Confronting Mild TBI and Co-occurring Post-traumatic Stress Disorder Symptoms in Combat Deployed Service Members

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Justin S. Campbell, Jeffrey H. Greenberg, and Jennifer M. Weil

Abstract

Traumatic Brain Injury (TBI) and Post-traumatic Stress Disorder (post-traumatic stress disorder) have been called the signature injuries of the wars in Iraq and Afghanistan. While post-traumatic stress disorder is frequently associated with exposure to traumatic events such as combat, surviving head injuries is a novel phenomenon likely associated with improved protective headgear, adept field medical attention, and the ability to expeditiously evacuate injured persons to upper echelon care facilities as indicated. Frequently, disorders (psychological and physical) are viewed discretely in spite of a mounting evidence base that suggests that these and similar injuries tend to co-occur. This chapter explores TBI and post-traumatic stress disorder in a historical context, identifies available assessment and treatment modalities, highlights a global approach to case conceptualization, and suggests research lines to address the key questions about developing simultaneous assessment and treatment models for the co-occurrence of TBI and post-traumatic stress disorder as well as other potentially confounding injuries.

Keywords

Traumatic brain injury • Post-traumatic stress disorder • Co-occurring disorders • Military health care • Veteran's health care • Assessment • Treatment • Case conceptualization

Introduction

To date, many thousands of service members have been deployed to Iraq and Afghanistan—Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF). These conflicts have placed military personnel at high risk for experiencing traumatic events that may affect coping capacities as well as injuries by blasts, vehicle crashes, and other war-related dangers. Epidemiological studies

J.S. Campbell, Ph.D.
U.S. Navy Space and Naval Warfare Systems Pacific, San Diego, CA, USA

J.H. Greenberg, Ph.D. (✉)
Altarum Institute, Washington, DC, USA
e-mail: Jgreenberg16@hotmail.com

J.M. Weil, Ph.D.
Deployment Health Clinical Center, Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury, Arlington, VA, USA

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examining the incidence of post-traumatic stress disorder (post-traumatic stress disorder) and traumatic brain injury (TBI) among service members have suggested high rates of both psychological and medical conditions as compared to civilian populations (Hoge et al. 2004). Yet, few studies have examined the prevalence of post-traumatic stress disorder co-occurring with TBI, and many scientists and clinicians argue whether or not a person who has experienced impaired consciousness associated with a mild TBI (mTBI), otherwise termed "concussion," can develop post-traumatic stress disorder (Bryant 2001). Given that effective treatments are predicated on understanding the mechanisms and experiential processes that mediate a disorder, it is vital to disentangle the relationship between these conditions. The current chapter reviews the evidence of post-traumatic stress disorder and TBI among service member populations, discusses the potential that these two conditions may co-occur, presents valid and reliable screening/assessment tools that mental health professionals can use to assess post-traumatic stress disorder and TBI, highlights the latest empirical treatments for both disorders, and provides recommendations for future directions in understanding the interaction between post-traumatic stress disorder and TBI.

Diagnostic Definitions

What Is post-traumatic stress disorder?

post-traumatic stress disorder is a clinical disorder that may result after a person experiences a traumatic event. According to the Diagnostic and Statistical Manual-Fourth Edition-Text Revised (DSM-IV-TR) American Psychiatric Association (APA, 1994), a person may be diagnosed with post-traumatic stress disorder if the following five criterion sets are met. First, the individual must have experienced a real or imaged event that is physically threatening to himself or herself or others and invokes intense fear, helplessness, or horror. Second, the person reports symptoms related to reexperiencing the traumatic event, such as disturbing memories, thoughts, and/or nightmares. These reexperiencing symptoms are often triggered by reminders (e.g., watching the news, being in a crowd, attending a memorial service). Third, the person actively attempts to avoid thoughts, feelings, and/or reminders of the trauma. Avoidance attempts may include isolating self from social support and social activities or using maladaptive coping strategies to manage feelings of anxiety, such as substance abuse. Fourth, the person describes symptoms of hyperarousal such as sleep disturbances (e.g., initial insomnia, frequent waking throughout the night, and early morning rising), hypervigilance (e.g., excessive and unnecessary guarding or watchful behavior), and exaggerated startle response (feeling jumpy when hearing a sound or other reminder of the event). Finally, a person reports that these symptoms have persisted for at least 1 month post exposure to the traumatic event. Persons diagnosed with post-traumatic stress disorder experience impairment in social, occupational, or other areas of functioning. Impairment for less than 3 months is considered acute, whereas symptoms that last longer than 3 months are considered chronic (APA 1994). post-traumatic stress disorder can have a "delayed onset" which is defined as at least 6 months post stress exposure. Prior to 1 month of symptoms, individuals who meet criteria for post-traumatic stress disorder may be diagnosed with Acute Stress Disorder (ASD). If symptoms are present after 1 month, the diagnosis is changed to post-traumatic stress disorder. Table 12.1 summarizes symptoms for criterions B–D.

What Is TBI?

The Defense and Veterans Brain Injury Center (DVBIC) defines a TBI as a blow or a jolt to the head or a penetrating head injury that disrupts the function of the brain. Not all blows or jolts to the head result in a TBI. The severity of such an injury may range from "mild"—a brief change in mental status with or without loss of consciousness (LOC)—to "severe," an extended period of unconsciousness or amnesia after the injury. The terms "concussion" and "mild TBI" are interchangeable

Table 12.1 Criterion B–D symptoms for post-traumatic stress disorder from the DSM-IV-TR

