APPENDIX B

Speech-Language Pathology

Clinical Management Guidance

Cognitive-Communication Rehabilitation

For Combat-Related

Concussion/Mild Traumatic Brain Injury

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Working Group to Develop Speech-Language Pathology Clinical Guidance for Cognitive-Communication Rehabilitation for Combat-Related Concussion/Mild Traumatic Brain Injury

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1. Development of Clinical Management Guidance (CMG)

1.1 Objective

This document was developed to provide speech-language pathologists (SLPs) with clinical guidance for cognitive-communication interventions for Active Duty (AD) Service Members and Veterans (SMs/veterans) with cognitive-communication deficits after concussion/mild traumatic brain injury (mTBI).

A clinical toolkit with resources and examples of educational, assessment, and treatment materials accompanies this document.

1.2 Scope/Target Population

This Clinical Management Guidance (CMG) is intended to address the cognitive-communication needs of SMs/veterans who: a) are 18 years or older, b) have a history of concussion/mTBI, and c) are three months or more post injury with persistent cognitive-communication symptoms.

This guidance does NOT address: a) interventions for moderate or severe traumatic brain injury (TBI) managed in an inpatient setting, or b) concussion/mTBI in the acute phase (<3 months post injury). The VA/DoD Clinical Practice Guideline for Management of Concussion/Mild TBI (April, 2009) recommends that, between 7 days and 3 months post-injury, concussion/mTBI symptoms be addressed through education and by setting expectations for full resolution of symptoms.

1.3 Approach

This document is offered as guidance for clinical decision-making. Recommendations are based upon reviews of: a) research literature; b) existing guidelines and documents; c) consensus recommendations of experts with clinical experience in cognitive-communication rehabilitation within the Department of Defense (DoD), Department of Veterans Affairs (VA), and academia; and d) feedback from patients who participated in cognitive-communication interventions.

A Working Group comprised of subject matter experts from the DoD, VA, and the civilian sector convened in three face-to-face meetings in September 2008, November 2008, and September 2009, and met biweekly via WebMeeting from February through August 2009 to discuss the charge, define the scope of work, formulate a plan to meet the charge, develop an outline of the SLP CMG, assign writing sections, discuss and refine drafts of the document, and finalize recommendations based upon suggestions from an expert review panel. The SLP CMG was revised in January 2011 and January 2012 based upon feedback from the Proponency Office for Rehabilitation and Reintegration, Health Policy and Services, Office of The Army Surgeon General (OTASG). In 2010, the SLP Working Group was invited by OTASG to collaborate with occupational and physical therapists to develop the cognitive-communication section of the companion mTBI rehabilitation toolkit. The final draft of the toolkit was completed in March 2012.

1.4 Evidence-Based Practice

Evidence-based practice is an integration of: 1) best available current evidence, 2) clinical expertise, 3) clinical judgment, and 4) patient/family preferences and values with the goal of providing high-quality services reflecting the interests, needs, and choices of the individuals served (ASHA, 2005; Montgomery & Turkstra, 2003). References in this CMG, were shaped by the consensus conference on cognitive rehabilitation conducted by the Defense Center of Excellence for Psychological Health and Traumatic Brain Injury (DCoE) and the Defense and Veterans Brain Injury Center (DVBIC) (Helmick, 2010), and the "VA/DoD Clinical Practice Guideline for Management of Concussion/Mild Traumatic Brain Injury" (April 2009). The literature review was inclusive of research on moderate and severe TBI since studies specific to the mTBI population are sparse. Likewise, research on concussion/mTBI incurred in civilian settings (e.g., from sports injuries or motor vehicle crashes) was included in the review because literature on combat-related concussion/mTBI is still emerging. Despite differences between mTBI and moderate-to-severe TBI, as well as between concussion/mTBI sustained in combat versus civilian life, crossover of effectiveness of intervention strategies is reasonably expected. Recommendations also evolved through a consensus process for areas where research does not exist, is not sufficient, or is not of high quality. It is important to appreciate that insufficient evidence for the efficacy of cognitive-communication intervention with the mTBI population should not be interpreted as evidence for the lack of efficacy of such treatments (Ruff & Jamora, 2009; Institute of Medicine, 2011).

The SLP CMG document was reviewed by a panel of experts including: a) three SLPs with distinguished research careers, clinical expertise, and publications as subject matter experts in cognitive-communication rehabilitation for individuals with brain injury, b) a physiatrist/audiologist/researcher who serves as chair of an academic program in Communication Sciences and Disorders and as a consultant to the Defense and Veterans Brain Injury Center, and, c) a U.S. Army S3 Operations Officer who earned advanced degrees at the Command and General Staff College and the School of Advanced Military Studies after completing cognitive-communication rehabilitation and treatment for polytrauma injuries sustained during his deployment in Iraq.

1.5 Overview of Process

The following describes the process of developing and disseminating this CMG:

Phase 1: Define scope of work; identify best practices based on review of literature; solicit expert advice; conduct focus group with SM/veteran stakeholders; draft outline of document; determine the need for and identify additional subject matter experts; assign writing tasks and determine timeline for task completion.

Phase 2: Draft recommendations for each aspect of care based on review of literature and expert opinion; request funding for face-to-face meeting to finalize document.

Phase 3: Integrate feedback from external subject matter experts; finalize recommendations; explore avenues for continued support for project development and dissemination of outcomes; submit CPG document to the Office of the Surgeon General (OTSG) and the Veterans Health Administration (VHA).

Phase 4: Develop clinical toolkit; develop educational and mentoring programs to disseminate CPG; survey impact of CPG.

1.6 Overview of Format

This SLP CMG provides: 1) background of the target population including mechanisms of injury, co-morbidities, special aspects of mTBI in the military population; 2) overview of cognitive-communication deficits, and assessment and treatment modules for SMs/veterans with mTBI. Modules include background information (introduction/rationale), an "Action Statement" (summary/charge), recommendations, and discussion (literature synopsis to support recommendations).

2. Key Elements Addressed in the CMG

The following statements provide a summary of the key elements covered in this guidance. The CMG will provide the rationale, references, and more information for each of these statements.

2.1 Background of Mild Traumatic Brain Injury (mTBI) and the Military Experience

- Mild TBI, also known as concussion, is the most frequent type of brain injury in the civilian population. It is also one of the "invisible injuries" experienced by SMs who served the two theaters of operation in Iraq [Operation Iraqi Freedom (OIF)] which ended in December 2011, and Afghanistan [Operation Enduring Freedom (OEF)].
- Blasts are a leading cause of TBI for AD military personnel in war zones. The mechanisms of blast-related TBI may include both high-force blast waves and external force application.
- The diagnosis of mTBI is based on the injury event and the alteration of mental state immediately following the event.
- The recovery trajectory from mTBI sustained in combat may be different from that of the civilian cohort. The high incidence of blast-related mTBI, multiple injuries, and co-morbidities, particularly the psychologically traumatic component, complicate recovery from wartime mTBI.
- Symptoms associated with concussion are not specific to mTBI. They can occur in persons with other conditions such as chronic pain or depression, and can also be found in healthy individuals.
- DoD and VA have implemented TBI screening processes to help identify persons with possible TBI and provide appropriate services.

2.2 Cognitive-Communication Sequelae of mTBI and the Role of Speech-Language Pathologists (SLPs)

- Persistent mTBI symptoms may include cognitive-communication deficits that can cause significant functional disability.
- Cognitive-communication difficulties related to mTBI persisting beyond the acute phase of injury (3 months) should be assessed and treated symptomatically regardless of the time elapsed since injury or the confirmed etiology of the complaint.
- SLPs have a unique role in assessing and treating cognition as manifested through spoken and written communication (i.e., cognitive-communication symptoms).
- SLPs who provide cognitive-communication services to SMs/veterans with mTBI should be competent in brain injury rehabilitation and military/veteran culture and capable of developing a therapeutic alliance with their patients.
- It is essential that DoD and VA medical facilities recruit, train, and retain SLP providers with specific TBI expertise. Additionally, continued professional education in the areas of assessment and treatment of TBI and associated conditions is an ongoing need.

2.3 Assessment of Cognitive-Communication Disorders in the Target Population

- Speech-language pathology (SLP) screenings are used to identify individuals with potential cognitive-communication symptoms.
- A comprehensive assessment helps to determine the nature of the problem, establish the clinical indications for rehabilitation, and develop a treatment plan.
- Assessment tools should include standardized performance and self-report measures. These tools serve to determine the level of cognitive-communication functioning of the individual and to develop measurable treatment goals.
- To the extent possible, the cognitive-communication screening and evaluation should be incorporated into a comprehensive assessment process conducted by an interdisciplinary rehabilitation team.
- Upon completion of the assessment, the SLP (or interdisciplinary team, when available) should be able to determine the following:
  - What is the nature of the cognitive-communication deficits, if present?
  - Is cognitive rehabilitation needed? Warranted?
  - What kinds of rehabilitation interventions are recommended?
  - What are the short- and long-term goals (functional and measurable)?
- If, at any time after cognitive-communication problems are identified, the SM/veteran does not choose to engage in treatment, information should be made available to enable him/her to contact the appropriate DoD or VA medical facility for follow-up in the future.

2.4 Treatment of Cognitive-Communication Disorders in the Target Population

- Cognitive-communication rehabilitation should be grounded in scientific evidence including theoretical foundations of brain-behavior relationships, cognition, communication, neuroplasticity, learning theories, behavioral modification, and counseling.
- Clinical experience in treating SMs/veterans suggests that a comprehensive holistic approach that integrates treatment of cognitive-communication, emotional, and interpersonal skills is a "best practice model" for the rehabilitation of mTBI sequelae.
- Cognitive-communication rehabilitation is most effective when provided as part of an interdisciplinary team (IDT) approach. Alternatively, cognitive treatment can be offered as a discrete therapy, often assigned to SLP.
- Group treatment, in addition to individual treatment, provides a supportive context for rehabilitation and reinforces the concept of unit cohesion in military and veteran culture.
- The following are identified as potential areas for cognitive-communication interventions:
  - Education about mTBI symptoms and recovery patterns that should target normalizing symptoms and recommending techniques to manage stress;
  - Direct attention training;
  - Selection and training of assistive technology for cognition, including devices to compensate for memory deficits;
  - Metacognitive strategy training;
  - Social communication training;
  - Environmental modification and strategy training to support re-entry into community and vocational/educational activities.

- Treatment should address the unique needs of military and veteran populations with reference to returning to duty or work, balancing military and family relationships, readjusting to civilian life, and considering risk for post-traumatic stress and other co-morbidities.
- Cognitive-communication treatment goals, strategies, intensity, and duration of treatment should be based on the individual functional needs of the SM/veteran and reasonable expectations of improvement with treatment.
- Involvement of family members and the SM's Command is highly encouraged to optimize treatment outcomes.

2.5 Return to Duty and Community Re-entry

- Across each phase of treatment, identifying, assessing, and addressing community reintegration needs are key to successful transition and community reintegration.
- Discharge from cognitive-communication rehabilitation should be considered when the SM/veteran no longer requires the facilities, skills, and therapeutic intensity of SLP interventions to make progress and meet his/her cognitive-communication needs for social, vocational, and avocational activities.
- Follow-up visits should be scheduled, whenever possible, to monitor the transfer of treatment gains into the community environment, to refine strategies established in therapy, and to provide additional support, as necessary.
- Use of telehealth technologies can facilitate transition of care and treatment follow-up, and return of Reservists and National Guardsmen to their local communities.

3. Background of mTBI/Target Population

3.1 Definition of Traumatic Brain Injury (TBI)

Traumatic brain injury (TBI) refers to a traumatically induced structural injury and/or physiological disruption of brain function as a result of an external force that is indicated by new onset or worsening of at least one of the following clinical signs, immediately following the event (VA/DoD, 2009):

- Any period of loss of or a decreased level of consciousness (LOC);
- Any loss of memory for events immediately before or after the injury (post-traumatic amnesia [PTA]);
- Any alteration in mental state at the time of the injury (confusion, disorientation, slowed thinking, etc.) (Alteration of consciousness/mental state [AOC]);
- Neurological deficits (weakness, loss of balance, change in vision, praxis, paresis/plegia, sensory loss, aphasia, etc.) that may or may not be transient;
- Intracranial lesion.

External forces may include any of the following events:

- The head being struck by an object, the head striking an object,
- The brain undergoing an acceleration/deceleration movement without direct external trauma to the head,
- A foreign body penetrating the brain,
- Forces generated from events such as a blast or explosion, or other forces yet to be defined.

TBI severity is divided into mild, moderate, and severe categories, based on the length of LOC, AOC, or PTA, and the Glasgow Coma Scale results. Table B.1 summarizes the classification of TBI severity (VA/DoD, 2009).

Table B.1. Classification of TBI Severity (VA/DoD Clinical Practice Guideline for Management of Concussion/mTBI, 2009)

Criteria	Mild	Moderate	Severe
Structural imaging	Normal	Normal or abnormal	Normal or abnormal
Loss of Consciousness (LOC)	0-30 min	>30 min and <24 hrs	>24 hrs
Alteration of consciousness/ mental state (AOC)*	a moment up to 24 hrs	>24 hrs Severity based on other criteria	
Post-traumatic amnesia (PTA)	0-1 day	>1 and <7 days	>7 days
Glasgow Coma Scale (best available score in first 24 hrs)	13-15	9-12	<9

**Alteration of mental state must be immediately related to the trauma to the head. Typical symptoms would be looking and feeling dazed and uncertain of what is happening, confusion, difficulty thinking clearly or responding appropriately to mental status questions, and being unable to describe events immediately before or after the trauma event.*

A TBI resulting from an object passing through the skull into the brain, such as a bullet or fragments from an explosion, is called a penetrating brain injury. Penetrating brain injuries are classified as severe.

Each year in the United States, approximately 1 to 2 million people sustain a TBI (Thurman, Alverson, Dunn, Guerrero, & Sniezek, 1999); approximately 75% of patients who sustain TBI have mild TBI (Centers for Disease Control and Prevention (CDC), 2003).

3.2 mTBI or Concussion

The terms *mild TBI (mTBI)* and *concussion* are used interchangeably in this and other DoD and VA guidance documents (VA/DoD, 2009). Concussion/mTBI may result when injury triggers a pathologic neurochemical cascade but is insufficient to produce widespread neuronal dysfunction or the diffuse axonal disruption that characterizes more severe brain injuries (Silver, McAllister, & Arciniegas, 2009). In mTBI, there is often an absence of structural injury that can be reliably detected with conventional clinical neuroimaging. The formal definition of mTBI by the American Congress of Rehabilitation Medicine (1993) is presented in Table B.2.

Table B.2. Diagnostic Criteria for Mild Traumatic Brain Injury (American Congress of Rehabilitation Medicine, 1993)

I. Traumatically induced physiologic disruption of brain function as indicated by at least one of the following:

A. Any period of loss of consciousness
B. Any loss of memory for events immediately before or after the accident
C. Any alteration in mental state at the time of the accident
D. Focal neurologic deficits that may or may not be transient

II. Severity of the injury does not exceed:
A. Loss of consciousness of 30 min
B. GCS score of 13-15 after 30 min
C. Post-traumatic amnesia of 24 hr

3.3 Mechanisms of Injury in TBI

For the general population, the most common means of sustaining a TBI is through falls. Data from the CDC indicate that falls account for 28% of all reported TBIs. Following falls are motor vehicle-related incidents (20%). These include all incidents involving motor vehicles, bicycles, pedestrians, and recreational vehicles. Firearm use is the leading cause of death related to TBI (CDC, 1999). Blasts in combination with other mechanisms are a leading cause of TBI for AD military personnel in war zones (Warden, 2006).

Brain injuries can be classified as focal, diffuse, or mixed depending on the mechanism of injury and the host response. Focal damage, such as contusion or hematoma, can be appreciated by standard neuroimaging studies such as computed tomography (CT) or magnetic resonance imaging (MRI). Widespread disruption of neuronal circuitry or *diffuse axonal injury* (DAI) can be difficult to detect on standard neuroimaging. It is possible to have both focal and diffuse injuries from a single traumatic incident.

Focal lesions are usually the result of direct impact of the brain against the cranium, most often from impact with the frontal and temporal bones or the occipital bone. Focal injuries may also occur in penetrating TBI resulting from gunshot wounds, fragments, or missiles. The anterior and inferior frontal and temporal areas of the brain are those most commonly and most severely affected by impact forces (Bigler, 2007). Inertial and particularly rotational forces stretch and strain white matter in these and other areas (the upper brainstem, the parasagittal white matter of the cerebrum, the corpus callosum, and the gray-white matter junctions of the cerebral cortex), resulting in diffuse (or, more accurately, multifocal) axonal injury (Meythaler, Peduzzi, Eleftheriou, & Novack, 2001).

Traumatic brain injury is a frequent injury among U.S. military and civilian personnel who served in Iraq and Afghanistan (Hoge et al., 2008; Tanielian & Jacox, 2008; Terrio et al., 2009; Warden, 2006). The DoD and VA have implemented TBI screening procedures to help identify persons with possible TBI and to ensure that SMs/veterans receive appropriate follow-up services. The TBI screen consists of identifying any injury that resulted in an alteration of consciousness and determining current symptoms. SMs/veterans with positive TBI screens are then evaluated with a clinical interview to establish the TBI diagnosis and to make appropriate referrals. For OEF/OIF veterans entering the VA system

of care, similar screening occurs upon presentation for medical care, regardless of entry portal. The purpose of this screening is to identify those in need of ongoing TBI related services.

Points to Remember

- Falls and motor vehicle crashes (MVCs) are the most common causes of TBI in the general population.
- Brain injuries can result in diffuse axonal injuries, focal lesions, or both depending on the mechanism of injury and the host response.
- Diffuse axonal injury results from inertial (rotational acceleration-deceleration) forces.
- Focal injuries are typically due to a direct blow to the head or penetrating head injury.
- DoD and VA have implemented TBI screening processes to help identify persons with possible TBI and initiate appropriate services.

3.3.1 Blast-Related mTBI

Blast-related mTBI is among the most common injuries experienced by U.S. military and civilian personnel who served in Iraq and Afghanistan. Data based on self-reports indicate that approximately 15% to 22% of troops deployed in OIF/OEF may have suffered a mTBI as a result of exposure to improvised explosive devices (IED) (Hoge et al., 2008; Tanielian & Jacox, 2008; Terrio et al., 2009; Warden, 2006).

Explosive mechanisms (e.g., IEDs, landmines, rocket-propelled grenades) account for 78% of injuries in servicemen and women injured in Afghanistan and Iraq, which is the highest proportion seen in any large-scale conflict (Owens et al., 2008). While blast-related injuries are not new, it is the use of IEDs with ever-increasing amounts of explosive (and sometimes toxic) materials that have become the hallmark of OEF/OIF.

IEDs and other explosive munitions can cause injury via high-force blast waves (primary blast injuries); or by penetration of expelled missile fragments (secondary injuries); or by being forcefully thrown against hard surfaces, or being crushed by collapsing objects (tertiary injuries); or from inhalation of gases and vapors or from anoxic injuries (quaternary blast injuries) (DePalma, Burris, Champion, & Hodgson, 2005; Taber, Warden, & Hurley, 2006). As such, exposure to blast-level forces can result in a multitude of injuries, including damage to internal organs, multiple fractures, amputations, burns, and TBI.

The effects of the high-force blast waves in the brain have received increased scrutiny in recent years. Primary blast most often damages air-filled organs, such as the lungs, colon, and the ear; or those filled with fluid, such as the eyes (DePalma et al., 2005). The effect of blast on the brain is more uncertain. The Institute of Medicine (2008), weighed on the side of accepting "biologic plausibility" of blast induced neurotrauma, and concluded that rigorous human studies are needed to examine the consequences of these injuries, their recovery trajectory, and factors that determine their outcome. In contrast to injury from the primary blast, secondary and tertiary blast injuries are mechanical injuries and would therefore likely be physiologically similar to brain injuries sustained from falls or MVCs.

The potential neuropsychological implications of exposure to blast are still uncertain. The existing TBI literature was created almost exclusively using data from individuals having sustained TBIs from blunt force trauma. Preliminary studies seem to indicate that neuropsychological consequences of blast related TBI are not very different from those of non-blast related TBI. Sayer et al. (2008) found that the mechanism of

injury did not predict outcomes, such as changes in motor or cognitive functioning, as measured by the Functional Independence Measure. More pointedly, Belanger et al. (2009) suggest that cognitive sequelae following TBI are determined by severity of injury rather than the mechanism of injury. Overall, current literature does not provide strong evidence that blast is categorically different from other mechanisms of TBI, at least with regard to cognitive sequelae.

Points to Remember

- Blast exposure is one of the common causes of TBI in combat zones.
- The mechanisms of blast-related TBI can include both high-force blast waves and external force application.
- Preliminary data indicate that the neuropsychological effects of blast related TBI are not categorically different from those of non-blast related TBI.

3.3.2 Multiple mTBIs

A study of the Navy-Marine Corps Combat Trauma Registry revealed that the battle-injured were more likely than those injured outside of battle to have multiple TBIs (Galarneau, Woodruff, Dye, Mohrle, & Wade, 2008).

Most of the data regarding the impact of multiple concussions is derived from the sports literature, which suggests a possible cumulative effect of multiple concussions (De Beaumont, Lassonde, Leclerc, & Theoret, 2007; Pontifex, O'Connor, Broglio, & Hillman, 2009). With regard to long-term outcomes, the threshold for frequency and severity of concussion has yet to be established. There is concern that a second concussion prior to complete recovery from the first injury may pose increased risk for poorer eventual functional and vocational outcome and greater symptoms than would be expected from either of the injuries separately (Macciocchi, Barth, Littlefield, & Cantu, 2001).

Finally, the cumulative effect of two or more TBIs that occur well after full recovery from the initial injury may still result in worsened outcomes and greater symptoms than would otherwise have been expected with either injury in isolation (Iverson, Gaetz, Lovell, & Collins, 2004). Multiple mTBIs are of particular concern in the veteran population and current military cohorts given their exposure to multiple combat-related events that can result in brain injury.

Points to Remember

- Incidence of multiple concussions is higher in combat-injured veterans than in those injured outside battle.
- There is growing evidence of negative effects of multiple concussions on long-term neuropsychological outcomes.

3.4 The Natural History of mTBI

Immediately following mTBI, cognitive, emotional, behavioral, physical, and psychosocial problems are frequent and may be a source of temporary disability and stress for TBI survivors. The overwhelming majority of people who sustain mTBI recover fully in a matter of days to a couple of months (Dikmen, Machamer, & Temkin, 2001). Some, however, may develop chronic neuropsychological problems and significant disability

(Vanderploeg, Curtiss, Luis, & Salazar, 2007). It is not clear how long it takes to recover from mTBI, what the predictors of positive or negative outcomes are, and what treatments best promote recovery.

A large number of studies and several recent meta-analyses have shown that trauma patients and athletes often report extensive symptoms and perform poorly on neuropsychological tests in the initial days and up to the first month following the mTBI (McCrea et al., 2003; Carroll, Cassidy, Holm, Kraus, & Coronado, 2004; Belanger & Vanderploeg, 2005). Headache is the most commonly reported symptom in mTBI, with dizziness also frequently reported. Immediate symptoms such as nausea, vomiting, and drowsiness are typically short-lived. Other possible symptoms include decreased concentration, slowed information processing speed, fatigue, and irritability. Most severe symptoms occur immediately after the injury. Within a week to one month from injury, the vast majority of people with mTBI return to baseline level on neuropsychological testing (McCrea et al., 2003).

A small minority of people, estimated at approximately 5% (McCrea, 2008) to 15% (Helmick, 2010; Ruff & Jamora, 2009) continue to exhibit physical, cognitive and/or behavioral symptoms for more than three to six months after injury. These are known as post-concussive symptoms (PCS). If symptoms continue beyond 12 months post-injury, the term *persistent* post-concussion symptoms can apply. When distant from the time of the injury, PCS tend to be non-specific and the etiology is not always clear. It is important to note that mTBI is not the only predictor of PCS. Multiple factors including demographic, psychiatric, and social support variables, and mTBI co-morbidities and their interactions all contribute to ongoing PCS in persons with mTBI (Vanderploeg, Belanger, & Curtis, 2009).

The most common system for defining and diagnosing post-concussion syndrome comes from the 10th edition of the International Classification of Diseases (ICD-10). See Table B.3.

Table B.3. ICD-10 Diagnostic Criteria for Post-Concussion Syndrome

A. A history of head trauma with loss of consciousness precedes symptom onset by maximum of four weeks.
B. Symptoms in three or more of the following symptom categories: • Headache, dizziness, malaise, excessive fatigue, noise intolerance • Irritability, depression, anxiety, emotional lability • Subjective complaints of concentration or memory difficulty • Reduced alcohol tolerance • Preoccupation with above symptoms and fear of brain damage

Several points related to the ICD-10 criteria warrant further discussion. First, it is not clear what the minimum threshold for injury is that would result in post-concussion syndrome. There is general acceptance in clinical practice and research that mTBI can occur without loss of consciousness. In such cases, it becomes difficult to determine whether a "being dazed and confused" episode is causally related to PCS

occurring many months after the injury. At the same time, there is now substantial literature showing that PCS are not specific to brain injury. Rather, PCS occur among individuals with various medical and psychological disorders (Hoge et al., 2008) and even in the healthy population (Vasterling et al., 2006).

The nature of treatment for concussion/mTBI symptoms depends on the time post-injury when the patient enters clinical care. In the acute phase of uncomplicated TBI (<3 months), treatment typically includes education, counseling, and a period of rest and observation. Education regarding fatigue, irritability, and mood lability that may occur during recovery has been shown to facilitate improvement and lessen the likelihood that the patient develops persistent PCS (Mittenberg, Tremont, Zielinski, Fichera, & Rayls, 1996). Recommendations regarding return to partial or full-time work are tailored to the individual depending on the speed of recovery.

Symptomatic interventions for cognitive-communication difficulties related to PCS (>3 months post injury) can be effective in lessening the functional impact of the disability. There is increasing evidence that functional improvements may continue years post-injury and that SMs/veterans can be effectively supported through active treatment (Draper & Ponsford, 2008). Additionally, interventions to reduce the level of functional disability caused by cognitive-communication symptoms should be considered irrespective of whether the etiology of the symptoms can be teased out among presenting co-morbidities (Cornis-Pop, 2008).

Points to Remember

- The overwhelming majority of people who suffer mTBI recover fully in a matter of days to months.
- Approximately 5% to 15% of all individuals who sustain mTBI may experience prolonged symptoms and require ongoing medical care.
- PCS typically are not specific to brain injury, and therefore are difficult to assess and treat.
- Educational intervention in the acute phase of mTBI can significantly reduce the extent of post-concussive symptoms.
- Cognitive-communication difficulties related to PCS should be assessed and treated symptomatically regardless of the time elapsed since injury or the etiology of the complaint.

3.5 Co-Morbidities of mTBI – The Military Experience

The same combat exposure that causes mTBI may also result in other co-morbidities. In contrast to civilian settings, recovery from combat-related concussion/mTBI is complicated by at least four factors:

1. The physically and emotionally traumatic circumstances in which injuries are sustained;
2. The potentially repetitive and cumulative nature of concussions sustained over a tour (or multiple tours) of combat duty;
3. The high incidence of co-morbid mental health conditions (Tanielian & Jacox, 2008; Hoge et al., 2008);
4. The difficulty in following typical recommendations for post-concussion care (e.g., rest) in the deployed setting.

Common post-deployment co-morbid conditions, such as post-traumatic stress disorder (PTSD), pain conditions, amputations, acute stress reactions, and substance use also can result in symptoms overlapping with TBI. Mental health co-morbidities are common in the SM/veteran

population including PTSD, depression, anxiety, and somatoform disorders. Other complications include frequent auditory and visual dysfunction and exacerbations of pre-existing conditions.

In addition to the co-morbid conditions, returning SMs/veterans presenting to military or VA healthcare facilities often have numerous psychosocial and financial stressors. The normal psychological adaptations that occur in a theatre of war are referred to as "battlemind." Readjustment from a "battlemind" state to a civilian mind-set and environment is neither instantaneous nor easy for individuals returning home (Munroe, 2005).

It is reasonable to assume that the overall recovery process is more complicated and prolonged in OEF/OIF veterans with mTBI and co-morbid conditions than in veterans without these conditions, or than in civilians.

3.5.1 mTBI and Post Traumatic Stress Disorder (PTSD)

Recent combat service is frequently associated with TBI, PTSD, and depression. In the RAND study (Tanielian & Jacox, 2008), 37.4 percent of those individuals with an mTBI history also had either PTSD or depression. Similar findings are reported in a VA study in which 42 percent of OEF/OIF veterans with an mTBI history also had PTSD symptoms (Lew, Poole, et al., 2007). Hoge et al. (2008) also found that more than 40% of soldiers who had symptoms associated with mTBI with loss of consciousness also met criteria for PTSD.

Overlapping symptoms impede understanding of the relationship between PTSD and mTBI (Hoge et al., 2008). Because cognitive impairments such as decreased memory and attention/concentration can occur in mTBI, depression, and PTSD, it can be difficult to determine the presence or absence of an independently recognizable, "pure" post-concussion syndrome. The symptoms of co-morbid PTSD (associated with intrusive thoughts, concentration difficulty, and poor sleep) interfere with normal cognitive functioning. On the other hand, the cognitive impairment and emotional dyscontrol associated with mTBI are detrimental to the resilience essential to overcoming PTSD (Vanderploeg et al., 2009).

For individuals with co-morbid mTBI and PTSD, studies have shown that established treatments for PTSD may need to be modified given the potential interference of TBI-related cognitive compromise. Vanderploeg et al., (2009) showed that the combination of mTBI and PTSD is associated with more complicated and prolonged recovery and that there are no empirically validated treatments for this population. The appropriate timing of treating either co-morbidity is a matter of clinical judgment - one size does not fit all (Knight, 2008). When symptoms of PTSD and mTBI co-exist, they can be addressed sequentially or concurrently. If a determination is made to address them sequentially, arguments can be made to treat one first over the other. The choice will depend in large measure on the amount of distress experienced and the person's tolerance within sessions and between sessions. A "best practice model" would require engaging the SM/veteran in coordinated treatment of both PTSD and mTBI sequelae (Vanderploeg et al., 2009).

3.5.2 mTBI and Depression

After mTBI, as individuals attempt to return to their prior roles, physical and cognitive difficulties may become more apparent and, consequently, psychological adjustment problems may develop leading to depression. Estimates of post-traumatic depression range from 10%

to 77% (Alderfer, Arciniegas, & Silver, 2005). The risk of developing depression is higher in the first year after TBI, but it remains elevated in later years.

As with mTBI and PTSD, the interaction between co-morbid mTBI and depression is bi-directional. Depression has been shown to be associated with an increase in the number and perceived severity of mTBI symptoms. Co-morbid depression may also increase anger, aggression, the risk of suicide, and cognitive dysfunction (Fann, Katon, Uomoto, & Esselman, 1995). Alternatively, impaired daily functioning and the experience of other psychosocial changes after mTBI may exacerbate depressive symptoms (Pagulayan, Hoffman, Temkin, Machamer, & Dikemen, 2008).

Other factors such as sleep disturbance, fatigue, problems with concentration, and apathy may produce apparent depressive symptoms. However, when there are sufficient symptoms to merit a diagnosis of depression—regardless of the possible causes—treatment should be promptly initiated both to improve mood and to mitigate its adverse effects on cognitive, behavioral, physical, and psychosocial functioning (Fann, Uomoto, & Katon, 2001).

3.5.3 mTBI and Headaches/Pain

Pain is common in SMs/veterans with mTBI. Headache is the most frequent pain complaint, but other pain sources, either musculoskeletal or neuropathic, also occur. Post-traumatic headaches develop within seven days of head trauma in up to 90% of all individuals who sustain a concussion (Lew et al., 2006). Most post-traumatic headaches resolve within three to six months following injury. However, chronic headaches beyond one year post-injury may be present in 50 to 93% of OEF/OIF SMs/veterans with mTBI (Hoge et al., 2008; Ruff, Ruff, & Wang, 2008).

Evaluating pain and treating it symptomatically is important as pain is associated with poor outcomes in TBI. Treatment depends on the etiology of the pain and should focus on interventions that are least likely to cause cognitive side effects and abuse. Specific treatment options include short-term use of medication, conventional physical therapy, biofeedback, and psychotherapy for the development of coping techniques. The use of cognitive behavioral therapy may be effective, but more difficult to use in SMs/veterans with TBI due to cognitive demands (Scholten & Walker, 2009). With such individuals, a holistic approach to rehabilitation, where cognitive behavioral therapy is provided in the broader context of a team based cognitive rehabilitation, could be a "best practice model."

3.5.4 mTBI and Substance Abuse

Substance use disorders and TBI may occur together. Alcohol use may be a cause and also a consequence of TBI. Alcohol use is a recognized risk factor for motor vehicle injuries, falls, and violence, all of which are frequent causes of TBI. Studies have shown that one-third to one-half of persons with TBI are intoxicated at the time of their injuries (Parry-Jones, Vaughan, & Cox, 2006). Alcohol use may also persist after TBI. While drinking may initially decrease after the TBI event, it has been shown to increase by two years post-injury in many individuals (Ponsford, Whelan-Goodinson, & Bahar-Fuchs, 2007). Neurological deficits associated with TBI may explain the increased susceptibility of individuals with TBI to substance use disorders.

The goals of therapy for TBI and substance use disorders may be viewed as complementary. Enhancing the ability of SMs/veterans to cope with cognitive and emotional impairments associated with TBI is also critical for managing the patterns of behavior that sustain addiction. The complexity of co-occurring TBI and substance use disorders may necessitate the development of new treatment concepts to address these combined disorders (Corrigan & Cole, 2008).

3.5.5 mTBI and Sensory Impairments

Visual impairments occur in up to half of all individuals who sustain mTBI. Typical symptoms include sensitivity to light, diplopia, blurring of vision and other difficulties in visual acuity. In turn, these can cause pain, headache and eye ache. Visual symptoms of mTBI tend to resolve within a month from the time of the injury (Goodrich, Kirby, Cockerham, Ingalla, & Lew, 2007).

The visual impairments of mTBI may negatively impact the individual's ability to engage in education, employment, and activities of daily living. SLPs who provide services for individuals with mTBI should be observant for visual impairments and facilitate referrals to specialists. Treatments of visual difficulties generally target symptom management: reassurance, pain management, controlling environmental light, sunglasses, and intermittent patching for double vision (Brahm et al., 2009).

Hearing difficulties resulting from head trauma with damage to the auditory system can occur anywhere from the outer ear, middle ear, and inner ear to the auditory cortex. In studies of SMs/veterans with TBI, hearing impairments were reported in approximately 30% of SMs/veterans, and complaints of tinnitus were reported in approximately 25% {Jury, 2001 #101;Lew, 2007 #100}.

Injuries to the auditory system are common in individuals who sustained a blast-related concussion. Up to three-quarters of those with a blast-related concussion experience altered acuity and sensitivity to noise during the first month following the injury. The majority of those symptoms resolve, though complaints of hearing loss may persist well beyond the acute phase of the injury (Lew, Jerger, et al., 2007).

When hearing loss is suspected in an individual with a blast-related concussion, referrals should be initiated for complete otologic and hearing examinations. Recommended treatments include controlling environmental noise, using white noise generators, prescribing assistive listening devices and hearing aids, and counseling/education. The collaboration between SLPs and audiologists can be particularly effective when providing auditory training and rehabilitation services for SMs/veterans with hearing difficulties due to mTBI.

Points to Remember

- The same combat exposure that causes mTBI may also result in other co-morbidities, particularly PTSD.
- Common post-deployment issues, such as PTSD, pain conditions, acute stress reactions, depression, and substance use also can result in numerous symptoms overlapping with mTBI.
- It is reasonable to assume that the overall recovery process will be more complicated and prolonged in the OEF/OIF veterans with mTBI and co-morbid conditions.
- SLPs should be particularly vigilant for signs of vision, hearing, and vestibular impairments in the SM/veteran with TBI.

4. Special Aspects of mTBI in the Military Experience

4.1 Environment of Care – Echelons of Care

BACKGROUND

The United States has been engaged in military conflict in Afghanistan and Iraq since 2001. Improvements in body armor and advances in medical care have resulted in the highest survival rate of wounded SMs from any previous conflicts in U.S. history (Gawande, 2004). A study (Murray et al., 2005) found that 88% of military personnel treated at a medical unit in Iraq had been injured by IEDs or mortar. A VA-based study found that 56% of its war-injured sample had been injured by blasts (Sayer et al., 2008). Survival of the wounded SM has highlighted issues of TBI and PTSD in returning troops.

The true incidence of mTBI among military troops remains largely unknown, as many either do not seek immediate medical care or receive a diagnosis long after the injury, when the details of the event are more difficult to establish. There is no question, however, that mTBI is one of the most common injuries sustained by our Warriors (Helmick, 2010). Data from combat-exposed military personnel returning from Afghanistan and Iraq since 2001 report a 15% to 22% mTBI incidence rate (Hogue et al., 2008; Terrio et al., 2009).

Neurocognitive assessment is an important part of a comprehensive approach to care for mTBI in the theater of operations. Medics in the field screen troops for TBI using the Military Acute Concussion Evaluation (MACE) tool developed by DVBIC. The history component of this measure can confirm the diagnosis of mTBI and provide further assessment data by utilizing the Standardized Assessment of Concussion (SAC) (McCrea, Kelly, & Randolph, 2000) to preliminarily document neurocognitive deficits. The four cognitive domains tested are: orientation, immediate memory, concentration, and delayed recall.

The MACE is the recommended tool for use in theater at Levels I, II, and III. Level I is the Battalion Aide Station staffed by a Combat Medic and provides immediate treatment and transport. Both the medic and the casualty are still under fire and there is limited medical equipment available. Triage outcome at this level is either return to duty with minimal treatment, or evacuate to Level II echelon of care that ideally is less than one hour away.

Level II echelon of care generally comprises a Forward Surgical Team (FST) ranging from 5 to 20 personnel, including orthopedic and general surgeons, nurse anesthetists, critical care nurses and technicians. The team is able to perform life-saving resuscitative surgery. Evacuation to Level III echelon of care is up to 24 hours after injury and may take several hours of transport to access, depending on mode of travel and distance.

Level III is defined by a Combat Support Hospital (CSH), Navy ships, or Air Force Theater Hospitals which is capable of further definitive care, still rendered within the combat zone. The Level III team is capable of providing resuscitation, initial surgery, definitive and re-constructive surgery, post-operative care, and intensive care for either return to duty in theater or stabilization for further evacuation. Some facilities are quite large,

accommodating up to 300 patients in their full complement of intensive care unit (ICU) beds, intermediate care beds, ward care, and up to eight surgical tables. Within 48 to 72 hours, a strategic evacuation can be underway to the next level of care out of the combat theater.

When injuries are extremely severe, requiring Level IV echelon of care, evacuation can occur within 12 hours or less from the time of injury. Level IV is the definitive care stop at the general hospital that is en route to the continental United States (CONUS). For OEF/OIF this is Landstuhl Regional Medical Center (LRMC) in Germany. Level IV echelon of care treats complex injuries. The hospital is staffed and equipped for general and specialized medical and surgical care. Those SMs not expected to return to duty within the theater are stabilized and evacuated to CONUS. Those SMs who will be returned to duty within the theater are provided reconditioning and rehabilitative services. Virtually 100% of U.S. troops injured in OEF/OIF pass through LRMC before returning to duty or being transferred to CONUS medical facilities. When it is determined that the SM needs further evaluation and/or intervention and is not able to remain in combat, he/she is medically evacuated to one of four military treatment facilities (MTF) in the United States: Walter Reed Army Medical Center, Naval Medical Center Bethesda, Brooke Army Medical Center, or Naval Medical Center San Diego.

A recent advancement in the medical care provided at the front is the establishment of several Level 2 TBI Centers in theater that have the capacity to rehabilitate casualties who experience events associated with TBI. A group of specially trained experts evaluates blast injury patients within 24 hours of the injury to assess for indications of TBI with a battery of tests including hearing, vestibular function, and cognition. Cognitive exercises include memory quizzes and timed maze completion (Hoffer, 2009).

Early detection of the symptoms of mTBI has been promoted at all levels of military medical care, resulting in more immediate evaluation and treatment than ever before. All SMs with multiple injuries are screened for concussion and military medics and corpsmen are now being trained to assess for TBI on the battlefield.

4.2 Veterans Administration (VA) Polytrauma/Traumatic Brain Injury System of Care

BACKGROUND

Department of Veterans Affairs (VA) facilities may provide health care to SMs and their beneficiaries on a referral basis under the auspices of a sharing agreement. All VA facilities have been directed to become TRICARE network providers. This action has been taken to ensure VA's ability to meet its responsibility to provide timely care to SMs returning from theaters of war.

Additionally, there has been a long-standing Memorandum of Agreement (MOA) between VA and DoD for the provision of specialized care for SMs sustaining spinal cord injury (SCI), TBI, and blindness. VA is known for its integrated health care system for the treatment of these conditions. The MOA provides opportunities for AD military personnel to receive timely and high quality specialty care within a continuum of health care services dedicated to the needs of persons with SCI, TBI, and blindness.

VA receives referrals for health care services from MTFs or TRICARE Service Centers through clinical orders or authorization for care. The point of contact (POC) for VA-DoD issues at each VA facility receives and expedites referrals and transfers of care and ensures that the appropriate

linkage is made for the requested clinical services. It is VA policy that injured and ill SMs are transitioned seamlessly from MTFs to VA facilities and that the care of all SMs/veterans treated at VA facilities is coordinated, monitored, and tracked.

4.2.1 VA Polytrauma/TBI System of Care (PSC)

The VA Polytrauma/TBI System of Care (PSC) is a nationwide integrated system of more than 100 facilities with specialized rehabilitation programs for veterans and SMs. The mission of the PSC is to ensure that veterans and SMs have access to the full continuum of specialized rehabilitation services, case management, family education and support, psychosocial services, and community re-integration assistance.

PSC is organized into a four-tier system of hub and spokes facilities that include four Polytrauma Rehabilitation Centers (PRC) serving as regional referral centers for acute medical and rehabilitation care. They provide national leadership in clinical research, education, and training. The four PRCs are located at the medical centers in Richmond, Tampa, Minneapolis, and Palo Alto.

Polytrauma Network Sites (PNS) (22 sites) serve veterans/SMs in each of the Veterans Integrated Service Networks (VISN) and provide key components of post-acute rehabilitation care and case management. Services may be provided in inpatient, outpatient, and community-based settings.

Polytrauma Support Clinic Teams (PSCT) (82 programs) are responsible for managing veterans/SMs with TBI and polytrauma within their geographical catchment area. These teams address chronic and emerging medical and psychosocial problems that affect community re-integration.

Polytrauma Points of Contact (PPOC) (48 POCs) are designated at VA facilities without specialized rehabilitation capabilities. Their role is to manage referrals for TBI and polytrauma rehabilitation and to coordinate such services.

PSC either directly provides, or formally links with, key components of rehabilitation care including, but not limited to, inpatient rehabilitation, outpatient rehabilitation, emerging consciousness programs, transitional rehabilitation, day programs, and community re-entry programs. The hallmark of rehabilitative care in PSC is interdisciplinary team (IDT) interventions by specialists who work collaboratively to identify veterans' rehabilitation needs and to develop treatment plans to meet those needs. SLPs are core members of the IDT in PSC and provide a full range of services including swallowing, voice, language, and cognitive-communication interventions.

Cognitive rehabilitation for TBI sequelae is a well-established area of practice in the VA. These services are delivered by IDTs of rehabilitation specialists in a variety of settings including acute, transitional, outpatient, and re-integrated in the community. Cognitive rehabilitation can take many forms, including modeling, guided practice, distributed practice, errorless learning, direct instruction with feedback, neurofeedback (EEG biofeedback), computer-assisted retraining programs, and use of memory aids. The interventions can be provided in either one-on-one or in a small group setting. SLPs in the VA are active providers of cognitive-communication services and receive ongoing education and training to support them in this role.

4.2.2 TBI Screening and Evaluation in the VA

Since April 2007, all OEF/OIF veterans who come to the VA for health care services are screened for possible TBI. Veterans who screen positive are offered referral for a comprehensive medical evaluation and follow-up services, as indicated. Veterans who already have a TBI diagnosis may also be referred for further specialized evaluation and follow-up, depending on their established needs.

The TBI screening tool consists of four sections that address: (a) identification of events that increase the risk of TBI, (b) alteration of consciousness related to the event, (c) symptoms immediately following this event, and (d) current symptoms associated with TBI. If a person responds positively to one or more questions in each of the four sections, the screen is positive. Veterans who screen positive for TBI are offered referral for a comprehensive evaluation to confirm a diagnosis and to provide treatment and follow-up for associated symptoms. Completion of the comprehensive evaluation determines the presence of a TBI (vs. other causes for their symptoms) and assists with developing a treatment plan.

5. Cognitive-Communication Deficits in mTBI

BACKGROUND

Cognitive-communication deficits are observed when changes in cognition adversely affect communication and language abilities (ASHA, 2005). Cognitive deficits often result in communication impairment because of the complex, dynamic interactions among cognition, language, and speech. Linguistic processes are critical to the acquisition of knowledge and mediate cognitive processes (ASHA, retrieved 14 Jun 2009; Cicerone et al., 2000).

A pilot study was conducted with injured veterans, caregivers, and clinicians using semi-structured interviews to identify challenges faced by OEF/OIF veterans as they transition and reintegrate into their communities. Findings highlighted specific difficulties across three functional domains of the World Health Organization's International Classification of Functioning, Disability and Health (Resnik & Allen, 2007).

- Challenges in *communication* included: difficulties with word finding, sustaining a conversation, recalling conversations because of memory impairments, social pragmatics;
- Challenges in the areas of *learning and applying knowledge* included: acquiring complex skills, focusing attention, remembering important information, solving problems, reading lengthy and complex material, planning, participating and succeeding in learning activities and decision making, generating alternative solutions;
- Challenges in the areas of *general tasks and demands* included: undertaking multiple tasks, organizing and managing time.

The following is a summary of cognitive-communication domains. Refer to Table 4 for a list of cognitive changes in mTBI and potential effects on function and communication.

5.1 Attention

Attention impairments are common after mTBI. Problems with attention are likely to affect other cognitive processes including memory and executive functions (Cicerone, 2002; Lezak, 2004).

Attention problems after TBI are seen particularly with novel and timed tasks. Difficulties are due, in part, to slowed information processing speed associated with diffuse axonal injury (Stuss et al., 1989) and problems with controlling and allocating attention resources resulting from injury to the dorsolateral aspects of the frontal lobes. Common functional complaints related to attention problems include:

- Difficulty completing tasks, reading lengthy materials, or following the plot line of a movie (may indicate problems with sustained attention);
- Distractibility or poor concentration when other activities are occurring in the immediate environment (may be related to impaired selective attention);
- Decreased ability to shift from task to task or to multitask (may indicate impaired alternating attention).

5.2 Speed of Processing

Information processing speed refers to the ability to perceive, attend to, organize, analyze, integrate, retain, and apply information in an efficient manner. Rather than a cognitive function in itself, speed of processing refers to how well incoming information can be processed through the various linguistic and non-linguistic components of the cognitive system to result in a desired output. A conceptual model of cognitive processing (Vanderploeg, 2000), shows speed and efficiency as dependent on the integrity of underlying cognitive functions and their connections. From reflexive responses that go directly from sensory-perceptual functions to motor responses, to those that require higher order abstraction and reasoning, disruptions in necessary aspects of the feedback loop will result in cognitive impairment and/or compromised speed and efficiency of processing. Increased complexity of information to be processed is directly related to speed (Tombaugh, Rees, Stormer, Harrison, & Smith, 2007) given the greater number of interrelated cognitive components that must be employed.

Individuals who experience difficulty at any of the levels of cognitive processing will have problems responding appropriately to incoming information during daily functioning. Slowing of information processing capacity has been shown to affect various cognitive and communication processes such as encoding information, verbal comprehension, and adaptive responding to novel situations (Felmingham, Baguley, & Green, 2004). Functionally, individuals may report experiencing problems with a wide range of daily tasks such as processing information over the telephone, processing verbal or written instructions at work or at school, learning and integrating new information, and effectively participating in social communication and "reading" other people's feelings, opinions and intentions.

These problems may become more prominent when tasks require more mental control and are less automatic. People who have sustained mTBIs often report that their thinking is less automatic and that it requires more effort to respond appropriately (Cicerone, 1996). As such, cognitive fatigue may occur at a lower threshold of mental effort than it did prior to the injury, and trigger symptoms such as headaches or irritability that, in turn, may further tax the speed and capacity of the information processing system.

Problems with speed of processing or problems related to a reduced capacity for information processing may be difficult to capture in the clinical setting, as individuals with mTBI tend to perform adequately under structured, single-task testing conditions and for finite periods of time. To best identify efficient and sustained processing skills, it is necessary to use measures that require higher levels of sustained effort than are typically associated with standardized tests or measures that most resemble the multi-faceted demands of the workplace. In fact, it is measures of complex speed of processing (e.g., conceptual/semantic processing), along with working memory and attention that show the most potential for being sensitive to cognitive dysfunction after mTBI (Frencham, Fox, & Mayberry, 2005; Tombaugh et. al., 2007).

5.3 Memory

Memory deficits are a common consequence of mTBI that affect working memory (the ability to hold information in mind and manipulate it), episodic recall (remembering information that is linked to a specific time and place), and new learning of episodic and semantic (fact) information. Individuals identified with attention problems frequently also exhibit difficulties on memory tasks (Mateer & Sira, 2006).

Based on clinical experience, SMs/veterans with concussion/mTBI frequently report forgetting appointments, directions/instructions, names of individuals, and losing or misplacing items such as keys, cell phones, and identification badges/cards. These problems present significant barriers for many SMs/veterans at work or school, and in activities of daily living.

5.4 Executive Functions

The prefrontal cortex, which is likely to be injured during blunt force trauma, is associated with the processes of executive function. Cicerone et al. (2000) define executive functions as "cognitive processes that determine goal-directed and purposeful behavior and are super-ordinate in the orderly execution of daily life functions. These processes include the ability to: a) establish goals; b) initiate behavior; c) anticipate consequences of actions; d) plan and organize behaviors according to spatial, temporal, topical or logical sequences; and e) monitor and adapt behavior to fit a particular task or context" (p. 1605).

Executive functions are comprised of a set of skills rather than a single skill. An integration of these skills is necessary to complete complex activities successfully (Kennedy & Coelho, 2005). Executive function disorders following mTBI are heterogeneous (Kennedy et al., 2008); resulting in different profiles of executive function strengths and weaknesses.

5.5 Social Communication

Social communication refers to verbal and nonverbal communication skills necessary to be successful in social situations (Turkstra, 2009). It involves integration of linguistic (Cummings, 2007), cognitive (Godfrey & Shum, 2000; Moran & Gillon, 2005), and behavioral (Ylvisaker, Turkstra, & Coelho, 2005) processes and requires speed and agility in formulating comments that directly address the topic at hand, controlling utterance length to avoid monopolizing the conversation, taking the perspective of others, and using both verbal and non-verbal methods to convey stated and implied meaning (Burgess & Turkstra, 2006). Impairments in social communication may result from both cognitive and behavioral changes associated with concussion/mTBI and co-morbid conditions such as PTSD.

5.6 Acquired Stuttering and Other Speech Dysfluencies

Starkweather (1987) defined fluency as "the ability to talk with normal levels of continuity, rate, and effort" (p. 12). Fluency is recognized by the ease and rapidity with which words are produced. It is having words at one's command and producing them easily and smoothly. This latter definition encompasses aspects of both speech and language. Perkins (1971) suggested that when observers judge the fluency of a speaker they are probably judging the "adequacy of performance of the semantic, syntactic, morphemic, and prosodic dimensions of speech" (p. 92).

Table B4. Cognitive Changes in mTBI and Potential Effects on Function and Communication

Cognitive Domain	Changes Due to mTBI	Effects on Function and Communication
Attention	Lapses in sustained attention Highly distractible Decreased concentration Poor performance on competing tasks or stimuli	Difficulty responding appropriately to incoming information Difficulty learning new information Difficulty filtering out irrelevant stimuli Difficulty conversing in situations with distractions, background noise, and multiple participants Difficulty managing the demands of high-level activity Difficulty sustaining attention when reading complex and/or lengthy material Difficulty shifting attention as needed Difficulty maintaining or changing topics in conversation Tangential discourse Social avoidance to compensate for sense of overstimulation (Because attention is the foundation of other cognitive processes, problems in attention are likely to result in or compound impairment in other processes including memory and executive functions)
Speed of Processing	Slowness in processing information	Delayed response time Difficulty making decisions Difficulty comprehending rapid rate of speech Slowness when interacting in social situations Difficulty staying on topic Long pauses within discourse

Memory	Impaired memory Problems with new learning	Difficulty recalling instructions or messages Difficulty learning new information Difficulty remembering names of individuals, appointments, directions, location of personal effects (e.g., keys, cell phones, identification cards, head gear) Difficulty recalling details when reading complex and/or lengthy material Difficulty maintaining topic or remembering purpose of conversation Repetition of ideas, statements, questions, conversations or stories Failure to use compensatory strategies to improve performance on everyday tasks
Executive Functions	Disorganized thoughts and actions Ineffective planning Reduced initiation Decreased insight Ineffective reasoning, judgment, and problem solving Decreased mental flexibility Difficulties in self-monitoring performance and assessing personal strengths and needs Impulsivity and disinhibition	Lack of coherence in discourse Lack of organization in planning daily activities Difficulty implementing plans and actions Difficulty initiating conversations Problems recognizing and repairing conversational breakdowns Inability to determine the needs of communication partners Difficulty making inferences or drawing conclusions Difficulty assuming another person's perspective Difficulty interpreting the behavior of others Difficulty evaluating validity of information Verbose; lack of conciseness in verbal expression Decreased comprehension of abstract language, humor, indirect requests Difficulty meeting timelines Difficulty formulating realistic goals Difficulty recognizing complexity of tasks and need for simplification Difficulty anticipating consequences of actions Inappropriate comments

Hartley (1995); Sohlberg (2009); Sohlberg & Mateer (2001)

Fluency includes the ability to formulate and express thoughts by retrieving words, sequencing words into phrases and sentences according to grammatical rules and standards of practice for the speaker's cultural-linguistic community. Two aspects of fluency typically are considered in evaluation of communication ability: verbal fluency, which relates to word-finding ability and the fluent expression of ideas; and speech fluency, which refers to the articulation of speech sounds (vs. stuttering).

Fluency problems may also occur as a result of word-finding difficulties associated with cognitive impairments of attention and speed of information processing (Canter 1971). Motor speech disorders including stuttering may result from neurologic diagnoses. The nature and characteristics of communication dysfluencies require an examination of language, cognition and motor speech abilities as well as an astute perceptual assessment and analysis for differential diagnosis and intervention. Stuttering as it impacts conversational fluency will be discussed in section 6.5.7.

There is limited research that has systematically investigated the existence and nature of word retrieval deficits in naming and discourse contexts after mTBI (King, Hough, Walker, Rastatter, & Holbert, 2006).

5.7 The Role of SLPs in Cognitive-Communication Rehabilitation Services

Speech-language pathologists (SLPs) are uniquely qualified to provide rehabilitation services for individuals with cognitive-communication disorders, due to their specialized knowledge and skills in the following areas:

- Cognition and its relationship to language and communication in normal development and aging as well as in neurogenic and psychogenic disorders;
- Clinical tools and methods for assessing cognitive-communication disorders;
- Evidence-based interventional approaches and methods for cognitive-communication disorders across the life span;
- Effects of pharmacological interventions on cognition and communication;
- Counseling, collaboration, education, and advocacy;
- Responsivity to cultural and linguistic diversity of SMs, veterans, and their family members;
- Research principles.

A broad spectrum of cognitive-communication impairments may result from TBI. As a member of the IDT of professionals who collaborate to evaluate and treat individuals with TBI, the role of the SLP includes evaluation and treatment of all aspects of communication as well as the communication implications of cognitive deficits (ASHA, 1987, 1991).

Intervention for cognitive-communication disorders involves not only direct therapy but also environmental modifications. Modifying contextual factors can reduce barriers and facilitate successful communication and community participation. SLPs also serve as advocates for persons with language, socio-communicative, and cognitive-communication impairments. Through education of the Command and supervisors, SLPs and members of the IDT advocate for adaptations and environmental modifications when appropriate, to improve a SM's/veteran's job performance (ASHA, 1991, 2004a, 2005).

Counseling and consultation are essential components of SLP interventions that address the nature and impact of cognitive-communication symptoms and engage the SM/veteran, family/caregiver, SM's Command, and others (e.g., teachers, employers, peers) in the clinical process, as appropriate. Services may include instruction of communication partners in how to facilitate functioning, remove communication barriers, and enhance community participation.

6. Clinical Pathway

6.1 Interdisciplinary Team (IDT)

BACKGROUND

Care for SMs/veterans with concussion and cognitive-communication deficits is complex and may require the intervention of multiple medical, mental health, social work and rehabilitation specialties. Integration of medical, psychosocial, financial, educational, and vocational resources will support optimal outcomes for TBI and polytrauma survivors.

An interdisciplinary team (IDT) should be used to reduce the risk of missing potential complicating factors that may negatively influence rehabilitation outcomes. Members of the team may have complementary roles in cognitive intervention. For example, cognitive-communication deficits may adversely affect progress in the treatment of behavioral and emotional problems and the SLP can offer important information to assist mental health professionals to optimize treatment of SMs/veterans with mTBI. At the same time, the mental health professional can provide a more nuanced understanding of the influence of cognitive and behavioral processes on communication.

The IDT should develop a patient-centered treatment plan that incorporates the results of the comprehensive assessments from each discipline and formulates treatment goals in collaboration with the SM/veteran and his/her family, as appropriate.

The IDT may include medical and rehabilitation professionals such as physician, nurse, social worker, neuropsychologist, rehabilitation psychologist, SLP, audiologist, occupational therapist (OT), physical therapist (PT), and vocational counselor. Membership in the team should be adjusted based on the SM's/veteran's individual needs.

ACTION STATEMENT

Cognitive-communication rehabilitation is most effective when provided by an interdisciplinary team (IDT).

RECOMMENDATIONS

1. Ideally, an IDT should be formed at medical facilities charged with the care of SMs/veterans with mTBI and cognitive-communication deficits.
2. The IDT should be integrated and supportive to provide a strong rehabilitative framework, and should meet at appropriate intervals throughout the rehabilitative process.
3. The IDT should include the SM/veteran and, upon the SM's/veteran's consent, his/her family.
4. The SM/veteran and family should be invited to team meetings during active rehabilitation.
5. SLPs should educate the IDT regarding the results of speech, language, and cognitive-communication assessment and progress in treatment.

6. Members of the IDT should be available to the SLP for consultation during the course of rehabilitation.

DISCUSSION

The development of IDT in rehabilitation has been central to the emergence of creative approaches and innovative strategies to provide comprehensive and collaborative care (Strasser, Uomoto, & Smits, 2008). Behavioral, cognitive, communication, and physical issues may be addressed without unnecessary duplication or fragmentation of services. While each discipline contributes unique perspectives, collaboratively the team can provide integrated services and advocacy with joint planning, goal setting, strategy selection, and implementation (Joint Committee on Interprofessional Relations between the American Speech-Language-Hearing Association and Division 40 [Clinical Neuropsychology] of the American Psychological Association, 2007).
Patients with stroke (Strasser et al., 2008) and TBI (Sarajuuri et al., 2005) have shown improved outcomes when an IDT was a key component in the rehabilitation process. Strasser et al. (2005) found characteristics of team functioning that predicted improvement in stroke rehabilitation in a VA project. Forty-six VA rehabilitation teams including 530 rehabilitation team members from six disciplines (medicine, nursing, social work, SLP, and physical and occupational therapy) and 1,688 veterans with stroke participated in the study. Task orientation, order and organization, and utility of quality information were significantly associated with functional improvement in the stroke patients. Team effectiveness was associated with decreased length of stay. The authors concluded that improving team activities and relationships, including collaborative planning and problem solving and the use of feedback information may enhance rehabilitation treatment effectiveness (Strasser et al., 2005).

A non-randomized controlled trial compared "productivity" at two years post TBI between a conventional rehabilitation program in which physicians made referrals to the general health care system, and an intensive, interdisciplinary rehabilitation program. Patients' and significant others' reports of "productivity" were defined as employed, in school, or participating in volunteer activities. Eighty-nine percent of those patients who participated in the comprehensive, interdisciplinary rehabilitation program were productive, compared to 55% of the conventional care group (Sarajuuri et al., 2005).

In the current healthcare environment, patients and families have high expectations regarding their input into daily and long-term clinical care decisions. Family members can be effective advocates for services and resources that may benefit the SM/veteran. This trend presents a growing challenge for rehabilitation professionals to help families through a recovery process that may be frustrating and life-long (Strasser et al., 2008). Care should be taken to provide a supportive atmosphere for the family and medical caregivers to reach optimal rehabilitation outcomes.

6.2 Referral

Concussion or mTBI is a common combat-related injury, yet it is often overlooked when more obvious physical injuries must take precedence in the medical care of the individual. Identification of injuries that result in subtle cognitive deficits is difficult, particularly when those deficits are masked by the overwhelming complexity of other medical problems.

In cases where there are no apparent physical injuries, subtle cognitive deficits may be also be overlooked when they are attributed to pre-injury factors, combat-related stress, or other mental health factors, and do not receive appropriate follow up. Logistical problems of proper identification and follow-up of SMs/veterans may result in delayed referrals and underutilization of potentially effective services.

Referral for SLP evaluation may be initiated at the MTF or the VA upon identification of possible cognitive-communication problems. Common referral sources include primary care providers, physiatrists, neurologists, psychiatrists, psychologists, neuropsychologists, social workers, and case managers.

6.3 Cognitive-Communication Screening and Evaluation

When evaluating a SM/veteran with confirmed or suspected mTBI, it is important to recognize that acute symptoms will typically resolve within 90 days following trauma (Levin, Goldstein, & Mackenzie, 1997; Helmick, 2010). During this time of natural recovery, symptoms quickly evolve in a positive direction and comprehensive evaluation is generally not recommended. At the same time, education about the symptoms and risk communication that conveys reassurance about expected positive recovery have been shown to prevent or reduce the development of persistent symptoms (Mittenberg et al., 1996).

Comprehensive evaluation of persistent cognitive-communication symptoms (post 90 days) should take into account the fact that these symptoms are probably multi-factorial with regard to presentation and etiology. The evaluation should be based on a thorough history and include standardized instruments; patient (and family, and Command when appropriate) report of symptoms and the impact of symptoms on function; and problem-focused, hypothesis-based, and ecologically valid assessments (e.g., that consider military occupational specialties or work demands and environment). (Note: Refer to clinical toolkit that accompanies this CMG for examples of assessment instruments.)

6.3.1 Case History and Intake Interview

BACKGROUND

Assessment, including screening and evaluation of cognitive-communication impairments following mTBI, begins with review of records and case history. A case history is information gained by asking specific questions of the SM/veteran and other corroborative sources, with patient consent, such as family, friends, and/or the SM's Command. The case history and interview provide valuable information in determining a diagnosis and treatment strategy.

Records review and case history should be used to obtain information on the following (ASHA 2004a; Nolin, Villemure, & Heroux, 2006; VA/DoD, 2009):

- Medical status and timelines regarding injury(ies);
- Medical and surgical treatment since injury;
- Medical history including review of prescribed and over-the-counter medications, supplements, caffeine, tobacco, other stimulants such as energy drinks, alcohol/drug use (for potential causative or exacerbating influences);
- Presence and progression of the following:
    - affective symptoms: irritability, anger, depression, anxiety, and altered social functioning;
    - cognitive symptoms: poor concentration, loss of memory, reduced attention, slowness in processing information, and altered problem-solving skills;

  - physical symptoms: headaches, sleep problems, fatigue, dizziness, nausea, visual difficulties, auditory difficulties;
- Educational history;
- Vocational and recreational history;
- Socio-economic, cultural, and linguistic background;
- Communication history;
- Social history including family and support systems;
- SM/veteran reports of goals and preferences, as well as domains and contexts of concern.

ACTION STATEMENT

A screening and/or diagnostic assessment of cognitive-communication disorders should begin with a relevant case history and patient interview (and/or with patient consent, interview with a corroborative source, such as family, friends, or the SM's Command).

RECOMMENDATIONS

1. A case history and interview are essential components of the initial screening and/or assessment of cognitive-communication disorders following mTBI to identify the symptoms that may affect cognitive-communication status (e.g., headaches, sleeping problems) as well as the SM's/veteran's perception of his/her difficulties.
2. The interview should include detailed questioning about the frequency, intensity, and nature of symptoms and their impact on social and occupational functioning.
3. Open-ended questions should be used to allow the SM/veteran to describe his/her difficulties. While symptom checklists may be useful in documenting symptoms and their intensity, it is not recommended that these checklists be presented to patients.
4. The intake should include detailed description/inventory of the SM's Military Occupational Specialty (MOS)/veteran's occupation, including roles, responsibilities, type of transactions, work environment, and stressors.

DISCUSSION

The persistence of complaints or symptoms after mTBI is used to diagnose PCS (McCrea, 2008). The interview process is necessary to get a complete picture of the symptoms. The clinician's interview method may impact the symptoms reported by the patient. Specifically, patients who have suffered mTBI may report a greater number of symptoms when presented with a list of symptoms versus an open-ended question about symptoms experienced (Nolin et al., 2006; VA/DoD, 2009).
Personal contact during the initial interview sets the stage for patient-centered care. The two most common methods of obtaining a case history are interviews and questionnaires (Tomblin, Morris, & Spriestersbach, 2000). Although questionnaires may be effective and useful, an initial interview can facilitate trust and rapport between the SM/veteran and clinician and between the caregiver and clinician.

The following are additional benefits of a case history and interview: a) beginning the assessment with an interview as opposed to formalized testing helps the clinician to understand and gain insight into the effects of the mTBI on the SM/veteran; b) the clinician can learn about other

symptoms which may affect cognitive-communication status (e.g., pain, sleep disorders, hypervigilance); and c) will help identify the need for referrals to other specialists.

6.3.2 Cognitive-Communication Screening

BACKGROUND

Cognitive-communication screening of individuals with mTBI is conducted to identify individuals with potential cognitive-communication symptoms.

- Screening is a pass/fail procedure to identify individuals who require further assessment.
- Screening may result in recommendations for re-screening, comprehensive cognitive-communication assessment, or referral for other services.
- Screening typically focuses on body structures/functions, but may also address activities/participation, and contextual factors affecting communication.
- Individuals who fail screenings are seen by SLPs for further comprehensive evaluations.

SMs/veterans with mTBI may be referred for SLP services for concerns other than cognitive-communication issues (e.g., dysphagia, dysphonia, dysarthria, stuttering). In such cases, screening of cognitive-communication problems may still be considered based on patients' symptoms.

ACTION STATEMENT

Screening of cognitive-communication abilities may be conducted prior to a comprehensive evaluation.

RECOMMENDATIONS

1. Group or individual screenings of cognitive-communication abilities may precede more comprehensive evaluation to identify the need for further assessment or referral to other services.
2. Screening is indicated when an individual presents with cognitive-communication symptoms related to a concussive event or with a recent history (<90 days) of loss of or altered consciousness related to an acute physically traumatic event such as a blast explosion or MVC.
3. It is recommended that screening include:
    - Information on the SM's/veteran's cognitive-communication symptoms and concerns;
    - History of the injury event including mechanism of injury, duration and severity of alteration of consciousness, immediate symptoms, symptom course and prior treatment;
    - Information about pre-morbid intellectual functioning, level of education, previous speech-language diagnosis or services received, and other neuropsychological, psychiatric, or social factors that may affect current communication;
    - Patient self-ratings of symptoms or concerns, a written and/or verbal intake questionnaire and informal interaction/conversation with the SM/veteran;

- Identification of health care concerns that may be contributing to cognitive-communication symptoms and may warrant referral for further evaluation or management.

4. Referral to primary care or case management may be warranted following the initial cognitive-communication screening if there are co-occurring concerns (e.g., PTSD, pain or sensory deficits, medication side-effects).

6.3.3 Cognitive-Communication Evaluation

BACKGROUND

Cognitive-communication screenings with positive results should be followed by comprehensive evaluations that include formal (i.e., standardized) and informal (i.e., non-standardized) instruments that assess impairment as well as activities/participation, and contextual factors affecting communication. It is important to evaluate cognitive-communication abilities in real-life contexts, including the use of language in social and vocational contexts.

Many authors recommend a combination of standardized and non-standardized assessments to document real world functioning (Coelho, Ylvisaker, & Turkstra, 2005; Milton, 1988; Sohlberg & Mateer, 1989; Turkstra, Coelho, & Ylvisaker, 2005). According to Turkstra and McCarty (2006), communication competence, including the use of language within vocational and social contexts, is best assessed in real-world situations, which may be more sensitive to communication breakdowns than standardized tests or clinical tasks such as monologic discourse.

It is important that information regarding cognitive-communication skills is gathered from individualized tasks that test the upper limits of the person's resources. Cognitive-communication problems may be difficult to capture in the clinical setting as individuals with concussion tend to perform adequately under structured conditions.

Comprehensive evaluations are conducted for one or more of the following purposes:

- Diagnosing a cognitive-communication disorder;
- Documenting clinical characteristics of the cognitive-communication disorder; specifically, identifying underlying strengths and weaknesses related to cognitive, and linguistic factors, including social skills that affect communication performance;
- Measuring the effects of cognitive-communication impairments on the SM's/veteran's activities (capacity and performance in everyday communication contexts) and participation (ability to assume pre-injury roles in employment, education, and social and community life);
- Identifying contextual factors that serve as barriers to or facilitators of successful communication and participation for individuals with cognitive-communication impairment;
- Formulating recommendations for intervention and support;
- Assessing prognosis for change;
- Testing intervention hypotheses;
- Measuring the effectiveness of intervention and supports;
- Assessing change in a SM's/veteran's cognitive-communication symptoms or status;
- Determining the need for referral to other assessments or services;

- Supporting medical or neurological diagnoses;
- Generating epidemiologic or other research data.

ACTION STATEMENT

A comprehensive cognitive-communication evaluation is conducted to diagnose the impairment, make a prognosis for outcome, formulate treatment recommendations, and identify appropriate referrals.

RECOMMENDATIONS

1. Comprehensive cognitive-communication evaluation is not recommended in the first 90 days following an mTBI as full recovery is expected although current performance may be depressed. Education about possible cognitive-communication problems during this time, using the Mittenberg model (Mittenberg et al., 1996) and emphasizing positive expectations of recovery, have been shown to decrease the odds of developing persistent PCS.
2. Evaluation of cognitive-communication abilities includes the domains of:
   - Language
   - Attention
   - Memory
   - Processing speed
   - Executive functions
   - Self-awareness
   - Social communication.
3. Results of the comprehensive evaluation should be cross-referenced with test results from other rehabilitation team members (e.g., neuropsychologist, OT, audiology, vision) involved in cognitive assessments and with findings obtained on different days or at different times of the day (Malia et al., 2004).
4. Persistent cognitive-communication symptoms (post 90 days) are probably multi-factorial with regard to etiology and should not be labeled without careful consideration. It is recommended that interpretation of results of comprehensive evaluation of cognitive-communication impairments should also take into consideration other factors such as pain, sleep disturbance, or psychological factors.
5. Referral to mental health providers may be indicated when post-traumatic stress, anxiety, or other psychological health concerns may be contributing to depressed cognitive-communication performance.

DISCUSSION

SLPs are one of several rehabilitation disciplines that contribute to defining the nature of the cognitive deficits resulting from TBI. The focus of the SLP evaluation is on the underlying cognitive impairments that impact an individual's communication functioning (NIH, 1999). Comprehensive evaluation provides the basis for determining the nature, severity, and characteristics of cognitive-communication disorders. Effective evaluation of cognitive-communication abilities is a prerequisite to designing and implementing an effective treatment program with

baseline/pre-treatment measures, functional goals, and required supports.

The number of assessment tools designed specifically for cognitive-communication impairments resulting from TBI is limited. The Academy of Neurologic Communication Disorders and Sciences (ANCDS) reviewed 127 standardized assessments recommended by SLPs and test publishers or distributers for use with TBI patients (Turkstra, Coelho et al., 2005). The review focused on tests that were designed or administered to patients with TBI and met reliability and validity measures established by the Agency for Health Care Policy Research. Findings indicated a "striking absence of a test developed for the evaluation of individuals with cognitive-communication disorders, versus tests of basic neuropsychological functions that may be administered by SLPs or tests borrowed from other populations, such as aphasia" (p. 219).

Whelan, Murdoch, and Bellamy (2007) emphasized the importance of assessing higher-level language skills dependent on the integrity of the frontal lobes. Higher-level language skills appear to be particularly vulnerable to TBI and include summarization of written text, ability to persuade and debate, and comprehension of implied information (e.g., metaphors, sarcasm, or humor). They recommended that valid and reliable measures be used to assess language function, attention, word retrieval, and executive functions.

Assessment of the cognitive-communication challenges of SMs/veterans with concussion/mTBI should also address issues central to real-life situations, different family roles, social /community participation, and return to duty, work or school (Ylvisaker & Feeney, 1996).

A combination of standardized and non-standardized assessments, including functional and context-sensitive assessments, is required to address and document real-world functioning (Coelho et al., 2005; Turkstra, Ylvisaker, et al., 2005). For the military population, real-life demands include performing military operational specialties (MOS) and carrying out missions with potential emotional, physical, and environmental stressors. For the veteran population, challenges are related to community re-integration after discharge from the military and adjustment to disability.

6.4 Treatment

6.4.1 Principles of Cognitive-Communication Rehabilitation

BACKGROUND

Cognitive rehabilitation is a systematic, functionally-oriented treatment program based upon assessment and understanding of a patient's brain-behavioral deficits (Cicerone et al., 2000). Neuroplasticity is believed to be the mechanism by which the intact brain encodes experience and learns new behavior, and by which individuals with TBI re-learn lost behavior in response to environmental demands and rehabilitation. Understanding the nature of neuroplasticity can improve rehabilitation strategies to optimize functional outcomes (Kleim & Jones, 2008). Instructional practices that enhance neuroplasticity include providing intensive, repetitive practice of functional targets with careful consideration of salience, potential for generalization, and personal factors (Sohlberg & Turkstra, 2011).

The goals of therapeutic interventions for cognitive-communication sequelae of TBI are to enhance the individual's capacity to process and interpret information, to foster independence, and to improve the individual's ability to function in all aspects of family and community life (Cicerone, et al., 2008; NIH, 1999; Tsaousides & Gordon, 2009).

Cognitive-communication treatments for SMs/veterans should address their unique needs with reference to returning to duty or work, balancing military and family relationships, readjusting to civilian life, and considering risk for post-traumatic stress and other co-morbidities including pain, headache, irritability, sleep disturbances, and poor anger management (Trudel, Nidffer, & Barth, 2007).

The presence of co-morbidities has been found to be a significant predictor of physical, cognitive, and emotional symptoms post-deployment, including those associated with concussion/mTBI (Hoge et al., 2008; Vanderploeg et al., 2009). As such, caution must be exercised when assuming that cognitive-communication difficulties are the direct result of neurological deficits.

Cognitive-communication rehabilitation goals, strategies, scope, intensity, duration, and interval of treatment should be based upon diagnosis, prognosis, individual functional needs of the SM/veteran, and reasonable expectations of continued progress with treatment (Katz, Ashley, O'Shanick, & Connors, 2006).

Individuals with mTBI respond positively to appropriate information and reassurance given shortly after injury (Comper et al., 2005). While education and support seem to benefit patients with respect to somatic and psychological complaints (Comper, Bisschop, Carnide, & Tricco, 2005), a recent review of trials incorporating educational and supportive treatment for mTBI identified a proportion of patients who demonstrated intractable disability (Snell, Surgenor, Hay-Smith, & Siegert 2009).

Cognitive-communication rehabilitation domains include attention, memory, comprehension, social communication, reasoning, problem solving, judgment, initiation, planning, and self-monitoring. Specific interventions may be directed at:

- Reinforcing, strengthening, or reestablishing previously learned patterns of behavior;
- Establishing new patterns of behavior through compensatory mechanisms;
- Enabling persons to adapt to their cognitive disability to improve their overall functioning and quality of life (Cicerone et al., 2000).

A paradigm shift has occurred in cognitive-communication therapy from repetitive decontextualized drills in the clinic to training of compensatory and metacognitive strategies that can be directly applied in naturalistic situations to address functional recovery goals using supports available within the individual's personal interactions and communication environments (ASHA, 2003). Training/education in the use of compensatory strategies has been shown to be effective in decreasing the functional impact of cognitive-communication impairments related to non-degenerative neurological and mental health conditions (NIH, 1999). Comprehensive-holistic rehabilitation programs provide individual- and group-based treatment of cognitive, emotional, and interpersonal skills within an integrated therapeutic environment to remediate impairments and promote meaningful and satisfactory life, even in the presence of existing limitations (Cicerone et al., 2008).

ACTION STATEMENT

Cognitive-communication rehabilitation is recommended to optimize functional recovery from mTBI.

RECOMMENDATIONS

1. Cognitive-communication rehabilitation should be grounded in scientific evidence including theoretical foundations of brain-behavior relationships, cognition, communication, neuroplasticity, learning theories, behavioral modification, and counseling.
2. Intervention programs should be based upon results of thorough individualized assessments to identify cognitive strengths and weaknesses and changes in cognitive-communication function following brain injury.
3. Co-morbidities should be addressed as appropriate to optimize recovery and rehabilitation.
4. Rehabilitation plans should be developed with consideration for the time frame available, realistic discharge criteria, and skills and abilities that the SM/veteran brings to the rehabilitation process.
5. Rehabilitation programs should focus on retraining previously learned skills, reinforcing residual abilities, teaching compensatory strategies, developing functional skills, modifying the environment, and increasing awareness and acceptance of disability in order to facilitate successful adaptation or adjustment.

DISCUSSION

Patient and family education are important components of early intervention and should continue throughout the continuum of care (Mittenberg, Canyock, Condit, & Patton, 2001; Ponsford et al., 2002). Clinical management of patients with mTBI symptoms typically has focused on (a) prevention of "excess disability" through education to promote expectations of rapid and complete recovery, (b) providing a "timeout" period to permit recuperation, (c) avoidance of dangerous activities that could lead to secondary injury, and (d) using aggressive medical treatment to improve symptoms (e.g., headache, sleep disturbance, dizziness) that can interfere with optimal recovery (Comper et al., 2005). This period of recovery should include increased rest hours that are interspersed within the workday, reduced daily demands and expectations, simplification of work schedule and work-load, and reinforcement of successes.

The recovery trajectory from combat-related mTBI is complicated by the physically and emotionally traumatic circumstances in which many concussions are sustained, multiple co-morbidities, the potentially repetitive and cumulative nature of concussions sustained during combat duty, and the difficulty in following typical recommendations for post-concussion care (e.g., rest) in the deployed setting.

Post-acute neurologic rehabilitation is based upon concepts of brain plasticity and evidence that brain reorganization is possible even years after brain damage occurs (Bach-y-Rita, 2003). Cognitive-communication intervention should be supported by sound theory with clear conceptualization of dysfunction caused by the brain injury, and cogent understanding of normal information processing and learning as well as dimensions of everyday communication (Hartley, 1995).

Although directly aimed at improving cognitive and psychosocial functioning, cognitive-communication rehabilitation may indirectly result in enhanced physical functioning. For example, improvement in memory may facilitate compliance with a medication regimen, improvement in attention and comprehension may increase understanding of instructions from healthcare providers, and improvement in executive function may foster better decision-making with respect to treatment options (Tsaousides & