, from the environmental factors negatively impacting the sleep of service members and veterans. The International Classification of Sleep Disorders, Third Edition (ICSD-3) has streamlined the diagnosis of insomnia by reducing the number of subtypes listed in previous editions where insomnia was categorized as either primary or secondary [19]. Authors of the current ICSD believe that the nosology of insomnia subtypes did not aid clinicians in choosing effective treatment modalities or prognosticating the success of treatment. The diagnosis has been reduced to categorizing insomnia by duration, rather than etiology.

Recent Changes to Insomnia Diagnostic Criteria

In previous editions of the ICSD, insomnia was characterized by the time of the night when the patient experienced symptoms. These sub-classifications included sleep-onset insomnia (initial insomnia), sleep maintenance insomnia (middle insomnia), or late (terminal) insomnia. Although subtypes are

no longer officially classified in the ICSD or Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), the distinction between sleep-onset, maintenance, and terminal insomnia may be helpful in determining the most appropriate treatment modality for a patient. As an example, a patient with maintenance insomnia might respond well to a longer acting non-benzodiazepine hypnotic, whereas a patient with sleep-onset insomnia may respond better to a short-acting benzodiazepine.

The diagnostic criteria for short-term or chronic insomnia only differ in the duration of symptoms over time. If symptoms persist longer than 3 months, a patient would be characterized with chronic insomnia. Common symptoms shared by insomniacs include difficulty initiating or maintaining sleep, early morning awakenings, resistance to going to bed on a regular schedule, and difficulty sleeping without parent or caregiver intervention. The patients or their caregivers also must report some daytime consequences of insomnia [19]. The diagnostic criteria in the ICSD-3 closely mirror the DSM-5. Service members and veterans may experience sleep onset during briefings, irritability with people at work and at home, and difficulty maintaining work schedules (e.g., morning formation),

Assessment of Symptoms

There are several ways to assess and quantify the severity of insomnia symptoms. One of the most essential tools for quantifying sleep is the sleep diary. The American Academy of Sleep Medicine (AASM) provides a standard sleep diary on their website. In combination, sleep diaries and actigraphy allow the provider to assess the patient's sleep-onset latency (SOL), wake after sleep onset (WASO), sleep efficiency, total sleep time, and factors influencing sleep such as caffeine use, exercise, or prescribed medications. The accuracy of these measures is highly dependent on the patient's consistency in wearing the device or using the sleep diary.

Standardized questionnaires such as the Pittsburgh Sleep Quality Index (PSQI) [20] (past month of insomnia symptoms) or Insomnia Severity Index (ISS) [21] (past week of symptoms) are valid measures for the initial assessment of insomnia symptoms. Both questionnaires have normed values that would indicate if a patient is likely suffering from insomnia symptoms and have been used as valid measures of treatment efficacy. While these measures are not essential to make the diagnoses of acute or chronic insomnia per ICSD or DSM criteria, they are useful as objective measures of treatment outcomes.

Diagnostic Challenges

It is essential to rule out other medical and psychiatric comorbidities that may present with significant insomnia symptoms.

According to one study, more than half the patients presenting to a health facility with insomnia symptoms also show symptoms of a psychological condition [22]. Sleep disorders which have been associated with insomnia include obstructive sleep apnea (especially in women), Willis-Ekbom disease (WED or restless leg syndrome), and periodic limb movement disorder. Medical diagnoses to consider include thyroid disease, chronic obstructive pulmonary disease, congestive heart failure, major depressive disorder, bipolar disorder, generalized anxiety disorder, and post-traumatic stress disorder.

After other diagnoses have been made, consideration for environmental conditions is especially important for service members. While deployed, they are often required to work in varying shifts because of continuous combat operations. When in combat, they are subjected to noise pollution from aircraft and indirect fire. Service members frequently present with insomnia symptoms after alterations in their sleep environments, such as a change in their duty station or deployment. Treatment is difficult while in the field, and veterans may be resistant to seeking medical treatment because of the stigma associated with mental health conditions and the thought that problems with sleep are due to a lack of personal strength.