Criterion	Symptoms	# of symptoms required for diagnosis
B (Reexperiencing symptoms)	1. Recurrent and intrusive recollections of the event including images, thoughts, or perceptions 2. Recurrent distressing dreams of the event 3. Acting or feeling as if the traumatic event were recurring 4. Intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event 5. Physiological reactivity on exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event	One or more
C (Avoidance symptoms)	1. Efforts to avoid thoughts, feelings, or conversations associated with the trauma 2. Efforts to avoid activities, places, or people that arouse recollections of the trauma 3. Inability to recall an important aspect of the trauma 4. Markedly diminished interest or participation in significant activities 5. Feeling of detachment or estrangement from others 6. Restricted range of affect 7. Sense of foreshortened future	Three or more
D (Hypervigilance symptoms)	1. Difficulty falling or staying asleep 2. Irritability or outbursts of anger 3. Difficulty concentrating 4. Hypervigilance 5. Exaggerated startle response	Two or more

Table 12.2 Symptoms of TBI

TBI category	Associated symptoms
Mild	• May remain conscious or may experience a loss of consciousness for a few seconds or minutes • Headache • Confusion • Lightheadedness • Dizziness • Blurred vision or tired eyes • Ringing in the ears • Bad taste in the mouth • Fatigue or lethargy • Change in sleep patterns • Behavioral or mood changes • Trouble with memory, concentration, attention, or thinking
Moderate/severe	• Same symptoms as above • Headache that gets worse or does not go away • Repeated vomiting or nausea • Convulsions or seizures • An inability to awaken from sleep • Dilation of one or both pupils of the eyes • Slurred speech • Weakness or numbness in the extremities • Loss of coordination • Increased confusion, restlessness, or agitation

(DVBIC 2010). Symptoms of a TBI are typically categorized as mild, moderate, severe, or penetrating, depending on the severity of symptoms. Table 12.2 provides symptom descriptions used when diagnosing TBI.

Are post-traumatic stress disorder and TBI Similar?

The nosology for post-traumatic stress disorder and TBI overlaps in the areas of sleep disturbance, behavior and mood changes, and problems with concentration, attention, memories, and thinking. Even more challenging from a diagnostic perspective is that many of the symptoms of TBI may yield maladaptive avoidance behaviors, such as strategies to avoid activities, places, and individuals. These avoidance behaviors are common for individuals meeting post-traumatic stress disorder diagnostic criteria.

Prevalence Estimates

Post-traumatic Stress Disorder

Data from the National Comorbidity Study-Replication, an epidemiological study examining lifetime prevalence of various psychiatric disorders among the US population, indicated that 3% of study participants met the criteria for post-traumatic stress disorder during the past year (Kessler et al. 2005a), whereas 8.7% of study participants met the criteria for post-traumatic stress disorder during their lifetime (Kessler et al. 2005b).

Epidemiological data examining service members' pre-deployment have suggested that rates of post-traumatic stress disorder are similar (5%) to those of civilian populations (Hoge et al. 2004). However, when examining service members at post-deployment, data has indicated that post-traumatic stress disorder is common, with approximately 9–12% of OIF and 5–6% OEF meeting the diagnostic criteria. This includes data from the Millennium Cohort Study, a large sample study of deployed combat veterans (Hoge et al. 2004; Hoge et al. 2006; Smith et al. 2008). Other studies support these findings (Vasterling et al. 2006; Adamson et al. 2008) and report data that many deployed service members are experiencing symptoms of post-traumatic stress disorder.

Limitations to the latter prevalence estimates for OIF/OEF populations should be noted, including that these data are based on self-report surveys (screening instruments) rather than clinical assessment tools to diagnose post-traumatic stress disorder. Despite these limitations, the base rate for post-traumatic stress disorder among deployed military service members exceeds the rates of both non-deployed service members and civilian populations and warrants the need for appropriate screening, assessment, and effective treatment for this population.

Traumatic Brain Injury

Approximately 5.8 million people (3%) in the general US population suffer with chronic disability due to head injury (Kim et al. 2007). The Centers for Disease Control (CDC) and prevention reports that 1.7 million people are treated and released with a TBI, 27,500 are hospitalized, and 52,000 individuals die annually from TBI (CDC 2010). While these numbers are daunting, they likely represent an underrepresentation of the number of individuals who experience a TBI annually as many people who suffer a head injury never seek medical care. In the civilian population, the leading causes are falls (28%), motor vehicle accidents (20%), struck by or against events (19%), and assaults (11%) (CDC 2010). In combat situations, TBI is typically associated with improvised explosive devices (IEDs) and other forms of blast exposure and may be caused by penetrating foreign objects and rapid acceleration/deceleration of the brain within the skull, all of which can result in brain contusions involving shearing and tearing of nerve fibers (DVBIC 2010). Additionally, overpressurization in the brain due to close proximity blast waves emanating from IED and rocket/mortar explosions are thought to produce harmful biochemical alterations in the brain (Kennedy et al. 2007) and

diffuse injury to connective, integrative white matter tracts (Stein and McAllister 2009).

The majority of combat duty in OIF and OEF has been sustained by the US Army and Marine Corps personnel. Therefore, it can be hypothesized that these service members may have the highest incidence of TBI in the military. In a large cross-sectional survey of the US Army Soldiers ($N=2,525$) examining the prevalence of mTBI, data revealed that approximately 15% of soldiers met the mTBI criteria (Hoge et al. 2008). mTBI was defined as an affirmative response to any one of the three questions indicating LOC or being "knocked out," "being dazed, confused, or seeing stars," or "not remembering the injury." Findings also revealed that soldiers with mTBI experienced more intense combat, and blast injury (singular as well as multiple exposures), and were more likely to be hospitalized for their injuries than soldiers who did not sustain a head injury (Hoge et al. 2008). Findings from other studies are consistent, suggesting that estimates for mTBI range from 7 to 30% (Schneiderman et al. 2008; Ramchand et al. 2008; Kennedy et al. 2007; Vasterling et al. 2006). These rates exceed the rates for post-traumatic stress disorder, suggesting that brain injuries do not always result in post-traumatic stress disorder.

