

Management of Sleep Disturbances Following Concussion/Mild Traumatic Brain Injury: Guidance for Primary Care Management in Deployed and Non-Deployed Settings

Introduction

More than 294,000 service members sustained a traumatic brain injury (TBI) between 2000 and 2013 with 82.5 percent of these classified as mild traumatic brain injury (mTBI), also known as concussion.¹ While symptoms are common in the immediate post-concussive period, most people who sustain a concussion completely recover within days to weeks. However, a small subset of individuals, most notably those with pre-existing and co-occurring conditions, experience persistent symptoms that interfere with function.² Sleep disturbances are commonly associated with concussion in the acute, sub-acute and chronic stages, and manifest as difficulty initiating and maintaining sleep or non-restorative sleep.^{3,4,5} Sleep disruption has a negative effect on the neural remodeling necessary for recovery from brain injury and may prolong post-injury recovery by impeding restorative processes occurring during sleep.⁶ A sleep disturbance associated with concussion exacerbates symptoms such as pain and irritability and negatively impacts cognition, social functioning, response to rehabilitation and return to work.^{7,8} Stabilizing sleep diminishes post-traumatic headaches.⁹ Additionally, sleep disturbances after concussion may partially mediate the development of post-traumatic stress disorder (PTSD) or depression.¹⁰

Individuals who sustain a concussion are affected by sleep disturbances more than those with severe TBI.^{11,12} The prevalence rates of insomnia, circadian rhythm sleep-wake disorders (CRSWD) and obstructive sleep apnea (OSA) are substantially higher in the concussion population than the general population.¹³ Military deployments further increase the risk for the onset or exacerbation of sleep difficulties given the crowded sleeping conditions, loud noise exposure and irregular sleep-wake cycles.¹⁴ Nearly all service members with combat-related TBI report sleep disturbances.¹⁵

Insomnia is the most common sleep disturbance following concussion with reported prevalence rates ranging from 21 percent to 93 percent.^{16,17,18,19,20} CRSWD also occurs in a substantial number of patients after concussion presenting with insomnia complaints.^{21,22} OSA occurred in 34.5 percent of service members who sustained a TBI in a 2012 retrospective study of a predominantly mTBI population (84.5 percent).¹⁵

Background

This clinical recommendation (CR) and the companion clinical support tool (CST) represent a review of currently published literature and expert contributions from the Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury (DCoE) in collaboration with clinical subject matter experts representing the academic, research and civilian sectors; the Defense Department (DoD) Armed Forces; and the Department of Veterans Affairs (VA).^{*} Representatives from the Defense Department TBI Quad Services – Army, Navy, Marine Corps, Air Force – Defense and Veterans Brain Injury Center (DVBIC), Army Medical Research and Materiel Command, Joint Trauma Analysis and Prevention of Injury in Combat program, National Intrepid Center of Excellence, U.S. Central Command, Readiness Division of the Defense Health Agency, the Coast Guard and VA have reviewed this recommendation. Provider judgment and operational requirements may supersede any recommendation for an individual patient. Each service may mandate service specific requirements regarding concussion and the management of sleep disorders.