Current Treatment Guidelines

Following AASM guidelines, the initial diagnosis of insomnia generally includes the assessment of sleep, medical, substance, and psychiatric histories. A sleep provider may also utilize standardized questionnaires, a 2-week sleep log, and actigraphy to help inform treatment and to rule out secondary causes of symptoms [23]. Actigraphy provides more objective data related to sleep-onset latency and the presence of circadian phase pathology, such as delayed or advanced sleep phase disorder. Sleep providers also use polysomnography to rule out sleep-disordered breathing and the Multiple Sleep Latency Test (MSLT) to rule out other causes of excessive daytime somnolence, such as narcolepsy. Primarily, the goals of treatment are to improve sleep quality, to improve sleep quantity, and to reduce daytime impairments related to insomnia [23].

Cognitive behavioral therapy for insomnia (CBTi) has been shown to be an effective treatment, especially when insomnia is comorbid with anxiety, depression, and PTSD [6]. Often in combination with medication, mindfulness meditation, or other alternative treatment strategies, CBTi is associated with an increase in total sleep time and a decrease in sleep-onset latency, as recorded via actigraphy, polysomnography, and sleep diary entries [6]. Sleep diaries are designed to provide clinicians with self-reported data on time in bed, medication administration, caffeine intake, exercise, and nocturnal awakenings. They are key components of CBTi and are intended to

reduce retrospective assessment, which may include recall bias and exaggeration of symptoms by the patient [6]. However, veterans and service members often forget to complete the diary on a nightly basis and rely on memory to record data points over several nights. Three treatment guidelines will be outlined in this section: psychological and behavioral modifications via CBTi and a military-adapted brief behavioral treatment for insomnia (BBTi), pharmacotherapy, and alternative therapy options. We will highlight how these techniques may be applied in the military treatment setting for both active duty service members and veterans.

CBTi Techniques

The term CBTi encompasses a variety of techniques, including cognitive alteration, relaxation, sleep hygiene, stimulus control therapy, and sleep restriction. These tactics, in addition to alternative methods and pharmacologic approaches, are summarized in Table 1. In an attempt to reduce both anxiety and unrealistic expectations about their sleep, patients are taught how to identify and mitigate cognitive distortions before, during, and after sleep through Socratic questioning. Patients may become caught in a vicious cycle of worry over

sleep loss, excessive time in bed, fatigue, and work impairment [24]. For the deployed military community, insomnia treatment becomes challenging with time zone changes that alter circadian rhythm, chronic sleep deprivation, physical and emotional stress, and excessive caffeine intake [7•]. Traumatizing combat experiences can have an impact on the development of insomnia, so that soldiers who do not show symptoms during pre-deployment medical evaluations might return home with chronic sleep problems [7•].

CBTi with behavioral analysis (CBTi-BA) is often used with psychological comorbidities like depression, which might otherwise be resistant to pharmacologic treatments [25]. This method consists of discussing the influence and consequence of a service member's behavior on their insomnia. As measured by the Pittsburgh Sleep Quality Index (PSQI) and the Athens Insomnia Scale (AIS), 63 insomniacs who had been previously treated with hypnotic medication were divided into CBTi-BA or treatment as usual (TAU) groups in a clinical study. The patients in the CBTi-BA group showed a significant reduction in both insomnia and depressive symptoms, as well as a reduction in hypnotic medication dosage over time [25]. Although behavioral analysis has been successfully utilized in civilian communities, it is difficult to

Table 1 Insomnia treatments

Treatment option	Purpose	Application
Relaxation	To progressively release tension and breathe naturally in the hopes that the patient will be mentally calm and physically relaxed in bed	<ul style="list-style-type: none"> • Patient is given exercises in breathing and relaxation • While lying in bed, the patient can mentally go through parts of the body and “breathe into” the muscles to slowly release tension (progressive muscle relaxation) • Breathing exercises may include deep breathing and natural rhythm, fully filling the lungs
Sleep hygiene	To reinforce new habits before bedtime to promote sleep	Techniques include the following: <ul style="list-style-type: none"> • Exercise in the late afternoon • 1-h wind-down before bed • A comfortable, darkened sleep environment • Regular sleep schedule, including weekends • Reduction of stimulants/alcohol, especially before bedtime
Stimulus control	To reset the stimuli that trigger wake- or sleep-promoting behaviors in an effort to re-associate bedtime with sleep	<ul style="list-style-type: none"> • Clinician encourages patient to only go to bed and remain in bed when sleepy • Daytime naps are progressively eliminated • The circadian rhythm can be gradually reset to accommodate for jet lag or insomnia symptoms
Sleep restriction	To reduce the amount of time spent in bed while not sleeping. This also increases sleep pressure on subsequent nights to enhance bed = sleep association	<ul style="list-style-type: none"> • Patients are instructed to only be in bed during sleep • Alternate activities can be offered if patient cannot sleep in the night • Time in bed is reduced to improve sleep efficiency
Mindfulness	To encourage mental and spiritual peace with the ultimate goal of reducing anxiety at bedtime	<ul style="list-style-type: none"> • Through a variety of media, meditation guidance can be provided • Patients may practice meditation before bedtime in order to relax muscles and center themselves
Pharmacologic	To relieve insomnia symptoms, at least temporarily, for patients	<ul style="list-style-type: none"> • Drugs may be administered according to the unique patient medical history and clinician discretion • Categories of drugs may include non-benzodiazepine hypnotics, benzodiazepines, melatonin agonists, non-hypnotics, and orexin antagonists