Co-occurring post-traumatic stress disorder and TBI

Some scientists argue that it is unlikely for individuals to develop post-traumatic stress disorder if a head injury is sustained. Why? There is a theoretical premise which asserts that post-traumatic stress disorder symptoms are a fear-conditioned memory of the traumatic event (Resick 2001). Consequently, if a person sustains a head injury that results in an LOC, the ability to encode memories should be disrupted and thus the person is incapable of forming a fear-conditioned memory (Sbordone and Liter 1995). Throughout the past decade, research has challenged this perspective, suggesting that a person may have both post-traumatic stress disorder and TBI (Bryant 2001).

Bryant and Harvey conducted a series of studies investigating the relationship between post-traumatic stress disorder and TBI (Bryant and Harvey 1998; Harvey and Bryant 2000; see also Bryant 2001; Harvey et al. 2003) among civilian populations. For example, in a study examining 79 automobile accident victims who were admitted to a trauma hospital during a 10-month period, 13.9% met the criteria for post-traumatic stress disorder at 1 month after sustaining the trauma and 24% met the criteria for post-traumatic stress disorder at 6 months (Bryant and Harvey 1998). Even more disturbing, at 2 years post assessment, 22% of the 79 participants met the criteria for post-traumatic stress disorder (Harvey and Bryant 2000). In another study, conducted by Bombardier et al. (2006) evaluating post-traumatic stress disorder in 125 patients from a trauma hospital who sustained definite TBI (excluding uncomplicated mTBI as well as several other medical-social history factors that might complicate diagnosis), 11.3% met the criteria for post-traumatic stress disorder at 6 months following the trauma. The most common sources of trauma in this sample were motor vehicle accident (49%), falls (32%), assault (7%), and others (12%). In contrast, Glasser et al. (2004) investigated post-traumatic stress disorder in 46 patients with TBI in a neurological rehabilitation clinic. Patients who maintained consciousness ($n=15$) were compared to patients who lost consciousness ($n=31$) during the trauma. Individuals who lost consciousness were less likely to develop post-traumatic stress disorder (3.2%) than those who retained consciousness (26.7%).

Research among military populations has suggested that post-traumatic stress disorder commonly co-occurs with TBI (Hoge et al., 2008). For example, in a study by Hoge et al. (2008), examining 2,525 US Army infantry soldiers 3–4 months after returning from deployment, post-deployment rates of post-traumatic stress disorder were highest for those with mTBI with associated LOC (range: 4.3–43.9%), followed by mTBI with altered mental status (range: 10.7–27.3%). Those with non-TBI-related injuries had a 16.2% post-traumatic stress disorder prevalence. For those in the sample with no injuries,

9.1% screened positive for post-traumatic stress disorder. LOC rivaled even combat exposure in a hierarchical logistic regression model predicting post-traumatic stress disorder with numerous risk variables. Additional multivariate modeling found that an LOC was a significant predictor, but mediated by post-traumatic stress disorder and depression (no longer significant when those variables were entered into the model). This last finding suggests that mTBI is most correlated to poor deployment health outcomes when co-occurring with post-traumatic stress disorder and depression. In contrast, data from the Adamson et al. (2008) national phone survey of 1,965 soldiers post deployment (Schell and Marshall 2008) reported a weighted percentage of comorbidity at just 1%, despite finding that 13.8% of the sample screened positive for probable post-traumatic stress disorder and 19.5% screened positive for probable TBI. Limitations to these studies and the vast differences in estimates include the various methodologies applied to determine TBI status and severity, as well as a reliance upon self-reports rather than clinician-confirmed examinations. It is also important to consider that exposure to combat experiences that increase the risk for blast exposure varies greatly by service and type of occupational specialty of service members deployed to OIF/OEF assignments. For instance, combat maneuver units such as those surveyed by Hoge et al. (2008) are more likely to patrol "outside the wire" and come into contact with IEDs and rocket attacks compared to service members assessed in broad population surveys (Schell and Marshall 2008; Schneiderman et al. 2008).

Despite the diversity of methods employed in the study of co-occurring post-traumatic stress disorder and TBI and estimates of prevalence, all of these studies suggest that it is possible for an individual to present with concurrent symptoms of post-traumatic stress disorder and TBI. Bryant (2001) posits four possible explanations. First, despite an LOC for the TBI event itself, the pain, anxiety, and suffering surrounding the event may form the genesis of a traumatic memory. Second, when it is impossible to create conscious declarative memories for a TBI event, unconsciously coded implicit memories for the event may still result in traumatic memories despite impaired consciousness. Third, individuals may modify or create memories of otherwise fragmented TBI-related experiences. Lastly, neurological trauma associated with TBI may also interact with the neurological systems that mediate the expression of post-traumatic stress disorder.

Bryant's potential explanations for post-traumatic stress disorder/TBI comorbidity are plausible for military populations; however, it should be noted that in civilian populations the co-occurrence of post-traumatic stress disorder and TBI is more likely to result from a single incident, such as an automobile accident or an assault (Langlois et al. 2006), whereas in combat-deployed military personnel, there may be numerous traumatic incidents over the course of a deployment which both meet the criterion A for post-traumatic stress disorder and result in LOC (Kennedy et al. 2007). Service members who present with co-occurring post-traumatic stress disorder and TBI symptoms likely represent a complex patient history involving multiple exposures to traumatic experiences or repeat stressors and injuries over the course of several months and multiple combat deployments.

Clinical Management

Post-traumatic Stress Disorder

The APA (APA 2004) recommends that individuals at risk for post-traumatic stress disorder should be screened for recent/remote trauma exposure and for those individuals who are positive a diagnostic assessment should be conducted. Diagnostic assessment should include a complete evaluation that assesses the symptoms of post-traumatic stress disorder, including dissociative, reexperiencing, avoidance/numbing, and hyperarousal symptom clusters and their temporal sequence relative to the trauma (i.e., before versus after 1 month from the traumatic event). The guidelines for persons diagnosed with post-traumatic stress disorder suggest that interventions and activities that ensure physical and psychological safety, required medical care,

and self-care resources should and made available. Examples of psychiatric management goals which are consistent with the APA guidelines include establishing a therapeutic alliance, ongoing assessment of safety and psychiatric status, ongoing assessment of comorbid disorders and treatment response, and increasing the patient's capacity to cope with the psychosocial effects of trauma. The practice guideline also identifies effective treatments for the symptoms of post-traumatic stress disorder, such as psychopharmacology, psychotherapy, psychoeducation, and other supportive measures. Combinations of these treatment approaches may offer benefits; however, it should be noted that research related to treatment combinations is not currently available. Subsequent sections of this chapter highlight screening, assessment, and treatment tools that are widely used with combat-related post-traumatic stress disorder populations and are consistent with the APA treatment guidelines.