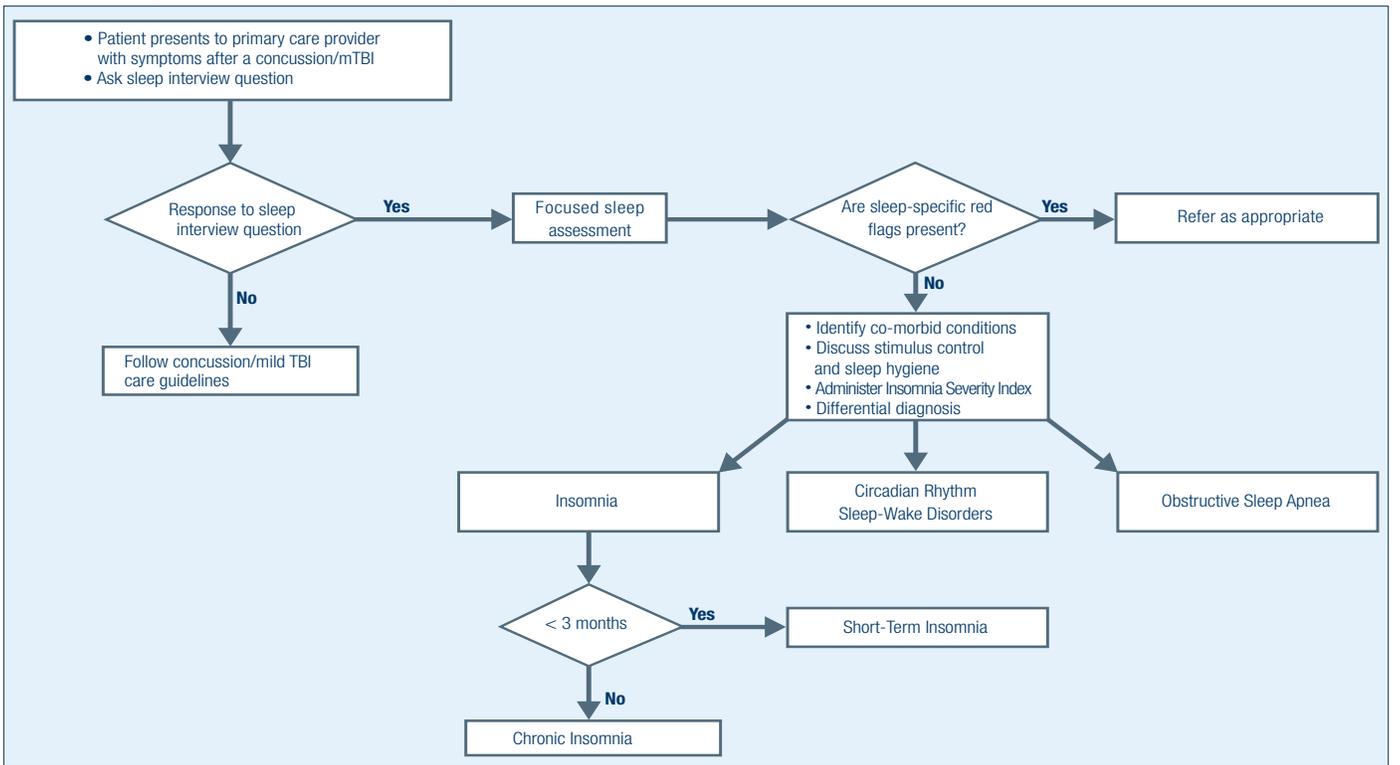
Summary

Sleep disorders commonly occur following concussion.¹⁵ The assessment and effective treatment of sleep disorders is essential for holistic care. Improved sleep positively impacts other symptoms that occur after a concussion, functional status and overall quality of life.^{7,8,9} This CR provides guidance for the primary care manager (PCM) in deployed and non-deployed settings for the assessment and management of the most common sleep disorders occurring after concussion: insomnia, CRSWD and OSA. **All patients presenting with symptoms following concussion should be screened for the presence of a sleep disorder.** Insomnia is the most common sleep complaint after concussion, and the initial diagnosis and management is facilitated by a focused sleep assessment and interview. Key elements of the interview and history, components of the physical exam, objective studies, and patient completed self-report measures (rating scales and questionnaires) are useful in the diagnosis and evaluation of sleep disorders. Non-pharmacological measures emphasizing stimulus control are the foundation of good insomnia care. The addition of a sleep medication may be necessary to augment these measures. The presence of other medical conditions or medications may have an additional adverse effect on sleep. Appropriate referral for specialty care may be necessary after the initial management of chronic insomnia and is often necessary for other sleep disorders including CRSWD and OSA. The assessment and management of sleep disorders is a vital part of patient care after a concussion.

^{*} A full list of working group participants may be viewed at: dvbic.dcoe.mil/cr-working-groups

Clinical Algorithm

The following algorithm is a guide for primary care managers (PCM) for screening and initial assessment of sleep disturbances in a service member or veteran after concussion. This algorithm is fully explained including sleep disorder diagnostic criteria, screening recommendations and primary care treatments in the companion [CST](#).



Sleep Interview Question

Given the high incidence of sleep disturbances in patients after a concussion and the potential benefits of improved sleep on a wide range of symptoms, all symptomatic patients should be screened for common sleep disorders. Patients may have a sleep disturbance that existed prior to the concussion, as a consequence of concussion or diagnosed after concussion. During the patient interview, the following question is recommended: **Are you experiencing frequent difficulty falling or staying asleep, excessive daytime sleepiness or unusual events during sleep?**

Focused Sleep Assessment

The clinical interview (see Table 1.0) is a critical component in the assessment of patients who have a sleep disturbance.²³ The clinical interview establishes the symptom picture as well as the duration, TBI severity and consequences of the sleep disturbance. Familial, social or occupational roles, as well as mood and cognitive complaints may be adversely affected by disturbed sleep. An assessment of the three “Ps” — predisposing, precipitating and perpetuating factors — are a central focus of the clinical interview. Important aspects of the physical examination for assessment of all sleep disturbances include blood pressure, neurological status and an evaluation for obesity including body mass index (BMI).

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Area of Assessment	Examples
Symptoms	Difficulty initiating and/or maintaining sleep, non-restorative sleep, nightmares, snoring, awakening with gasping and choking, fatigue, tiredness or drowsiness during the daytime
Consequences	Cognitive impairment, mood disturbances, irritability, decrease in functional ability, role interference (family, social, academic, occupational)
Predisposing factors	Pre-concussion sleep pattern, prior history of a sleep disturbance, excessive weight, increasing neck circumference, narrow upper airway, older age, genetic factors, mood disturbances, anxiety or preoccupation concerning sleep quality, medications, other co-morbid behavioral health or medical conditions
Precipitating factors	Concussion, deployment, acute stress
Perpetuating behavioral factors	Napping, excessive caffeine/stimulant use, irregular sleep schedule Watching TV, reading, working on a computer, or playing video games while in bed
Perpetuating environmental factors	Light, noise, travel, time zone changes
Perpetuating psychosocial factors	Familial stress, inadequate social support system, financial stress, safety concerns or other worries
Perpetuating occupational factors	Shift work, standing watch, duty schedule incompatible with preferred sleep schedule, work stressors
Perpetuating physical factors	Pain, discomfort, tinnitus
Perpetuating lifestyle factors (habits)	Alcohol use, diet, smoking, limited physical activity, family and community obligations

Key elements of the interview and history, components of the physical exam, objective studies, and patient completed self-report measures (rating scales and questionnaires) are useful in the diagnosis and evaluation of sleep disorders.²⁴ Use of a [sleep diary](#) to establish a record of the patient's sleep patterns can be of additional benefit in the sleep evaluation.

