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## Deployment-Related Insomnia in Military Personnel and Veterans

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### Abstract

Insomnia is a prevalent disorder that greatly impacts military personnel, especially those deployed in support of combat efforts. Deployment-related stressors like combat exposure, mild traumatic brain injury (mTBI) irregular sleep-wake schedules, and adjustment to the return home all contribute to insomnia. However, insomnia can also exacerbate the deployment experience and is a risk factor for traumatic stress reactions such as PTSD, depression, and suicide. Military personnel with mTBI are significantly impacted by insomnia; the majority experience sleep disruption and this can impede recovery and rehabilitation. As more service members return home from deployment, treatment is vital to reduce the impact of insomnia. Preliminary outcome data, showing positive results for reduction of sleep disruption, has been found with treatments such as combined cognitive behavioral treatment of insomnia (CBTI) and imagery rehearsal therapy (IRT), preference-based interventions, as well as efforts to broadly disseminate CBTI. The recent literature on the impact and treatment of deployment-related insomnia is reviewed.

### Keywords

insomnia; comorbid insomnia; military personnel; veterans; PTSD; depression; anxiety; traumatic brain injury; suicide; psychotherapy; pharmacotherapy; sleep disorders; psychiatry

### Introduction

E.R. is a 27-year-old male who served two tours of duty in Afghanistan (2009–2010). He served at a forward operating base in Kandahar as an infantry. He frequently went on night missions, was in the field for days at a time, and was often awake for more than 24 hours. While on base, he would often work rotating shifts and rarely kept a consistent sleep schedule. In the field, he was exposed to combat, fired his weapon, and felt his life was

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#### Compliance with Ethics Guidelines

#### Conflict of Interest

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threatened numerous times. He witnessed both friends and insurgents killed. Across both tours he was exposed to 3 improvised explosive device (IED) blasts with one causing loss of consciousness for several minutes and was subsequently diagnosed with mild traumatic brain injury (mTBI). Upon returning home E.R. struggled to maintain a “normal” sleep schedule. He had difficulty falling asleep at night, rarely slept for more than a few hours at a time, and reported distressing combat-related nightmares. The insomnia and nightmares have made it difficult for him to focus on school work and he relies on energy drinks, several per day, to stay awake and alert. Now three years post-deployment, he still struggles to obtain quality sleep.

This vignette illustrates how deployment-related experiences can directly and chronically affect sleep patterns and quality, as well as daytime functioning, years after deployment. With the ongoing drawdown from combat theaters, clinicians are bound to encounter a growing number of adults who have served in these operations, and who present with chronic and severe sleep disturbance.

Insomnia is a prevalent problem, affecting 10–22% of civilian adults [1;2]. Among active duty military, insomnia is one of the most frequent reasons for mental health referrals [3] and is among the most frequent complaints of recently deployed Veterans [4]. The recent literature suggests much higher rates among men and women who served in the military involved in Operation Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn (OEF/OIF/OND) compared to community samples, 24–54% [4]. In both civilian and military samples, insomnia is often comorbid with mental and physical health disorders, such as posttraumatic stress disorder (PTSD), depression, traumatic brain injury, and chronic pain. Additionally, insomnia may develop prior to joining the military, during the service period, or post-deployment upon return to civilian life.

Thus, this review summarizes studies focused on deployment-related insomnia in military personnel and military Veterans. Studies published between 2010 and early 2013 were selected in order to highlight the most recent developments in this area of research. First, a revised model of predisposition, precipitating, and perpetuating (3P) factors [5] is described to highlight the unique elements that contribute to insomnia in military samples. Studies that have investigated the prevalence of insomnia, or more generally, of sleep disturbance, and insomnia as a risk factor in military samples are summarized. Next, we discuss the relationships between insomnia and comorbid psychological and physical conditions that are prevalent among these cohorts of Service Members. Finally, we present recent developments in the treatment of insomnia and nightmares. Potential future directions for insomnia research and clinical practices in military samples are also provided.

### **3P Model of Insomnia: Adaptation for Military Samples**

The influential 3P model of insomnia [5] offers a template to identify and understand the predisposing, precipitating, and perpetuating factors that contribute to insomnia complaints. The rapidly growing literature on correlates of poor sleep and psychological injuries among active duty service members and Veterans suggests some additions to the traditional 3P model to acknowledge and include factors that are common to military samples. These are summarized in Table 1 below.