Screening and Assessment for Military Populations

Several valid and reliable screening and assessment instruments have been tested with military populations. These instruments are described below and are frequently used in both research and clinical settings.

Screening Tools: post-traumatic stress disorder Checklist

The post-traumatic stress disorder checklist (PCL) which is frequently used in epidemiological research to examine trends and rates of post-traumatic stress disorder is available in three versions: civilian, military, and trauma specific. The PCL is a 17-item self-report measure that assesses each of the 17 post-traumatic stress disorder symptoms. Using a 5-item Likert scale, the PCL asks individuals to estimate symptom severity. Scoring criteria for the 17-item screener is based upon a 1–5 point criteria with a score of 1 representing "not at all" and a score of 5 representing "extremely." The cutoff score for this instrument is 50. Numerous studies have indicated that the PCL is a valid and reliable screening instrument (Ruggierro et al. 2003; Lang et al. 2003).

Primary Care post-traumatic stress disorder Screener

This four-item screen (Prins and Ouimette 2004) has been studied in Veterans Affairs hospital general medical clinic patients, and appears to have strong sensitivity (0.78) and specificity (0.87) at the optimal cutoff score of 3 versus the Clinician-Administered post-traumatic stress disorder Scale (CAPS—see description below). This self-report screening tool uses yes/no response options with scores ranging from 0 (all questions marked "no") to 4 (all questions marked "yes").

Mississippi Scale for Combat-Related post-traumatic stress disorder

This 35-item self-report measure assesses post-traumatic stress disorder symptoms as well as associated features (i.e., substance abuse, suicidality, depression). Using a 5-point Likert scale, individuals are asked to identify symptom severity. Scores can range from 35 to 175 (Keane et al. 1988 Feb).

The post-traumatic stress disorder scales discussed above are brief, easy to use, administer, and score. Although these screening tools should not be substituted for a thorough clinical interview, providers treating large numbers of service members at risk for an exposure to a traumatic event may find these tools useful in situations of limited time and/or resources. For patients that screen positive for post-traumatic stress disorder, follow-up assessment tools should be used to determine if the patient meets diagnostic criteria. Two assessments frequently used for military populations are described below.

Assessment Tools: CAPS

The CAPS is the gold standard post-traumatic stress disorder structured clinical interview. This 30-item assessment measure corresponds to the DSM-IV criteria for post-traumatic stress disorder and is used to make current (past month) or lifetime diagnosis of post-traumatic stress disorder. Items assess the 17 symptoms of post-traumatic stress disorder, the impact of symptoms on social and occupational functioning, and the improvement in symptoms since previous administrations. The CAPS should be

administered by trained clinicians, researchers, or paraprofessionals. A symptom is counted as present if it has a frequency of 1 and severity of 2 (Blake et al. 1995).

The Keane post-traumatic stress disorder Scale

Used by clinicians and researchers, the Keane post-traumatic stress disorder scale which is derived from the Minnesota Multiphasic Personality Inventory-2 (MMPI-2) has been found to be a useful indicator of post-traumatic stress disorder (Lyons and Keane 1992). This 46-item scale uses the same norms based on the MMPI-2 standardization of 1,138 males and 1,462 females sampled from the general population. A useful feature of the Keane post-traumatic stress disorder scale is that it may be difficult for a patient to fake "bad" due to the difficulty in identifying specific items on this scale from the hundreds of items on the lengthy MMPI-2. Further, the MMPI-2 contains validity scales explicitly designed to detect invalid responding.

post-traumatic stress disorder Treatment Models

Several treatment models have been studied and found to be effective with military populations. The following sections describe these models.

1. *Exposure and behavioral therapy*. In a large-scale review of randomized, controlled trials for the treatment of post-traumatic stress disorder, the National Academies of Science (2007) concluded that the only therapeutic modality with sufficient evidence to warrant a recommendation was exposure therapy. This is based upon the principles of Classical Conditioning (Pavlov 1927) which asserts that a person who is exposed to stimuli that, through biologically and/or cognitive pairing with life-threatening situations, will develop conditioned fear and startle responses. The goal of exposure treatments is to facilitate habituation when stimuli are present through the use of safe and supportive environments. Habituation in the presence of conditioned stimuli will ultimately decrease fear or startle responses. Exposure as a treatment can be applied either gradually or rapidly (i.e., a technique known as flooding [Foa and Chambless 1978]) to help patients habituate to their traumatic experiences. Prolonged Exposure (PE) therapy for post-traumatic stress disorder consists of nine to twelve 90-min sessions that include psychoeducation, imaginal exposure (i.e., a detailed recounting of the trauma that should elicit affective responses), and in vivo exposure (i.e., continual and progressive first-hand exposure to stimuli that elicit affective response) (Foa et al. 2007). For those treating combat-related post-traumatic stress disorder, exposure therapy may emphasize habituation to reminders of the trauma rather than actual traumatic events themselves, hence the recent application of modalities such as virtual reality (Reger and Gahm 2008). A key goal of PE is the reduction of the patient's avoidant behaviors in the face of feared situations and stimuli, a critical step towards reducing relative distress surrounding traumatic experiences and helping patients to return to full functioning (Foa and Kozak 1986).
2. *Cognitive processing therapy (CPT).* CPT, originally developed for female sexual assault survivors, has been frequently applied to veteran populations. The CPT model uses an exposure approach that directs the patient to write about the traumatic event. These narratives are generally fraught with "stuck points." Stuck points are cognitive distortions (inaccurate beliefs or thoughts) that impact the patient's perception of the trauma, thereby facilitating continued avoidance, distress, and affective arousal when exposed to cues associated with the trauma. The goal of CPT is not to eliminate cognitions of the trauma, but rather to teach the patient how to live *with* the trauma. Living with the trauma could mean learning to trust when appropriate, openly grieving a loss, or understanding that justice is an ideal rather than a guarantee. Narrative writing should continue as long as stuck points or inaccuracies persist. Patient encounters require that the patients repeatedly read aloud their accounts of the trauma to facilitate habituation to the traumatic event. To evaluate progress, the PCL or another symptom-driven

screen/assessment should be repeatedly administered. Initially, the patients should show evidence of elevated PCL scores due to distress experienced while encountering the traumatic event; however, with time and continual exposure, PCL scores should decrease to subthreshold clinical levels along with the distress associated with reliving the trauma. At the conclusion of treatment, patients should (a) be able to grieve accurately, (b) assign responsibility, (c) understand that they were unable to control the trauma from happening, (d) accept that they must live with the trauma rather than perseverating on the cognition that wishes the trauma had never happened, and (e) concurrently experience significantly decreased distress and an ability to reengage in their lives despite the occurrence of the trauma(s).

3. *Cognitive behavioral therapy (CBT).* At the theoretical core of CBT therapies is the classic Beck model of Cognitive Therapy. Beck's model was originally designed to address depression (1979) and emphasizes the relationship among cognition, emotions, and behaviors. Specifically, cognitive-based models help the patient identify erroneous thoughts and belief systems that cause distress in individuals and are intricately associated with feelings and patterns of behavior. Since the model's genesis, CBT has been used for many psychiatric disorders including post-traumatic stress disorder and substance abuse. Clinicians working with military populations may have challenges using a CBT approach, particularly for post-traumatic stress disorder. For example, military populations are trained to be "on guard," and watch for potential signs of danger in the environment. This hypervigilance is protective in a combat situation, yet in a civilian situation this same thought processing and behavioral response may be interpersonally inhibiting and socially problematic. For persons who may be redeployed to combat, challenging these thoughts may be unrealistic as hypervigilance is often a necessary attribute in the combat zone.
4. *Psychopharmacology for post-traumatic stress disorder*. Psycho-pharmacological approaches to the treatment of post-traumatic stress disorder are another treatment used in the management of post-traumatic stress disorder symptoms. Despite research to support the use of psychopharmacological treatments, it should be noted that neither the National Academies of Science report or the APA practice guideline (1994) endorses any one particular psychopharmacological approach for the treatment of post-traumatic stress disorder. Typically, selective serotonin reuptake inhibitors (SSRIs) such as Prozac (Fluoxetine) are used as a first line of treatment for patients meeting the diagnostic criteria for post-traumatic stress disorder (Davidson et al. 1991; Lineberry et al. 2006). Other psychopharmacological treatments used to treat post-traumatic stress disorder are tricyclic antidepressants, monoamine oxidase inhibitors (MAOIs), the neurological agent carbamazepine, beta blockers, clonidine, and lithium and benzodiazepines such as valium or klonopin (Davidson et al. 1991).

   Aside from symptom management, the drug propanalol, a beta adrenergic blocker, has been studied to determine its impact in blocking the encoding of traumatic memories that are thought by some to be a primary causal agent of post-traumatic stress disorder (Pitman et al. 2002). Additionally, GABA agonist hypnotics such as Ambien (Zolpidem) are being studied to determine their impact in reducing many of the sleep-related problems associated with post-traumatic stress disorder (Bobo et al. 2007).

   Other pharmacological options that may be used to address post-traumatic stress disorder-associated sleep problems, atypical antipsychotics such as Abilify (Aripiprazol), Zyprexa (Olanzapine), Seroquel (Quetiapine), and Risperdal (Risperidone), may help impact and improve sleep function (Lineberry et al. 2006). The alpha-1 adrenergic antagonist Prazosin, typically prescribed for hypertension, has recently received a great deal of attention because of studies linking it with reduced nightmares in veterans suffering from post-traumatic stress disorder (Peskind et al. 2003; Maher et al. 2006; Raskind et al. 2006).
5. *Emerging psychotherapeutic approaches*. While not yet extensively studied for treatment

of post-traumatic stress disorder, Hayes et al.'s Acceptance and Commitment Therapy (ACT) may be a promising intervention. In contrast to CBT, the ACT model helps patients to identify and work towards goals, rather than focusing on modifying thoughts, feelings, and behaviors (Hayes et al. 1999). In this model, the patient is able to reduce avoidance behaviors and increase value-based living. The five principles of ACT are as follows:

1. Develop an understanding that trying to avoid emotional pain will not work. Pain and distress are normal parts of life.
2. Understand that trying to control the problem is itself a source of distress.
3. Develop the ability to separate one's self from one's thoughts.
4. Stop the struggle with one's own thoughts.
5. Commit to action.

Aside from ACT, a growing movement within the field of post-traumatic stress disorder therapy is the use of integrative medical treatments, an approach known collectively as complementary and alternative medicine (CAM). Of the CAM approaches, acupuncture is receiving some attention as a promising approach for post-traumatic stress disorder. For example, in a randomized, controlled study conducted by Holifield et al. (2007), findings suggested that patients receiving acupuncture in conjunction with CBT showed a substantial reduction in post-traumatic stress disorder symptoms compared to participants who received CBT alone and a wait-list control group. Other CAM modalities being studied for the treatment of post-traumatic stress disorder include exercise therapy, massage therapy, relaxation and mindfulness techniques, and yoga. These modalities teach skills that can be readily incorporated into a healthy lifestyle, and, most importantly, appear to have little risk of doing harm. On the periphery of CAM techniques are spiritual counseling, music and art therapy, Qi Gong, Tai Chi, and Reiki. Despite the objectively benign nature of these alternative practices, practitioners are nonetheless urged to proceed with caution with respect to the application of all the approaches described in the alternative approaches section given the paucity of empirical evidence examining their efficacy and propensity for doing further harm.

Traumatic Brain Injury

During the past decade, institutions such as the CDC, Department of Defense (DoD), and Congress have been establishing workgroups to identify guidelines for the screening, assessment, and treatment of mTBI. Presently, the DoD has developed a clinical practice guideline for theater management of TBI which includes an assessment and treatment algorithm.

Screening and Assessment: Head injury symptomatology in combat zones, especially those associated with exposure to blasts from IEDs, is likely to copresent with gross physical trauma to the entire body, making head injury assessment a secondary or tertiary consideration to more vital diagnostic and treatment endeavors. Therefore, when patients sustain blast injuries or enter treatment in an unconscious state for unknown reasons, care should be taken to ensure that these patients are screened for cognitive impairment once an assessment of their post-head injury cognitive function is appropriate. Although there are a number of assessment models designed to identify individuals meeting the diagnostic criteria for TBI, few service members undergo screening for cognitive impairment. Why? Lack of resources and knowledge in both the caregivers and the patients limits both screening and assessment endeavors. However, once a person has been flagged for an assessment to investigate the impact of head trauma, there are a number of assessment modalities that may be used (Schwab et al. 2007).

Glasgow Coma Scale

Primary assessment of acute head injury can be accomplished through the Glasgow Coma Scale (GCS) (Teasdale and Jennett 1974). The GCS measures three factors of neurological functioning: eye opening, motor response, and verbal response. Scores range from 1 to 6 with total scale scores ranging from 3 to 18. While there are other factors associated with assessing a TBI such as CT

scans (e.g., imaging) and length of LOC, the GCS is considered a gold standard model for rapidly assessing neurological functioning and is most useful for prognosticating clinical outcomes in moderate to severe TBI.

Military Acute Concussion Evaluation

A tool that can be utilized by first responders, derived from the Sideline Assessment of Concussion (SAC) frequently used on college and professional football players, is the Military Acute Concussion Evaluation (MACE) (DVBIC 2006). The MACE can be administered in approximately 10 min and comprises three main sections: history, screening neurological examination, and cognitive evaluation. The history section asks the provider to obtain a description of the incident, cause of the injury, determining the presence or absence of a helmet, investigation of anterograde and retrograde amnesia, and LOC. The neurological examination assesses ocular (papillary response and eye tracking), verbal (speech fluency and word finding), and motor (pronator drift and gait and coordination) functions. The cognitive portion includes an assessment of orientation to various factors of time, immediate memory, brief neurological screening, recalling digits backwards, and a delayed recall of the items on the immediate memory word list. The MACE can be scored to produce three outcomes: (a) no concussion, (b) concussion with LOC, (c) or concussion with no LOC (DVBIC 2006). A diagnosis of concussion can be made from the history section alone. *Repeatable Battery for the Assessment of Neuropsychological Status (RBANS).* Use of repeatable assessment batteries such as the RBANS (Randolph 1998) is another assessment model. This assessment tool measures a variety of neuropsychological and neurocognitive performance constructs identifying the current status. The multiple forms available from the RBANS lend the instrument to longitudinal evaluation of patient progress (Randolph 1998).

Pre-deployment Neuropsychological Assessment

In response to the high incidence of combat-related TBI, the DoD Assistant Secretary of Defense for Health Affairs (ASD-HA) released a directive that all service members shall have a neurocognitive evaluation prior to deployment. While a number of different automated neurocognitive instruments are available, the ASD-HA directed that the Automated Neuropsychological Assessment Metrics (ANAM) would be used by all branches of the armed services until a thorough comparison of multiple neurocognitive tools could be completed. The ANAM, also known as ANAM4, is a battery of tests which have been normed for service member populations. The current ANAM4 TBI battery measures the following domains: simple reaction time, code substitution (learning), procedural reaction time, mathematical processing, matching to sample, code substitution (delayed). Additionally, the battery includes a demographics page, TBI questionnaire, sleepiness scale, and mood scale. This instrument is a relative of the initial ANAM, a battery of neuropsychological tests developed by the DoD for research purposes over the past 30 years.

Treatment of Traumatic Brain Injury: The treatment model for mTBI in military settings is fairly straightforward, starting with rest and sustenance in the initial aftermath of the incident. Medications that inhibit blood clotting should be avoided as diffuse bleeding throughout the brain remains a possibility. Close observation during the initial stages of the trauma is warranted in case symptoms worsen (e.g., reports of a worsening headache). Pharmacological interventions have been employed to address a number of the symptoms of TBI, such as using Triptan agents to treat headache (Lane and Arciniegas 2002). For mTBI symptoms that do not remit, a number of treatment models are being explored. For example, Hyperbaric Oxygen Therapy (HBOT) is being evaluated by the DoD as part of a clinical trial (Golden et al. 2002).

Assessment of TBI with the Potential for Comorbid post-traumatic stress disorder: TBI, because of its propensity for acute life-threatening conditions, takes priority upon intake. For those suffering with moderate or severe TBI or a penetrating head wound, practitioners in combat hospitals will likely emphasize only life-saving care prior to medical evacuation of the patient to a higher, more definitive level of care. For those

suffering from mTBI, the real issue at hand is whether or not the patients are seen by medical staff in conjunction with their injury. For those who are adequately healthy and conscious, and seen in close proximity to their injury, assessments such as the MACE can be conducted. In many cases, the patients may not seek out medical care and misinterpret or ignore the initial symptoms of mTBI or concussion. When these patients finally are evaluated, perhaps in a mandatory screening prior to departing the combat zone or due to complaints for other injuries, a more thorough neurocognitive screening, such as the RBANS, can be conducted. Given the traumatic nature of many instances that result in TBI in the combat zone, it is reasonable to screen for the presence of ASD—the precursor to post-traumatic stress disorder—during the course of the assessment. A positive screen for ASD warrants a future evaluation for post-traumatic stress disorder if symptoms do not remit. ASD may be identified using standard screening instruments designed for post-traumatic stress disorder; however, it is important to remember that temporal factors delineate ASD from post-traumatic stress disorder. In addition, the amount of time in which one experiences post-traumatic stress disorder may further confound the diagnosis. Alternative clinical disorders in the mood, anxiety, and substance abuse families may be present as well as social and other behavioral problems. Many individuals will have some type of psychological response to a traumatic event; however, the majority does not proceed to experiencing acute or chronic post-traumatic stress disorder. Evaluation based upon clinical decision making and case conceptualization are warranted as individuals experiencing early traumatic stress symptoms may present with variable responses dependent on their coping or recovery pathway.

Granacher (2008) has been one of the few to offer a detailed strategy for assessment of TBI patients thought to also be at risk for post-traumatic stress disorder. With respect to assessment, Grenacher notes that "comprehensive neuropsychiatric assessment is the most important single tool with which to determine whether a patient with post-traumatic stress disorder has co-morbid TBI." This model includes the following: (a) review records of TBI event, (b) detailed neuropsychiatric history, (c) mental status and neurological examination, (d) brain imaging with MRI, (e) standard neurocognitive assessment, (f) standard behavioral assessments, and (g) laboratory testing. Obviously, some of these recommendations are impractical for clinicians working in deployed environments (e.g., MRI, laboratory testing, and, depending upon the availability of neuropsychologists or neuropsychiatrists, the standard neurocogntive assessment).

Treatment Models for TBI with Comorbid post-traumatic stress disorder: The Institute of Medicine (IOM) report on the evidence related to the treatment of post-traumatic stress disorder forcefully states: "The scientific evidence on treatment modalities for post-traumatic stress disorder does not reach the level of certainty that would be desired for such a common and serious condition among Veterans" (IOM 2007). Given that the identification of efficacious treatment for post-traumatic stress disorder alone is in such a state, it should come as no surprise that the literature has little to offer with respect to evidence-based treatments for comorbid TBI and post-traumatic stress disorder.

Prior to the start of the wars in Iraq and Afghanistan, Bryant (2001) noted that there is no approach currently applied that can differentiate between the overlapping symptoms in TBI and post-traumatic stress disorder. In fact, many clinicians overlook one condition for the sake of an unduly warranted focus on the other condition. Bryant (2001) also argued that best practices in post-traumatic stress disorder therapy may need to be modified if TBI is suspected. In particular, LOC or other encoding problems may preclude therapies that rely on recall of the traumatic event such as imaginal exposure. Further, deficits in attention may make cognitive therapies challenging and require use of strategies and techniques (cue cards, written reminders) that mitigate TBI-induced problems with sustained attention and memory. Finally, Bryant advocated early cognitive therapy after the identification of TBI as a means to prevent the development of cognitions that cause individuals to inaccurately attribute TBI-induced symptoms to some sort of psychological disturbance.

Posttraumatic Stress Disorder Assessment and Treatment Model

Event	Assessment	Treatment	Clinical Outcomes
A criterion A event such as a shooting, crime or exposure to disaster. The individual experiences fear or horror, although freezing may also be a common response. Impairment and symptoms are noted in several criterion areas. These areas are re-experiencing the event through thoughts or dreams, avoidance of stimuli that are reminders of the event, physiological arousal such as sleep difficulties, hypervigilance and exaggerated startle response, the symptoms last greater than a month and result in clinically significant distress in multiple areas of functioning.	Assessment for Posttraumatic Stress-Disorder includes multiple steps: Initial use of screeners such as the Posttraumatic Stress Disorder Checklist (PCL) or the Mississippi Scale for Posttraumatic Stress Disorder identify symptoms consistent with a diagnosis of Posttraumatic Stress Disorder. A diagnosis of Posttraumatic Stress Disorder should include use of the Clinician Administered Posttraumatic Stress Disorder Scale (CAPS). The CAPS is the gold standard clinical assessment measuring the DSM-IV criteria for Posttraumatic Stress Disorder. Further models such as the Minnesota Multiphasic Personality Inventory –II (MMPI-II) Posttraumatic Stress Disorder Keane Scale (PK) have been significantly correlated with the diagnosis of Posttraumatic Stress Disorder. The MMPI-II contains scales to identify invalid answering.	While a number of models have been identified to address Posttraumatic Stress Disorder, the literature generally supports the use of exposure-based treatment models. These models include Prolonged Exposure Therapy (PET) and Cognitive Processing Therapy (CPT). Psychopharmacological agents such as selective serotonin reuptake inhibitors (SSRI) have been identified as appropriate treatments. Additionally, Ambien and Prazosin have been identified as useful models for sleep disturbance and nightmare reduction respectively. Further models such as Acceptance and Commitment Therapy (ACT) and Complementary and Alternative Medicine (CAM) may yield promising treatments.	Successful treatment is correlated with improvement in functioning across multiple domains. Often individuals with Posttraumatic Stress Disorder hope that treatment will conclude with them feeling as though the trauma had never happened. This treatment goal is rarely realized. Treatment models that are successful reduce avoidance of feared stimuli, reduce re-experiencing of the event, reduce hyperarousal and bio-physiological reactivity. As a result anxiety and distress are reduced. Successful treatment results in individuals able to engage in their lives and experience significantly reduced distress. It should be noted that relapses, especially around anniversaries or strong reminders of the event may occur and result in a renewed need for treatment.

Fig. 12.1 post-traumatic stress disorder assessment and treatment model

TBI Assessment and Treatment Model

Event	Assessment	Treatment	Clinical Outcomes
TBI may be caused by multiple types of impacts or insults to the head. In the civilian population, TBI is most frequently associated with motor vehicle accidents, falls and assaults. In the military population, currently blast exposure is the most frequent cause of TBI. Other causes of injury are motor vehicle accidents and bullet/shrapnel wounds.	Assessment for TBI includes multiple steps: While most TBI cases are mild in nature and full recovery is expected within hours to days, moderate, severe or penetrating TBI may also be present. Initial screening for a TBI should be completed using the Military Acute Concussion Evaluation (MACE). A positive diagnosis can be made from the history section of the MACE. Further evaluation can be made using an automated neuropsychological test assessing cognitive performance across multiple domains. Follow up assessment can include use of the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS).	Treatment for TBI is a fairly straightforward endeavor. Generally, recovery is assisted by rest and access to a quiet environment as well as pain medication that does not impact clotting. Individuals who continue to experience problems secondary to TBI including: pain, balance, agitation, cognitive impairment and memory problems may be offered alternative treatment models. These models include use of the triptan medications for pain, hyperbaric oxygen treatment and cognitive rehabilitation. Further treatment models continue to be explored.	The majority of individuals with TBI are expected to make a full recovery within hours to days of the injury. Further recovery may take several weeks to months; however expectation of recovery is critical to a positive recovery curve. Full recovery is associated with return to function akin to function before the injury. Research continues to examine TBI, looking at questions such as the impacts of multiple TBI.

Fig. 12.1 (continued)

In a subsequent review paper developed by McMillan et al. (2003), the authors advocate for the use of CBT for the treatment of post-traumatic stress disorder following TBI citing four case studies and one quasi-experimental design that demonstrated efficacy for the approach. The authors state: "CBT may be of particular value to people with cognitive disability because it is structured, educative, and interactive."

Adjunctive problem-focused methods and services commonly offered to individuals suffering from TBI alone might also prove useful for individuals presenting with both post-traumatic stress disorder and TBI. Examples are patient/caregiver education, self-care and independent living skills training, referral to supported housing services, family skills training, social skills training, vocational rehabilitation, case management, religious/spiritual advisement, and substance abuse treatment (Kennedy et al. 2007).

Some pharmacotherapy interventions may target co-occurring symptoms of TBI and post-traumatic stress disorder. Shared symptoms of irritability, flash anger, and violent outbursts can be addressed with anticonvulsants (e.g., carbamazepine, gabapentin, valproate). Insomnia can be treated with the atypical antipsychotic Quetiapine (Kennedy et al. 2007). However, Kennedy and colleagues were quick to point out that individuals suffering from TBI may be more sensitive to both side and primary effects of medications, and therefore the introduction of pharmacotherapy to any patient with TBI should be made with lower starting doses and close observation while gradually increasing the dosage to therapeutic levels. The authors also note a paucity of literature examining the utility of combined pharmacotherapy and psychotherapy for the treatment of concurrent TBI/post-traumatic stress disorder.

Taber and Hurley (2009) advocate for use of therapeutic interventions that involve rescripting or reprocessing approaches for individuals suffering concurrently from post-traumatic stress disorder and TBI. These approaches focus less on the traumatic event, which for sufferers of TBI can be helpful in cases of LOC or amnesia for the traumatic event; instead the focus is directed at reducing self-directed attributions of shame, guilt, and anger.

Summary and Recommendations

Lew et al. (2008) noted the following: "No empirically validated therapies exist to treat comorbid post-traumatic stress disorder, depression, and post-concussive disorders, which may be confounded by self-medicated alcohol/substance misuse, abuse, or dependence." It is proposed that clinicians who expect to work with individuals experiencing comorbid post-traumatic stress disorder and TBI may have to follow a model that specifically addresses the uniqueness of their patients (case conceptualization) while customizing a treatment that draws from both treatment literatures and is tailored to the unique symptom presentation of the patient (Fig. 12.1).

This chapter was designed to give mental health providers who work with veterans or recent combat deployers, and especially those providers working in austere environments, with a starting point for developing their own approach to the assessment and treatment of comorbid post-traumatic stress disorder and TBI. The discussion of prevalence rates indicates that post-traumatic stress disorder will present a challenge to almost any provider who works with a population that has endured multiple combat tours of duty. With respect to TBI, first responders and emergency trauma providers are almost certain to encounter cases of severe, moderate, and mild TBI; however, providers outside of casualty collection points are more likely to experience a heavier post-traumatic stress disorder than TBI caseload. For those presenting with TBI symptoms due to combat, providers should know that their patient has likely already met one of the criteria for post-traumatic stress disorder and may score high on Cluster D hyperarousal symptoms that emphasize some degree of cognitive impairment and sleep problems that logically follow some forms of TBI. Likewise, when a patient presents with elevated Cluster D symptoms on post-traumatic stress disorder assessments, the provider may give serious consideration to pursuing additional assessment to investigate the presence of TBI. In either case, professional clinical judgment buttressed by empirical evaluation of symptom patterns is warranted.

In closing, we strongly recommend that mental health practitioners who work with combat-deployed service members become familiar with and follow the guidelines for the treatment of patients with ASD and post-traumatic stress disorder (APA 2004). These guidelines are quite relevant for individuals at risk for TBI, as the guidelines emphasize the collection of a thorough history of traumatic events and evaluation for potential comorbid conditions. For those service members who (a) screen high for post-traumatic stress disorder using self-reported screening instruments, (b) are known to have a previous diagnosis of post-traumatic stress disorder, or (c) present with symptoms strongly indicative of post-traumatic stress disorder, an additional screen for a history of blast exposure or head injury requires few additional resources. Similarly, when combat-exposed service members report primarily with complaints of symptoms related to blast exposure or other head injuries, administration of a short post-traumatic stress disorder screening instrument, such as the PCL, has little risk with potentially important benefits. In this latter scenario, the provider may have to administer the screening instrument orally if the symptoms make self-report problematic. In either case, short screening questions aimed at determining a history of head trauma, combined with short, self-reported post-traumatic stress disorder screens, provide a logical, low-cost, low-risk means for determining which service members receive more thorough screening such as that prescribed by the APA.

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