use during deployment because most service members do not have control over their schedules and are unable to choose behavioral modifications that may influence their sleep patterns. These issues extend far beyond their deployments and affect readjustment to civilian life as veterans.

Another component of CBTi, sleep restriction therapy, is based on a simple principle: the patient should not stay in bed when awake. Sleep efficiency is calculated by total sleep time divided by time in bed. This therapy improves sleep efficiency by reducing the time in bed for activities other than sleep or sex. The objective is to reduce anxiety at bedtime, condensing the amount of time in the bedroom to only when the patient is tired—which in turn, reduces the mental pressure to sleep. This therapy targets the homeostatic and circadian control systems in order to set a new and healthier sleep pattern for the patient. This therapy is considered the most helpful for the patient, based on sleep assessments by the clinician, and sleep restriction alone has resulted in improvements in insomnia symptoms without the other components of CBTi [6]. However, mission priorities often make it difficult to engage in sleep restriction therapy because of rotating shifts and alternating schedules. Practically, if a soldier has been diagnosed with insomnia, care could be taken that they are sent to a larger base camp where there are more soldiers to share shifts and where sleep restriction therapy could be effectively used.

A stand-alone technique that has been incorporated into CBTi, stimulus control therapy, is a classical conditioning technique that re-associates bedtime with sleep [6]. Tactics used in this therapy include going to bed only when sleepy, rising out of bed at a consistent time every day, and eliminating daytime naps. The conditioned stimulus of lying in bed is paired with the unconditioned stimulus of being tired. Stimuli that promote wakefulness, like watching TV, speaking on the phone, or eating a large meal, are discouraged immediately before bedtime [24]. Like sleep restriction therapy, stimulus control therapy would be difficult to utilize in the deployed military community. Because of lengthy mission assignments, military members may not go to bed when they are actually sleepy, bed times are inconsistent, and daytime naps may be the only way to make up for lost sleep time.

Sleep hygiene, which is considered by patients to be most helpful [6], consists of habitual adjustments for a better sleep pattern. The basis of sleep hygiene is the replacement of wake-promoting behaviors with sleep-promoting behaviors. Adjustments may include exercise in the late afternoon, a light snack before bed, a 1-h wind-down time before bed, a comfortable dark room for sleep, a regular sleep schedule including weekends, and reduction of stimulants and alcohol, especially a few hours before bedtime [24]. Practically, some of these new habits are possible even in a deployed setting; exercise is a common pastime for many deployed service members and can decrease sleep-onset latency if timed appropriately. Other habits, like maintaining a regular sleep schedule,

are less feasible. However, the inclusion of even some of these factors can result in significantly improved sleep, as measured by sleep latency and a reduction of daytime impairments. Progressive muscle relaxation and calming activities before bedtime are some of the most applicable measures of sleep hygiene tactics, but they also build the final major component of CBTi: relaxation. If engaged right before bed, meditation or yoga may be helpful to promote nocturnal somnolence in some patients. Alleviating anxiety and the mental pressure to sleep is a key component to mental relaxation—equally as important as physical relaxation at bedtime.

BBTi Techniques

BBTi, developed to meet clinician shortages and based on CBTi, consists of two in-person sessions and two telephone sessions over a 4-week period. The first session includes a brief sleep education and an assessment of sleep problems with the remaining sessions purposed to answer questions and to modify the sleep prescription. BBTi uses sleep restriction, sleep hygiene, and stimulus control techniques [26]. In a study with combat-exposed veterans from OEF, OIF, and OND, BBTi was compared to a control condition with assessments pre-treatment, immediately post-treatment, and 6 months following treatment. Significant reductions in insomnia severity and improvements in sleep quality were reported at 6 months post-treatment [27•]. Although relatively new, this treatment seems promising for the military and veteran communities in its brevity, effectiveness, and adaption of language into military vocabulary via BBTi-MV (military version). This version attempts to relate further to the military community by focusing less on thoughtful reflection and more on strategic, practical changes to improve sleep habits.

Alternative Therapies

Alternative medical treatments appeal to populations that actively avoid medication and favor a holistic approach to health. Techniques include mindfulness meditation, biofeedback devices, tai chi, acupuncture, hypnosis, and mindfulness awareness practices (MAPs) [6]. A study assessing older adults with moderate sleep disturbances divided treatment into a mindfulness meditation group and a sleep hygiene group for 6 weeks [28]. Significant improvements in insomnia symptoms and fatigue were present in the mindfulness treatment group, as compared to the sleep hygiene group. Although the biochemical basis for this improvement is unknown, meditation is associated with reduced rumination related to sleep, decreased sleep-onset latency, and overall improved sleep quality [28]. If initially trained in meditation techniques, a service member or veteran could meditate every night before bed, despite the surrounding environment, and thus reduce insomnia symptoms.

Delivery Platforms

The delivery modality for CBTi must be tailored to meet the needs and time requirements of patients. As such, CBTi is typically offered in three formats: individual, group, or virtual therapy. Individual sessions show improvement in sleep onset and sleep quality when compared to pharmacologic treatments [6]. Session length varies with clinician but usually consists of 4–8 sessions throughout 6–8 weeks of treatment. Treatment efficacy heavily relies on patient compliance with sleep hygiene recommendations and consistent sleep diary reports. Individual treatment, though effective, requires the expertise of a trained CBTi provider. As there are few of these providers, access to this resource may be limited, especially for veterans. BBTi is still an emerging treatment that needs further study to establish sustained and long-term efficacy; however, it addresses the scarcity of providers by enabling social workers and other allied health care providers to train and deliver treatment under supervision.

Group sessions for CBTi also consist of approximately 4–8 sessions over 6–8 weeks of treatment. These sessions are cheaper and more efficiently utilize limited provider availability. Contributing a sense of social support and validation, group sessions are a better option for insomnia comorbid with disorders such as depression and anxiety [25]. However, group sessions inherently reduce scheduling flexibility and individual attention from the clinician. The group format is especially useful in the garrison environment as service members have more flexibility in their routine schedule to attend group appointments. However, in other deployed settings, service members may operate with limited resources, and the needs of the unit would likely make group appointments less feasible. Conversely, group sessions may be appealing to retired veterans for the social support, although they may have to travel to participate in one.

Virtual CBTi methods have become increasingly popular in recent years. In a study comparing telephone-delivered CBTi versus an AASM pamphlet about chronic insomnia, telephone patients showed higher sleep efficiency and more total sleep time than the pamphlet patients, although both showed no significant difference in daytime functioning [29]. Evaluations were completed pre-treatment, immediately post-treatment, and 12 weeks after the conclusion of the treatment. Telephone reporting included a sleep diary and completion of treatment modules on topics like stimulus control, sleep hygiene, relapse prevention, and cognitive adjustments. In another study comparing audio downloads as a platform for CBTi treatment, patients reported improved consistency in sleep-wake cycles, although there were complaints about the low variety of audio files [3•].

Free or low-cost smartphone and internet applications have been developed. Specifically, “CBTi coach,” a smartphone application developed by the Department of Defence through

the National Center for Telehealth and Technology, includes a sleep diary for tracking sleep, tools for developing new sleep habits and wind-down activities, and other resources concerning healthy sleep habits. Although applications have not been shown to be as effective as provider-led treatment, they can increase patient knowledge about sleep hygiene habits and decrease sleep anxiety [6]. Again, full functionality of these resources may be compromised with limited internet connectivity in deployed environments.

Pharmacology

A summary of the most frequently used pharmacologic treatments, including drug mechanisms, estimated efficacy period, adverse side effects, and recommendations, is included in Table 2. As always when prescribing medication, care should be taken to avoid adverse drug interactions and side effects of active drug metabolites [30].

Military and Veteran Applications

Given the high incidence of PTSD, depression, and anxiety in returning service members [31], the identification and treatment of insomnia is essential in recovery and health promotion in veteran populations. In a study of psychotherapy naïve veterans, CBTi was first used to treat symptoms of insomnia, and then exposure therapy was used to treat PTSD symptoms [31]. Symptoms for both PTSD and insomnia were significantly reduced, which may suggest that CBTi can work in combination with exposure therapy, especially when patients are reluctant to participate in treatment.

Another study treated insomnia and comorbid bipolar disorder by splitting treatment groups into CBTi-BP (bipolar) and psychoeducation [32]. To participate in the study, patients had to have been on a stable medication routine for the past 4 weeks prior to screening. The CBTi-BP group had fewer days of bipolar episodes and less insomnia symptoms. The researchers who conducted the study also promote the development of a bipolar disorder sleep diary standard. Future treatments may include treatment of insomnia with other comorbid psychiatric disorders, such as depression and PTSD.

A novel program at the Veterans Health Administration (VHA) trains clinicians to lead CBTi for veterans with comorbid psychiatric conditions [33, 34•]. This program utilizes experienced CBTi providers, who train, monitor, and supervise new clinicians, who will provide treatment [33, 34•]. The VHA may serve as an example for other health care systems in making CBTi treatment more widespread and cost-effective. Deployment combat exposure, mild traumatic brain injury, irregular sleep, and adjustments from home life can lead to insomnia in service members and veterans [3•]. In turn, insomnia increases the risk of developing PTSD, depression, and suicide [3•]. Clinicians must be prepared to treat insomnia

Table 2 Current insomnia pharmacological treatments

Drug	Common name	Mechanism	Half-life (h) [6]	Efficacy and uses	Common side effects	Recommendations
Non-benzodiazepine hypnotics						
Zolpidem	Ambien, Ambien CR, Intermezzo	Act on GABA _A receptors [41, 42]	1.5–2.4	Literature shows low dependency and tolerance, except in certain case studies where dosage >160 mg daily [43]; effective for sleep maintenance [6] Aids in sleep onset [42]	Morning drowsiness, loss of coordination [44], unusual dreams, headache, dizziness [42]; cognitive impairment with memory [4]	Effective for short uses, <2 weeks [42]
Zaleplon	Sonata	Act on GABA _A receptors [41, 42]	1	Aids in sleep onset [42]	Lack of coordination, drowsiness, dizziness [42]	Effective for short uses
Eszopiclone	Lunesta	Act on GABA _A receptors [45, 52]	6	Decrease in ISI scores, improved concentration, TST, sleep latency [45]	Headache, daytime drowsiness, lightheadedness, pain [42]	Effective, perhaps especially for schizophrenia comorbidity in place of sedative anti-psychotics [45]
Benzodiazepines						
Temazepam	Restoril	Act on GABA _A receptors [46]	8–20	Increases total sleep time, reduces muscle tone [46]	Anterograde amnesia, drowsiness, effects decline after 1–2 weeks; slow-wave sleep time reduction, tolerance, dependence, increase depressive effects of other drugs	Effective for occasional use (shift workers) [46]
Triazolam	Halcion	Act on GABA _A receptors [46]	2–6	Sleep onset and sleep maintenance [42]	Drowsiness, lack of coordination, nausea [42]	Effective for occasional use [42]
Lorazepam	Ativan	Acts on GABA _A receptors [24]	10–20 [24]	Sleep maintenance [24]	Drowsiness, dizziness, restlessness, nausea [42]	Effective at low dosage (between 0.5 and 2 mg) [42]
Clonazepam	Klonopin	Unknown, perhaps Act on GABA _A receptors	30–40	Aids in sleep onset and maintenance [42]	Drowsiness, lack of coordination, memory issues [42]	Effective under monitoring as it can be highly addictive [42]
Non-hypnotics						
Doxepin	Silenor	Binds to 5-HT _{1A} and 5-HT _{2c} ; antagonist at H ₁ and H ₂ [6]	20	Aids in sleep maintenance [47]	Affects heart rhythm and hypertension, cognitive impairment [47]; risk of increased suicidal thoughts, nausea, drowsiness [42]; reduces REM sleep [24]	Effective for short-term under careful monitoring
Mirtazapine	Remeron	Binds to 5-HT _{1A} and 5-HT _{2c} [42]	20–41 [42]	Sleep maintenance	Suicidal thoughts, anxiety, drowsiness, dizziness [42]	Caution should be taken when administering to elderly patients
Trazodone	Oleptro	Binds to 5-HT _{1A} and 5-HT _{2c} [42]	10–12 [42]	Increases slow-wave sleep, sleep maintenance [24]	Suicidal thoughts, headache, memory problems, nightmares [42]	Effective but with the risk of serious side effects; grapefruit should not be consumed while taking this medication [42]
Orexin antagonist						
Suvorexant	Belsomra	Orexin antagonist [48]	12 [49]	Decreases sleep latency, increases efficiency [50]	Dizziness, drowsiness, headache, vivid dreams [48]	Recommended dose at 10 mg; should be avoided with hepatic impairment; >40 mg results in daytime sleepiness [50]

Table 2 (continued)

Drug	Common name	Mechanism	Half-life (h) [6]	Efficacy and uses	Common side effects	Recommendations
Melatonin agonists						
Ramelteon	Rozerem	Acts on MT ₁ /MT ₂ receptors [42, 51]	1–2.6	Aids in sleep onset [42, 51]	Drowsiness, dizziness, psychomotor speed reduction, impaired balance, reduction of visual attention [51]	Effective at a <8 mg dose with caution at initial prescription to record effects on daily living, such as driving [51]
Melatonin	Naturally produced in the pineal gland; supplement	Agonist at MT ₁ and MT ₂ receptors [6]	0.667–1	Aids in sleep onset, increases sleep continuity [6]	Drowsiness if taken improperly	Effective if needed for jet lag and shift work to reset circadian rhythm

and a variety of comorbidities, despite the military bias against treatment, which is seen as a sign of weakness. A recent study that combined CBTi with image rehearsal therapy (IRT) for veterans showed increased total sleep time, a decrease in sleep-onset latency, and a decrease in wake after sleep onset [35]. IRT consists of re-scripting nightmares and practicing those dreams to reduce night terrors. The clinicians in the study evaluated stimulus control, sleep hygiene, and relaxation to be most effective for the patients, while the veterans assessed relaxation and pharmacological treatment to be the fastest and most effective short-term treatment methods [3]. Currently, the leading therapies for insomnia treatment may be yielding results in civilian studies but need more tailoring for application and appeal to both deployed and returning military members.

Future Directions

Insomnia in military and veteran populations poses unique treatment challenges. CBTi has been shown to be an effective and acceptable treatment for both clinicians and combat veterans. Adherence to the treatment and reduction in insomnia symptoms are the key measures of success [36, 37]. Training clinicians in standard application of CBTi provides the best dissemination of treatment and ensures that veterans are receiving a high standard of care [38]. Future research should continue to emphasize educating clinicians in a standardized approach and to further investigate which treatment modalities are most effective in active duty and veteran populations. It seems that appeal of the treatment is important; veterans and active duty members must fight the bias against seeking help in order to achieve long-term healthy sleep habits. Some studies discuss treatment preferences. For instance, while male veterans prefer relaxation therapy and pharmacotherapy [36], female veterans generally prefer behavioral interventions over pharmacotherapy [13]. In the future, a greater research emphasis should be placed on female veterans, as women are more likely to be diagnosed with insomnia [1, 6]. As the female veteran population grows, this matter will become increasingly relevant.

Comorbid disorders require clinicians to modify their approaches to treatment. Interventions aimed at trauma-specific sleep disturbances have been successful [39, 40], and future research should aim to compare which behavioral approaches (e.g., CBTi alone or in conjunction with other treatment) are most effective. More research is necessitated by the combination of comorbidities that service members may bring home; new publications should make an effort to standardize treatment for each insomnia and comorbidity development. Even in patients without comorbid symptoms, treatment can be limited by the availability of CBTi providers in their area. Veterans in rural areas, who may have trouble attending a group CBTi session, should have viable alternative platform

options. Determining which therapies may be offered successfully, as measured by a reduction in insomnia symptoms, and implementing accessible, innovative therapies are crucial for helping veterans.

As the military transitions to peacetime operations, veterans will be faced with the lingering effects of chronic insomnia at home. The symptoms of chronic insomnia may make transition to civilian life difficult and may exacerbate comorbid conditions. It is vital for providers to understand how service members are vulnerable and what treatment options are available and acceptable to this unique population.

Compliance with Ethics Guidelines

Conflict of Interest The views expressed in this paper are those of the authors and do not reflect the official policy of the Department of the Army, Department of Defense, or the US Government.

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