An increased prevalence of adverse childhood events (ACEs) is common among military samples, and has been related to poor psychological adjustment post-deployment [6;7]. ACEs increase vulnerability to subjective complaints and objective sleep disruption in adulthood [8]. While military deployment certainly involves significant sleep challenges, pre-deployment military training, exercises, and daily activity can also disrupt sleep, and contribute to the heightened vulnerability to chronic insomnia pre- and post-deployment.

Deployment itself constitutes a significant challenge to healthy sleep. Not only the physical and social sleep environments can be significantly altered relative to pre-deployment conditions, but the daily stressors associated with separation from one's family and worries about events at home compound the effects of shift work and irregular sleep/wake schedules that often characterize military deployment.

Combat exposure and the threat of injury to self or others inherent to working in combat theaters directly contribute to sustained increases in vigilance and arousal during wakefulness and sleep. In turn, sleep disruption can interfere with one's ability to regulate arousal, which creates a vicious cycle.

Although predisposing and precipitating factors are not readily amenable to modification, perpetuating factors offer targets for insomnia treatments. Among those with posttraumatic stress symptoms, nightmares and bad dreams that may or may not be related to traumatic or combat experiences can disrupt sleep and contribute to complaints of difficulty returning to sleep or non-restorative sleep. A recent report showed high levels of caffeine and energy drink consumption among service members [9], which likely contribute to difficulty initiating sleep and daytime cognitive deficits [10;11]. Alternatively, both active duty personnel and Veterans report using alcohol to facilitate sleep onset, and/or reduce hyperarousal during the day. The reintegration period is filled with challenges that may contribute to insomnia: re-negotiating family responsibilities and roles, re-adjusting to regular sleep/wake schedules and to the home and social sleep environments, as well as worries about employment and/or financial strain. These are some characteristics of the post-deployment phase that can directly perpetuate sleep/wake habits that maintain insomnia. Finally, symptoms of PTSD, mTBI, anxiety, and depression can contribute to insomnia in returning service members.

For 25 years now, the 3P model of insomnia has provided clinicians and patients with a concrete map to understand the etiologies and course of insomnia. Similarly, the proposed adaptations to the 3P model of insomnia can inform the personalization of treatments for current and former members of the Armed Forces.

## **Deployment-Related Insomnia: Prevalence, Comorbidity, and Associated Risk**

As mentioned above, insomnia is a prevalent disorder among military personnel. Contributing to the high prevalence of insomnia is comorbidity with medical and psychiatric disorders such as mTBI [4;12•], chronic pain [13], anxiety and depression [14], and PTSD [15]. Insomnia also acts as a risk factor for deployment and combat-related reactions: depression [16], substance use [17], and PTSD [18]. Approximately 14% of soldiers returning from OEF/OIF/OND receive a diagnosis of PTSD [[www.ptsd.va.gov/professional/pages/epidemiological-facts-ptsd.asp](http://www.ptsd.va.gov/professional/pages/epidemiological-facts-ptsd.asp)]; other common psychiatric diagnoses given to these returning soldiers include adjustment disorder, depression, and anxiety. Insomnia is a core symptom of these disorders and is often the primary complaint among combat-exposed military personnel.

### **Insomnia and Posttraumatic Stress (PTS)**

Three recent survey-based studies investigated the prevalence of insomnia and the role of insomnia as a predictor of PTS reactions. Insomnia was the most common symptom among U.S. service men and women returning from combat zones (Iraq and Afghanistan) and non-combat zones (Shipboard and Kuwait) when assessing for PTS symptom severity (PTSD Checklist [PCL [19]) [20]. Those serving in combat zones reported significantly greater insomnia complaints at initial (41% vs. 25%) and follow-up (36% vs. 20%) evaluations [20].

Additionally, service members with an insomnia complaint at the initial assessment had significantly greater PTS symptom severity at follow-up. Next, a study of Dutch soldiers [21] deployed to Afghanistan found that pre-deployment nightmares and anxiety increased their risk of PTS symptoms 6-months post-deployment. While pre-deployment insomnia did not significantly increase PTS symptomatology at post-deployment, insomnia severity did significantly increase from pre- to post-deployment independent of PTS severity. The finding of pre-deployment insomnia not significantly predicting post-deployment PTS was inconsistent with previous research [18;22;23]. Lastly, a cohort of U.S. combat Veterans exposed to trauma (e.g., 89% reported danger of being killed, 90% reported danger of injury) were assessed 4 and 12-months post-deployment to Iraq [15]. Insomnia severity at the first assessment predicted depression and PTSD symptom severity at the second assessment. The reverse relationship was not found—depression and PTSD severity at time 1 did not predict insomnia severity at time 2. Results also found that insomnia severity was predictive of intrusive thoughts of traumatic events experienced while deployed [15].

One recent study, focused on female service members, investigated the relationship between insomnia and stressful experiences while serving in the military [24]. The majority of the women (75%) reported a stressful event occurred at the onset of their sleep problems—approximately one-third reported a military-related stressor (e.g., deployment) and approximately 10% reported sexual harassment, trauma, abuse, or rape while in the military. Females with insomnia (ICSD-2 criteria) and probable PTSD (PCL>33) had lower sleep quality (PSQI [25]), greater insomnia severity (ISI [26]), and more dysfunctional beliefs about sleep (DBAS-10 [27]). Trauma severity, per the PCL, was the only significant predictor of insomnia severity among these female Veterans [24].

### **Insomnia and Suicidality**

In addition to PTS reactions, two recent studies investigated the role of sleep disturbance and suicide. Insomnia, sleep deprivation, and nightmares are common among deployed soldiers and have a strong relationship with suicidality [28–30]. In the first study, the authors highlight the importance of providing treatment to soldiers in these environments as a potential method to reduce risk of suicide [31]. Stimulus control, sleep hygiene, and relaxation—components of cognitive behavioral treatment of insomnia (CBTI)—can lead to successful treatment of insomnia in deployed soldiers. Additionally, cognitive therapy can help minimize the impact of erratic schedules and sleep disruption, which can reduce distress and help buffer the role of sleep on suicidality [31].

In the second study, a retrospective chart review of Veterans identified sleep disturbance prior to completed suicide [32]. Among Veterans who had an office visit in their last year of life, those with a sleep disturbance died sooner, approximately 75 days, following their last office visit than Veterans without a sleep disturbance, approximately 174 days. The study controlled for age and symptoms of psychiatric comorbidity [32]. The authors conclude that sleep disturbance, including insomnia, may be a potential target for suicide prevention. Sleep disturbance often precedes psychiatric disorders such as depression and Veterans may be more willing to acknowledge a sleep problem rather than other psychiatric symptoms such as depressed mood, anhedonia, or increased worry and anxiety.

### **Insomnia and Mild Traumatic Brain Injury**

Mild TBI (mTBI) is defined as a loss of consciousness lasting up to 30 minutes, alteration of consciousness/mental state from a moment up to 24 hours, and posttraumatic amnesia lasting 1 day or less, in the absence of detectable abnormal structural imaging findings. Blast injury is the most common type of mTBI reported, although blunt injuries are also frequent [33;34]. A majority of soldiers report more than one mTBI [35]. Prevalence estimates of

mTBI among soldiers vary from 4.9% to 22% [33;34;36–39]. Chronic mTBI (cmTBI) refers to persistent concussive symptoms (e.g., dizziness, headaches, cognitive impairments) for more than three months post-injury.

Insomnia and other sleep disturbances are prevalent among civilians and military personnel with cmTBI. As many as 50% of TBI patients report sleep disturbances and 25% to 30% meet diagnostic criteria for sleep disorders [40]. In military personnel, 97% with cmTBI report sleep complaints [41]. These complaints were corroborated by polysomnographic sleep/wake studies, and included hypersomnia (85%), insomnia (55%), sleep fragmentation (54%), and obstructive sleep apnea syndrome (OSAS; 35%). Those with comorbid mTBI and PTSD or anxiety endorsed more severe sleep complaints [12••;42]. There is preliminary evidence that blast- vs. blunt-related TBI may be accompanied by distinct profiles of sleep disturbances. Blast injuries characterized by insomnia and elevated anxiety symptoms, whereas blunt injuries were associated with obstructive sleep apnea [41]. In addition, insomnia severity increases with the number of TBI reported [43].

Insomnia and other sleep complaints often persist in individuals with cmTBI and impede recovery. For instance, one study found over 60% of patients with cmTBI symptoms still endorse clinically significant sleep/wake disturbances 3 years post-injury [44]. Sleep disturbances also impede recovery and rehabilitation. Two-thirds of patients who report clinically significant sleep disturbances have poorer functional outcomes relative to patients without sleep complaints [45]. Sleep disturbances in mTBI patients was also significantly associated with longer stays in trauma or rehabilitation centers [46]. Similar relationships are likely to be found in military personnel with mTBI and insomnia and/or other sleep disturbances.

## Summary

Insomnia is highly prevalent among service members deployed to combat and non-combat zones. Insomnia can last well beyond deployment to a combat zone, and is often comorbid with deployment-related psychological (i.e., depression, anxiety, PTSD) and physical injuries (i.e., mTBI). A rapidly growing body of literature demonstrates that insomnia is a reliable risk factor of poor clinical outcomes, including PTSD, depression, and/or suicidality, and impedes the recovery process. Thus, efforts for early identification and timely intervention are important goals in order to 1) attenuate the impact of deployment on sleep, 2) accelerate recovery from insomnia, and 3) ultimately prevent the onset of psychiatric comorbidities including suicide [47;48].

## Treatment of Insomnia in Military Samples

Recent intervention trials involving military personnel with insomnia have focused on the use of behavioral interventions, such as cognitive behavioral treatment of insomnia (CBTI) and imagery rehearsal therapy (IRT), and pharmacological interventions using prazosin. Behavioral treatment of insomnia relies on two key principles: stimulus control and sleep restriction. Stimulus control involves limiting the bed/bedroom to sleep (and sex) behaviors and eliminating wakefulness in bed (e.g., watching TV or staying awake, in bed, waiting to fall asleep) [49]. Patients are instructed to get out of bed if unable to fall asleep within 15–20 minutes and return to bed when they feel ready to fall asleep; this process is repeated as often as necessary throughout the night. Sleep restriction limits the time in bed to approximately match the amount of time sleeping [50]. Individuals with insomnia often spend a significant amount of time in bed while only sleeping a fraction of that time. Treatment of nightmares using IRT involves the re-scripting of nightmares into non-distressing scenarios and practicing the new dreams [51].



## Cognitive Behavioral Treatment of Insomnia (CBTI)

The most significant recent advancement in the treatment of insomnia for military veterans is the initiative to broadly disseminate CBTI training in the Veterans Health Administration (VHA) [52•]. The VHA's goal to train 1,000 clinicians will substantially increase the number of providers and increase access to care. The goal of this nationwide rollout is to train providers who 1) are licensed, credentialed, and routinely provide psychotherapy; 2) receive approval and release time from their supervisors to participate in training; 3) demonstrate the need for CBTI services in their setting; and 4) express commitment to regularly use CBTI after training. In order to make training the most relevant to clinicians in the VHA, training on comorbid psychiatric disorders was focused on major depressive disorder, PTSD, chronic pain, and mTBI. Currently, the VA CBTI dissemination has trained approximately 350–400 clinicians and offers four training sessions per year [52•]. Preliminary findings (102 clinicians trained and 182 Veterans treated) found that 92% of clinicians met training requirements and two-thirds of Veterans who completed treatment significantly reduced insomnia severity scores and improved depression and quality of life at post-treatment [53•].

## Treatment of Nightmares

Nightmares are one of the most commonly reported symptoms of military personnel with PTSD [54;55], and can contribute to chronic insomnia (Table 1). A behavioral intervention, IRT, has been shown to be efficacious in reducing nightmares in civilian samples [56]. In a Veteran sample [57], a retrospective chart review assessed the effectiveness of IRT delivered over four to five weekly sessions (individual or group). Results found Veterans who previously completed PTSD treatment were significantly more likely to engage in IRT. Also, Veterans who completed IRT significantly reduced nightmare frequency compared to non-completers, and significantly reduced nightmare intensity, insomnia severity, and PTSD symptoms. Individual treatment resulted in greater decreases in insomnia severity versus group treatment [57].