Patients with sleep disturbance usually describe one or more of the following symptoms:

- Difficulty initiating sleep
- Difficulty maintaining sleep
- Excessive daytime sleepiness
- Unusual events during sleep such as nightmares, abnormal behaviors, sensations or movements

These categories of sleep complaints are not mutually exclusive. A specific sleep disorder may be associated with one or more types of these problems. The patient's presenting symptoms, history and physical examination assist the provider in discriminating whether the reported sleep disturbance is due to one or more primary sleep disorder(s) or other factors such as a co-morbid condition, the adverse effects of medication or poor sleep hygiene. Poor sleep hygiene refers to sleep practices or activities that are inconsistent with good sleep quality as they increase arousal or directly interfere with sleep. Examples of poor sleep hygiene practices include irregular sleep scheduling and the use of alcohol, caffeine or nicotine close to bedtime.²⁵

Sleep Red Flags

Subjective complaints of significant sleepiness by patients in occupations where somnolence would jeopardize the safety of themselves or others require a priority referral to a sleep medicine specialist. Patients with behavioral or emotional symptoms and a severe sleep disturbance should be assessed for danger to themselves or others and receive immediate referral to the emergency department or psychiatry if suicidal risk or other similar concerns are present.

Identification of Co-Morbid Conditions

Sleep disruption in military personnel following concussion, particularly in those with combat-related trauma, is often accompanied by other co-morbid conditions including headache, pain, mood and anxiety disorders.¹⁵ (See table 2.0). Individuals with PTSD, whether diagnosed or undiagnosed, and those exposed to a traumatic event, may be more likely to experience a sleep disturbance such as insomnia or adult nightmare disorder.^{26,27} Differentiating between idiopathic nightmare disorder and nightmares associated with PTSD may require a referral to Behavioral Health or Sleep Medicine.

An anxiety disorder post-injury is a more significant predictor of sleep disruption than pain, other co-morbid conditions or the adverse effects of medications.³ Pain medications as well as medications used to treat other common health conditions can have an untoward effect on the sleep-wake cycle. Somnolence is a common side effect of opioid medication; sedation is a common side effect of benzodiazepines.²⁸ Antidepressant drugs can improve or disturb sleep depending on the drug and dosage. Clinical judgment will inform the treatment plan and whether to treat the co-morbid disorder first, concurrently with the sleep disorder or subsequent to the treatment of the sleep disorder.

Category	Examples of specific disorders, conditions or symptoms
Medical Disorders	Headache, chronic pain, endocrine abnormalities (anterior pituitary deficiency, hypothyroidism, adrenal insufficiency) ²⁹
Psychological Health Disorders	PTSD, generalized anxiety disorder, panic disorder, major depressive disorder, adjustment disorders, alcohol or drug use/dependence/withdrawal
Adverse Effects of Medication	Opioids, benzodiazepines, amphetamines, beta-adrenergic drugs used to treat asthma, selective serotonin reuptake inhibitors (SSRI), steroids, clonidine, theophylline ³⁰

Differential Diagnosis

The initial assessment will assist in the differential diagnosis of the three most common sleep disorders after concussion: insomnia, CRSWD and OSA.³¹ The newly revised third edition of the International Classification Sleep Disorders (ICSD) from the American Academy of Sleep Medicine (AASM) delineates diagnostic criteria for insomnia as well as minor changes in terminology.³² Short term insomnia disorder, previously known as acute insomnia, has symptoms present for less than three months. Circadian rhythm sleep disorders (CRSD) are now called circadian rhythm sleep-wake disorders (CRSWD). Table 3.0 provides the AASM diagnostic criteria from the third edition and the ICD-9 descriptions of each of these disorders along with proposed ICD-10 codes in parentheses.³²

Table 3.0 Diagnostic Criteria of Sleep Disturbances Following Concussion*	
Insomnia Disorders	
Short-term insomnia disorder: Sleep disturbance and associated daytime symptoms are present several days per week and for less than three months	
Chronic insomnia disorder: The sleep disturbance and associated daytime symptoms that occur at least three times per week and have been present for at least three months	
Criteria A-D must be met for both short-term and chronic insomnia	
<p>A. The patient reports one or more of the following:</p> <ol style="list-style-type: none"> 1. Difficulty initiating sleep 2. Difficulty maintaining sleep 3. Waking up earlier than desired 4. Resistance to going to bed on appropriate schedule 5. Difficulty sleeping without parent or caregiver intervention <p>B. The patient reports one or more of the following related to the nighttime sleep difficulty:</p> <ol style="list-style-type: none"> 1. Fatigue/malaise 2. Attention, concentration, or memory impairment 3. Impaired social, family, vocational, or academic performance 4. Mood disturbance/irritability 5. Daytime sleepiness 6. Behavioral problems (e.g., hyperactivity, impulsivity, aggression) 7. Reduced motivation/energy/initiative 8. Proneness for errors/accidents 9. Concerns about or dissatisfaction with sleep <p>C. The reported sleep/wake complaints cannot be explained purely by inadequate opportunity (i.e., enough time is allotted for sleep) or inadequate circumstances (i.e., the environment is safe, dark, quiet and comfortable) for sleep</p> <p>D. The sleep/wake difficulty is not better explained by another sleep disorder</p>	
Short-term insomnia disorder: ICD-9-CM: 307.41	(ICD-10-CM: F51-02)
Chronic insomnia disorder: ICD-9-CM: 307.42	(ICD-10-CM: F51.01)
Circadian Rhythm Sleep-Wake Disorder (CRSWD): Unspecified	
Subtypes of CRSWD have specific criteria that can be determined through Sleep Medicine evaluation and actigraphy	
General criteria A-C must be met:	
<p>A. The circadian rhythm disruption leads to insomnia symptoms, excessive sleepiness, or both</p> <p>B. The sleep and wake disturbances cause clinically significant distress or impairment in mental, physical, social, occupational, educational, or other important areas of functioning</p> <p>C. Chronic or recurrent pattern of sleep-wake rhythm disruption primarily due to alteration of the endogenous circadian timing system or misalignment between the endogenous circadian rhythm and the sleep-wake schedule desired or required by an individual's physical environment or social/work schedules</p>	
ICD-9-CM: 327.30	(ICD-10-CM: G47.20)

*American Academy of Sleep Medicine. (2014). International classification of sleep disorders, (3rd ed.). Darien, IL: American Academy of Sleep Medicine

Table 3.0 Diagnostic Criteria of Sleep Disturbances Following Concussion*

Obstructive Sleep Apnea (OSA)

Diagnostic Criteria: (A and B) or C satisfy the criteria for diagnosis

- A. The presence of one or more of the following:
 1. The patient complains of sleepiness, non-restorative sleep, fatigue, or insomnia symptoms
 2. The patient wakes with breath holding, gasping, or choking
 3. The bed partner or other observer reports habitual snoring, breathing interruptions, or both during the patient's sleep
 4. The patient has been diagnosed with hypertension, a mood disorder, cognitive dysfunction, coronary artery disease, stroke, congestive heart failure, atrial fibrillation, or type 2 diabetes mellitus
- B. Polysomnography (PSG) or out-of-center sleep testing (OCST) reports:
 1. Five or more predominantly obstructive respiratory events (obstructive and mixed apneas, hypopneas, or respiratory effort related arousals [RERAs]) per hour of sleep during a PSG or per hour of monitoring in OCST
- C. PSG or OCST demonstrates:
 1. Fifteen or more predominantly obstructive respiratory events (apneas, hypopneas, or RERAs) per hour of sleep during a PSG or per hour of monitoring in OCST

ICD-9-CM: 327.23

(ICD-10-CM: G47.33)

*American Academy of Sleep Medicine. (2014). International classification of sleep disorders, (3rd ed.). Darien, IL: American Academy of Sleep Medicine

Though short-term and chronic insomnia are the most common sleep disorders associated with the complaint of sleeplessness, some patients with CRSWD initially present with insomnia complaints. Infrequently patients with OSA, restless legs syndrome or narcolepsy may complain of insomnia. The physical exam, history and a [sleep diary](#) may aid in differential diagnosis. If the diagnosis is unclear the patient may be referred to Sleep Medicine for further diagnostic evaluation and management.

Although insomnia, CRSWD and OSA are the most common presenting sleep disorders following concussion, the diagnosis of one or more of these sleep disorders does not preclude the presence of other sleep disorders such as sleep-related movement disorders, parasomnias and hypersomnia.³² A patient who sustains a concussion may present with more than one sleep disorder diagnosis and one or more co-morbid psychological or medical conditions.

Primary Care Management of Common Sleep Disturbances

Treatment of sleep disturbances is a vital aspect of the primary care management of concussion. **Non-pharmacological treatments (e.g., stimulus control, environmental modifications, cognitive behavioral therapies (CBT) and sleep hygiene) are effective in patients with concussion and are first-line treatments for the most common sleep disorder – insomnia.**³³

INSOMNIA

Evaluation

Insomnia is defined as ongoing difficulty with sleep initiation, maintenance or quality in the presence of adequate scheduling and environment for sleep resulting in a decline in functional ability.³² Differential diagnosis of short-term versus chronic insomnia is made on the basis of patient history and is important due to the differences in recommended treatment. Short-term insomnia is considered when symptoms are reported as occurring several times per week for less than 3 months while chronic insomnia symptoms occur for more than 3 months.³² Additionally, a precipitating factor usually can be identified in short-term insomnia whereas assessment of chronic insomnia focuses on the perpetuating factors that maintain the sleep disturbance. (See Table 1.0 on Page 3)

The [Insomnia Severity Index \(ISI\)](#) is a brief, validated, seven-item, self-report questionnaire that is useful clinically for the initial assessment of insomnia symptom severity, as well as for the ongoing monitoring of treatment response.³⁴ A total combined score of greater than or equal to 10 is consistent with insomnia.³⁵ A two-week [sleep diary](#) is an adjunctive tool for differentiating insomnia from other conditions.²⁵

Non-Pharmacological Treatment of Insomnia

Non-pharmacologic, behavioral approaches are more time consuming for the PCM to initiate but when compared to pharmacologic treatment, they have similar short-term effectiveness and better long-term results. The initial management of short-term insomnia after concussion should focus on providing reassurance for symptom resolution. Weekly primary care follow-up appointments are encouraged.