## Multi-Component Treatments

Given that insomnia and nightmares often co-occur in military personnel with trauma-related symptoms, the combination of CBTI and IRT into a single treatment program is especially relevant, and has been shown to be effective [56;58]. Two recent studies used a multi-component treatment approach. First, in a sample of Veterans, a cognitive-behavioral sleep intervention for PTSD (SIP) was compared to usual care [59•]. SIP included 6 bi-weekly, hour-long sessions, with the first three sessions covering CBTI and the last three covering IRT. All Veteran participants met DSM-IV-TR criteria for PTSD, had significant insomnia symptoms and complained of nightmares. The SIP group showed significant improvements at post-treatment, compared the usual care group, on self-reported insomnia symptoms, overall sleep quality, and PTSD symptom severity. Sleep diary results showed the SIP group, at post-treatment, had significantly greater total sleep time and sleep efficiency, and significantly lower sleep onset latency and wakefulness after sleep onset. Of note, Veterans who dropped out of the study were OEF/OIF Veterans. Future interventions will need to be tailored to adequately address the needs of the recently deployed Veterans [59•].

The second multi-component study [60•] compared the effectiveness of 1) a behavioral sleep intervention (BSI), targeting nightmares and insomnia, 2) prazosin, an alpha-1 antagonist shown to be effective in the treatment of nightmares and insomnia, and 3) a placebo pill comparison group. Veteran participants all had significant insomnia and nightmare complaints and endorsed moderate to severe PTSD symptoms. BSI included stimulus control and sleep restriction (components of CBTI) and IRT. Prazosin was titrated up from

1mg, increasing each week to 2mg, 4mg, 6mg, 10mg, and 15mg. BSI treatment was delivered weekly, by a master's level clinician, over 8 weeks and included up to 5 in-person sessions and up to 3 telephone contacts. IRT was introduced first, followed by stimulus control and sleep restriction. Post-treatment, Veterans in active groups (BSI and prazosin) had significantly reduced insomnia severity and nightmare frequency versus the placebo group. At four-month follow-up, the BSI group had greater sustained improvement of insomnia severity versus the prazosin group. Findings suggest both active interventions offer viable options to treat insomnia and nightmares in military personnel and Veterans with chronic insomnia and nightmares [60].

### Preference-Based Treatment

Two recent studies, by the same research group, evaluated insomnia treatment preferences [61] followed by a pilot study [62] to test a brief intervention based their preference findings. First [61], OEF/OIF Veterans and VA clinicians were evaluated on acceptability and preference of insomnia treatments (e.g., stimulus control, relaxation, medication). Veterans and providers only differed significantly on one treatment option—stimulus control therapy; providers rated stimulus control as more acceptable. Veterans' preferred treatment was relaxation followed by pharmacotherapy, which was considered to be a "quick fix." Provider preferred treatments were relaxation, stimulus control, and sleep hygiene/education. Providers were concerned that stimulus control and sleep restriction might be difficult for Veterans due to problems with attention, concentration, and follow-through. Veterans' ranked individual and internet delivered-treatment (72.2%) as the formats of choice. Providers preferred individual treatment (89.5%) followed by DVD and PDA delivered treatment (63.2%). Brief treatment (<5 weeks) was preferred by 61% of Veterans and 95% wanted treatment sessions 1 hour [61].

In a follow-up study [62] a brief intervention based on Veteran preferences was tested— one in-person session with three weekly phone calls, plus electronic components (e.g., relaxation skills) on an iPod® (Apple, Cupertino, CA). Participants were OEF/OIF Veterans with a history of blast exposure or period of altered consciousness, a positive TBI screen, and an insomnia complaint. At post-treatment, 53% of Veterans considered treatment successful and 71% were confident they could use the skills (stimulus control, sleep restriction, sleep hygiene, sleep education) to address future problems. Ninety-one percent would recommend treatment to other Veterans and 97% thought it was important to make the treatment widely available. Stimulus control therapy was used significantly more often than sleep education and sleep restriction but there was no difference between treatment components in terms of perceived helpfulness. Only 36% were satisfied using the treatment materials on the iPod® and the biggest complaint was the lack of diversity of audio files available. The most effective component reported was developing a consistent sleep-wake routine. Also at post-treatment, Veterans significantly decreased insomnia severity scores [26]; 60% responded to treatment and 25% were in remission. At 3-month follow-up, response and remission rates were maintained at 50% and 30% of the post-treatment responders, respectively [62].

### Summary

A nationwide dissemination of CBTI training is ongoing in the VHA with the goal of training 1,000 clinicians. This represents a significant effort to bridge the gap between Veterans in need of services and providers available. However, additional treatment efforts still are needed for Veterans not eligible for VA care, active duty service members, and families of military personnel. Adaptations to CBTI are one mechanism to further increase access to care, such as brief behavioral treatment of insomnia (BBTI) that combines in-person sessions with brief phone follow-up. Initial BBTI studies show strong treatment effects and the ability to deliver treatment by non-doctoral level clinicians [63–65]. Also, the

Department of Defense, National Center for PTSD, and the VHA have all contributed to the development of online and app-based treatments. Data are not yet available, but programs such as AfterDeployment.org and the VA CBTI Coach mobile application offer evidence-based treatments that can be used as self-management tools or in conjunction with treatment with a clinician. Alternative therapies, such as cranial electrical stimulation, are also being investigated to improve sleep, although one recent study with Veterans showed no change in sleep at post-treatment compared to a sham device [66]. Recent studies also show multi-component treatments are efficacious for Veterans with insomnia and nightmares. Also, a brief treatment composed of 1 in-person session and 3 phone calls was acceptable to Veterans and feasible to deliver.

## Conclusions and Future Directions

Since the 9/11 attacks, almost 2 million military service members have deployed in support of OEF/OIF/OND. Pre- and post-deployment studies have highlighted that insomnia is a prevalent and often chronic condition. Additionally, retrospective and prospective studies have consistently found that insomnia increases risk of chronic psychological and physical war-related injuries. The specific psychological, socio-environmental, physiological, and neural mechanisms that contribute to this relationship remain speculative. For instance, it is unclear whether insomnia comorbid with PTSD arises from the same mechanisms that contribute to insomnia in the context of mTBI, despite similar precipitating events. Additional research is needed to understand the underlying pathways that result in chronic insomnia in military samples, but most importantly, to inform the development of effective treatments. Identifying individual characteristics and biomarkers of heightened vulnerability to chronic insomnia could also inform strategies for prevention and early detection as well as interventions to enhance sleep resilience to the multiple challenges of military deployment.

As new treatments and interventions are developed, it will be important to establish not only the efficacy of new treatments but also effectiveness compared to well-studied interventions, such as CBTI. Comparative effectiveness research (CER) is one such method. CER and non-inferiority and equivalency-designed studies can help to further establish the effectiveness of new treatments in various military and Veteran populations and using different delivery methods and providers. Also, it will be vital to understand and measure the process by which evidence-based treatments for insomnia are utilized in general clinical practice. In order to move from “bench to bedside,” dissemination of training is often not enough. Barriers still exist to delivering treatment and Implementation Science methods can help to identify barriers to “uptake,” and identify the pathways and facilitate the process of delivering the care where it will have the most impact.

Finally, little is known about sleep health and insomnia among family members of deployed service members. These individuals have supported OEF/OIF/OND on the home front, and the challenges of deployment may also affect their sleep health and habits. In addition, family and social support are critical elements of successful reintegration and/or recovery. Thus, research and clinical efforts directed at military family members may be important components in providing the care needed and promoting health and recovery among service members and their families.

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**Table 1**

Adapted 3P Model of Insomnia for Combat Exposed Military Personnel.

Predisposing	Precipitating	Perpetuation
<ul style="list-style-type: none"> <li>• Adverse childhood events</li> <li>• Pre-military/deployment sleep problems and patterns</li> </ul>	<ul style="list-style-type: none"> <li>• Deployment</li> <li>• Combat exposure</li> <li>• Shift work/irregular scheduling</li> <li>• Hyper-vigilance</li> </ul>	<ul style="list-style-type: none"> <li>• Nightmares</li> <li>• Energy drink consumption</li> <li>• PTSD/Psychopathology</li> <li>• Sleep schedule adjustment</li> <li>• Unemployment/financial stress</li> <li>• Family responsibilities</li> <li>• Coping mechanisms: alcohol/substance use</li> </ul>