Cognitive Behavioral Therapy for Insomnia (CBT-I), a treatment comprised of behavioral and cognitive techniques, is the most effective treatment for insomnia. CBT-I targets distorted cognitive beliefs and non-sleep promoting patient behaviors.²⁵ Two behavioral components of CBT-I, stimulus control and sleep hygiene, can be delivered in the primary care setting. The objectives of stimulus control are for the patient to form a positive and clear association between the bed and sleep, as well as to establish a stable sleep-wake schedule.³⁶ Sleep hygiene instruction teaches patients about healthy lifestyle practices that improve sleep and is also recommended because of the low cost and ease of implementation.³⁷ The PCM should routinely instruct about stimulus control and sleep hygiene as the standard treatment for patients who have had a concussion and either short-term insomnia or chronic insomnia (see Table 4.0). Patient education information is contained in the [Healthy Sleep sheet](#) available at dvbic.dcoe.mil.

Stimulus Control	Sleep Hygiene
Remove TV, radio, smartphone, electronic tablet, computer and other electronic devices from bedroom	Avoid caffeine/stimulant intake within six hours of bedtime
Relax before bedtime Avoid going to bed worried or angry Use the bedroom only for sleep and intimacy	Engage in exercise daily during the morning or afternoon, avoid exercise close to bedtime
Go to bed only when tired and sleepy	Avoid alcohol and nicotine use, large/heavy meals and excessive fluid close to bedtime
If unable to fall asleep within 15-20 minutes, get up, go to another room with the lights dim, and do something relaxing while avoiding electronic use (TV, computers, phone); return to bed when sleepy - Repeat above, as needed throughout the night, even after awakenings	Promote a sleep friendly environment, minimize noise and light, and maintain cool but comfortable temperature
	Get up at the same time every morning (regardless of the amount of sleep obtained), even on the weekends; avoid daytime naps
	Get exposure to natural light every morning ^{38,39}

In addition, training in progressive muscle relaxation may be helpful for patients with chronic insomnia to decrease the hyper-arousal and anticipatory anxiety associated with sleep. Progressive muscle relaxation involves alternately tensing and relaxing different muscle groups throughout the body focusing on the feeling of relaxation compared with the tension present prior to relaxation.⁴⁰ Brief instruction for patients can be found on the [Healthy Sleep sheet](#) at dvbic.dcoe.mil. Ear plugs, a sleep mask or a white noise machine may help the patient create an environment conducive to sleep.

Pharmacological Treatment of Insomnia

The non-benzodiazepine sedative-hypnotic drugs (zaleplon, zolpidem, eszopiclone and zopiclone) should be used with caution because of evidence that they may interfere with cortical plasticity.⁴¹ The use of these drugs for greater than 30 days may lead to tolerance or dependence.^{42,43,44} Existing concussion management algorithms and the VA/DoD Clinical Practice Guideline suggest the short-term use of low dose zolpidem. Providers who elect to prescribe non-benzodiazepine sedative-hypnotic medications need to inform patients that these drugs are not approved by the Food and Drug Administration (FDA) for the management of chronic insomnia following concussion. New dosing recommendations for this class of medications were released in 2013 and 2014 related to their extended half-life and prolonged morning mental impairment.^{43,44} For example with both immediate and extended-release zolpidem, patients need to be warned that they should take these medications only at bedtime, not to drive or engage in other activities that require complete mental alertness the day after taking these drugs and that there is the potential for tolerance or dependency.^{42,43,44} Women are at greater risk of decreased mental alertness due to the extended half-life of immediate- and extended-release zolpidem related to a generalized slower elimination of these products compared to men. **The FDA recommends “an initial dose of 5 mg immediate-release zolpidem for women and 5-10 mg for men.” For both men and women, if the 5 mg dose is not effective, the dose can be increased to 10 mg. The recommended dose of the extended-release forms of zolpidem are 6.25 mg for women and either 6.25 or 12.5 mg for men. For both men and women, if a 6.25 mg dose is not effective, the dose can be increased to 12.5 mg.**^{43,44} Prescribing benzodiazepines is specifically contraindicated because their use may impede neuronal recovery and negatively impact cognitive function following TBI.⁴⁵

Table 5.0 summarizes the clinical recommendations for primary care management of short-term and chronic insomnia.

Table 5.0 Primary Care Management of Insomnia Disorders		SHORT-TERM INSOMNIA	CHRONIC INSOMNIA
Diagnosis and Evaluation	Clinical Interview/History	<ul style="list-style-type: none"> • Symptoms present for several days per week and < 3 months • Precipitating stressor(s); predisposing factors • Decrease in functional ability 	<ul style="list-style-type: none"> • Symptoms present for several days per week and > 3 months • Perpetuating factors • Decrease in functional ability
	Physical Exam	<ul style="list-style-type: none"> • None specific to insomnia • Neurologic exam and/or OSA screening exam if indicated by history 	<ul style="list-style-type: none"> • None specific to insomnia • Neurologic exam and/or OSA screening exam if indicated by history
	Labs/Studies	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • Urine toxicology if indicated • Laboratory tests if symptoms greater than three months: 0800 cortisol levels, LH, FSH, PRL, IGF-1, TSH, FT4, T3, 0800 testosterone for males or estradiol for females²⁹
	Self-Report Measures	<ul style="list-style-type: none"> • ISI $\geq 10$³⁵ • Two-week sleep diary 	<ul style="list-style-type: none"> • ISI $\geq 10$³⁵ • Two-week sleep diary
Treatments in the Primary Care Setting	Non-Pharmacologic	<p>First-line treatment:</p> <ul style="list-style-type: none"> • Reassure patient that insomnia is expected to resolve when the identifiable stressor resolves • Educate patient about sleep and concussion (Healthy Sleep patient education sheet found at dvbic.dcoe.mil) • If symptoms do not improve with reassurance and education, further instruct the patient in stimulus control and sleep hygiene • Follow weekly until symptoms resolve 	<p>First-line treatment:</p> <ul style="list-style-type: none"> • Provide primary care components of CBT-I: stimulus control + sleep hygiene • Provide progressive muscle relaxation training (examples available on Healthy Sleep patient education sheet at dvbic.dcoe.mil) <p>Second-line treatment:</p> <ul style="list-style-type: none"> • Refer for CBT- I

Table 5.0 Primary Care Management of Insomnia Disorders

	SHORT-TERM INSOMNIA	CHRONIC INSOMNIA
Pharmacologic	<p>Use in combination with non-pharmacological treatment or as second-line treatment:</p> <ul style="list-style-type: none"> • Non-benzodiazepine sedative-hypnotics with caution: zaleplon, zolpidem, eszopiclone and zopiclone; prescribe for two weeks at a time and for no more than 30 days; follow new dosing guidelines • Concussion co-morbid with depression, pain or headaches: Prescribe low-dose tricyclic or other antidepressant (amitriptyline or trazodone) • Concussion co-morbid with PTSD and nightmares: Consider prazosin • Not recommended: antihistamines, antipsychotics, melatonin receptor agonists • Contraindicated: benzodiazepines 	<p>If patient has not attained relief during CBT-I with specialty provider consider combination therapies:</p> <ul style="list-style-type: none"> • Non-benzodiazepine sedative-hypnotics with caution: zaleplon, zolpidem, eszopiclone and zopiclone; prescribe for two weeks at a time and for no more than 30 days; follow new dosing guidelines • Low dose, sedating tricyclic antidepressant (amitriptyline) or other sedating antidepressant (trazodone) • Consider a melatonin receptor agonist (ramelteon) as an alternative • Contraindicated: benzodiazepines
Treatments in the Primary Care Setting	<ul style="list-style-type: none"> • Incorporate National Center for Telehealth and Technology smartphone apps (CBT-i Coach) and interactive websites (e.g., afterdeployment.t2.health.mil) to educate about the relationship between sleep and concussion recovery and provide self-management tools as an adjunct to treatment 	<ul style="list-style-type: none"> • Incorporate National Center for Telehealth and Technology smartphone apps (CBT-i Coach) and interactive websites (e.g., afterdeployment.t2.health.mil) to educate about the relationship between sleep and concussion recovery and provide self-management tools as an adjunct to treatment
Referral to Specialty Care	<ul style="list-style-type: none"> • Non-response or inadequate response to primary care treatment (e.g., patient remains symptomatic or has a decrease in their previous ISI score of <8 points after four weeks)/Sleep Medicine³⁵ • Further diagnostic workup/Sleep Medicine 	<ul style="list-style-type: none"> • Non-response or inadequate response to primary care treatment (e.g., patient remains symptomatic or has a decrease in their previous ISI score of <8 points after four weeks)/Sleep Medicine³⁵ • Four weeks of treatment with primary care CBT-I/Sleep Medicine • Further diagnostic workup/Sleep Medicine • CBT-I treatment/behavioral medicine sleep specialist or psychologist trained in CBT-I • Sleep interventions/sleep specialty trained occupational therapist
Complementary and Alternative Medicine (CAM)	<ul style="list-style-type: none"> • Consider acupuncture as adjunct to first-line treatment based on patient preference for CAM modalities 	<ul style="list-style-type: none"> • Consider acupuncture as adjunct to CBT-I based on patient preference for CAM modalities

Applications and Assistive Technologies

Web-based (e.g., afterdeployment.t2.health.mil) and mobile applications (e.g., [CBT-i Coach](#)) may serve to reinforce CBT-I interventions between appointments and provide a vehicle for patients to practice and measure behavior changes associated with treatment; however, such applications are neither stand-alone therapies nor are they substitutes for clinical care. Daily-timed exposure to natural sunlight or short wavelength light (blue) via a portable box in the morning has the potential to reduce fatigue and daytime sleepiness, and may improve mood as well as aspects of attention.²⁴ The use of white noise machines and tinnitus maskers in patients with tinnitus after concussion might be a helpful aid to sleep initiation.

Specialty Care Referral

A patient with chronic insomnia should be referred for CBT-I treatment if not responsive to stimulus control and sleep hygiene interventions provided in primary care. Other reasons for specialty care referral include the evaluation and treatment of co-morbid disorders such as intractable pain, persisting headaches, PTSD, depression and sleep disorders other than insomnia including hypersomnias, parasomnias, sleep-related breathing disorders and sleep-related movement disorders. Specialized diagnostic tests such as polysomnography, actigraphy and procedures such as acupuncture may require specialty referrals.

CIRCADIAN RHYTHM SLEEP-WAKE DISORDERS (CRSWD)

CRSWD is a group of disorders that are related to the timing of sleep within the 24-hour day due primarily to alterations in the endogenous circadian timekeeping system of the individual, or misalignment between the individual's circadian rhythm and external environmental factors that affect the timing of sleep (e.g., shift work, time zone change).³² Distinguishing a CRSWD from insomnia or other sleep disorders is based upon whether the patient is able to sleep without disturbance and awake refreshed when allowed to sleep on a preferred schedule. The [Morningness-Eveningness Questionnaire \(MEQ\)](#) may be beneficial for the screening and diagnosis of CRSWD.⁴⁶ The age of the patient is a factor to consider in differentiating the different types of CRSWD. Younger patients (18-25 years old) are more likely to have Delayed Phase Sleep Disorder (DPSD).^{38,47} It is important to differentiate between poor sleep hygiene, intentional maintenance of irregular sleep schedules and CRSWD.

Specialty Referral

Subtypes of CRSWD have specific criteria that are best determined by Sleep Medicine and actigraphy.³² For patients suspected of having CRSWD, simultaneously begin first-line, non-pharmacologic treatment and refer to a sleep medicine specialist for a diagnostic workup and further management recommendations. Table 6.0 summarizes the clinical recommendations for primary care management of CRSWD.

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Table 6.0 Primary Care Management of Circadian Rhythm Sleep-Wake Disorders (CRSWD)

Diagnosis and Evaluation	Clinical Interview/History	<ul style="list-style-type: none"> Discordance between physiological sleep preference and environmentally imposed sleep-wake schedule External issues-shift work, standing watch, jet lag, time zone changes Quality of sleep on preferred sleep schedule Daytime impairments
	Physical Exam	<ul style="list-style-type: none"> Neurologic exam and OSA screening exam if indicated by history
	Labs/Studies	<ul style="list-style-type: none"> None
	Self-Report Measures (optional)	<ul style="list-style-type: none"> Morningness-Eveningness Questionnaire (MEQ)⁴⁶ Two-week sleep diary
Treatments in the Primary Care Setting	Non-Pharmacologic	<p>First-line treatment:</p> <ul style="list-style-type: none"> Assist patient in identifying and scheduling optimal sleep-wake schedule; adjust patient activity schedule (as feasible) to meet preferred sleep-wake cycle; encourage patient adherence to good sleep hygiene practices <p>Follow-up care following specialty treatment:</p> <ul style="list-style-type: none"> Stimulus control and sleep hygiene for residual insomnia complaints, reinforcement of protocols recommended by specialty care for light exposure/restriction and use of equipment such as blackout shades Liaison with Command to adjust duty schedule for consistency of sleep-wake schedule if possible
	Pharmacologic	<p>Treatment for DSPD only:</p> <ul style="list-style-type: none"> Melatonin (0.5-5mg); prescribed 5-6 hours before the time that the patient would usually go to sleep^{38,48}
	Complementary and Alternative Medicine (CAM)	<ul style="list-style-type: none"> None indicated
	Applications and Assistive Technologies	<ul style="list-style-type: none"> Short wavelength light (blue) therapy
	Referral to Specialty Care	<ul style="list-style-type: none"> CRSWD definitive diagnostic workup/Sleep Medicine Actigraphy/Sleep Medicine Chronotherapy; short wavelength light (blue) therapy/Sleep Medicine

OBSTRUCTIVE SLEEP APNEA (OSA)

Evaluation

The patient history and the physical exam establish a presumptive diagnosis of OSA. Inclusion of the patient's bed partner in the interview is useful regarding witnessed pauses in breathing and gasping or choking. The physical exam provides an assessment of obesity (as indicated by neck circumference and BMI), airflow obstruction, cardiovascular risk factors, blood pressure and retrognathia.⁴⁹ However, patients with OSA may have a normal examination and BMI within normal limits. Polysomnography, a formal sleep study conducted in a sleep lab, is the gold standard for a confirmatory diagnosis of OSA and assessment of OSA severity.

Providers can use one of three self-report questionnaires as an aid in screening and diagnosis of OSA. The [Epworth Sleepiness Scale](#) requires the patient to rate his/her tendency to become sleepy during each of eight situations.⁵⁰ The [STOP-BANG questionnaire](#) contains a series of yes/no questions to assess risk of OSA.⁵¹ (The name of this questionnaire is derived from an acronym of the eight screening questions: **S**nore, **T**ired, **O**bserved stop breathing, high blood **P**ressure, **B**ody mass index, **A**ge, **N**eck circumference and **G**ender.) The [Berlin Questionnaire](#) contains three categories of questions regarding snoring, excessive sleepiness and physical risk factors for OSA.⁵² The diagnostic value of these questionnaires is secondary to the patient history and physical exam. If possible, the selected questionnaire should be filled out by both the patient and his/her bed partner.

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Specialty Referral

Patients with risk factors for OSA (obesity, history of facial trauma, anatomical airway impediments) or a presumptive diagnosis of OSA are recommended to have polysomnography or be referred to a sleep medicine specialist for diagnostic workup and initial management. Table 7.0 summarizes the clinical recommendations for primary care management of OSA.

Diagnosis and Evaluation	Clinical Interview/History	<ul style="list-style-type: none"> • Difficulty maintaining sleep, excessive daytime sleepiness, fatigue, snoring, non-restorative sleep, cognitive changes • Sleep apneas and hypopneas as witnessed by informant (preferably bed partner)
	Physical Exam	<ul style="list-style-type: none"> • Neck circumference (>17" for males or 16" for females), BMI (>25), blood pressure, upper airway exam (assess for airflow obstruction), cardiovascular, retrognathia (overbite/recessed chin, small jaw)
	Labs/Studies	<ul style="list-style-type: none"> • Polysomnography - for definitive diagnosis (may require referral to Sleep Medicine)
	Self-Report Measures	<ul style="list-style-type: none"> • Epworth Sleepiness Scale,⁵⁰ STOP-BANG questionnaire⁵¹ or Berlin questionnaire⁵²
Treatments in the Primary Care Setting	Non-Pharmacologic	<ul style="list-style-type: none"> • Body position therapy • Oral appliances • Positive Airway Pressure therapies (CPAP, APAP, BiPAP)
	Pharmacologic	<ul style="list-style-type: none"> • No role for pharmacology as stand-alone treatment
	Combination	<ul style="list-style-type: none"> • If compliant with positive airway pressure (PAP) therapies, consider use of modafinil or armodafinil as adjunctive therapy for residual hypersomnia⁵³
	Complementary and Alternative Medicine (CAM)	<ul style="list-style-type: none"> • None
	Applications and Assistive Technologies	<ul style="list-style-type: none"> • None
Referral to Specialty Care	Urgent Referral	<ul style="list-style-type: none"> • Patients with concussion associated behavioral or emotional symptoms and a severe sleep disturbance should be assessed for danger to themselves or others and immediately referred to the emergency department or psychiatry if suicidal risk or other similar concerns are present.
	Referral to Sleep Medicine	<ul style="list-style-type: none"> • Subjective complaints of significant sleepiness by patients in occupations where somnolence would jeopardize the safety of themselves or others require a priority referral to a sleep medicine specialist. • Initial management of patients suspected with OSA • Patients requiring polysomnography • New, persistent, recurrent or worsening signs/symptoms after initiation of treatment or non-efficacy of treatment • Oropharyngeal surgery
	Referral to Behavioral Health	<ul style="list-style-type: none"> • Patients who may benefit from behavioral or psychological interventions to facilitate PAP compliance, smoking cessation, weight reduction or alcohol reduction

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Deployed Operations

Screening for insomnia is recommended as a routine component of concussion management in deployed settings. All service members who sustain a concussion while deployed should be assessed for any symptoms, including sleep difficulty, 24 hours post-injury. If the service member is still symptomatic 24 hours post-concussion, use of the [Neurobehavioral Symptom Inventory \(NSI\)](#) will aid in the assessment of sleep with particular attention to how the service member rates *difficulty falling or staying asleep*.⁵⁴ The NSI is used throughout the Progressive Return to Activity Clinical Recommendation and facilitates the assessment of any sleep difficulties.⁵⁵ At concussion care centers, all service members should be assessed and treated for sleep disorders.

Reassurance, education and an optimal sleep environment are the cornerstones of management of short-term insomnia in service members with concussion. Use of ear plugs and sleep masks minimize noise and light as sleep interfering factors. Service members may benefit from instruction in stimulus control and sleep hygiene if short-term insomnia continues for more than seven days after injury.

Service members who complain of excessive daytime sleepiness should be clinically evaluated for operational functionality and safety. For service members with suspected but unconfirmed OSA, positional therapy (non-supine position), nasal decongestant relief, and discontinuation of sedative/hypnotic medications may reduce snoring. Patient education about the importance of avoiding sleep deprivation and discontinuing tobacco use is also indicated. By virtue of their small size and portability, nasal expiratory positive airway pressure (EPAP) devices may have a role for these patients in reducing snoring and daytime sleepiness.

A post-deployment evaluation for sleep disorders is recommended for service members with persistent post-concussive symptoms (> three months post-injury) and an OSA specific evaluation is recommended if there are OSA risk factors.

Conclusion

Sleep disorders commonly occur following concussion; assessment and treatment is essential as improved sleep positively impacts other symptoms associated with concussion, functional status and overall quality of life. This CR provides guidance for the assessment and management of sleep disturbances in the primary care setting and specific recommendations for management of insomnia, CRSWD and OSA in patients after concussion. The guidance was systematically developed through a process that included a review of the evidence, an analysis of the applicability of current clinical practice guidelines and the input of a multidisciplinary expert panel. This guideline does not replace the clinical judgment of the provider regarding the appropriateness of specific procedures and interventions for a particular patient. These decisions are influenced by the individual circumstances of the patient, available diagnostic tools and accessibility of treatment options.

Clinical Support Tools for Providers

In addition to this CR and companion [CST](#), links to provider training materials, quick reference cards, patient self-report measures and patient educational materials ([Healthy Sleep](#) sheet) can be accessed at dvbic.dcoe.mil. Additional resources such as mobile applications and computer based programs for patients are available at afterdeployment.T2.health.mil. [CBT-i Coach](#) mobile application for patients is available through mobilehealth.va.gov/app/cbt-i-coach.

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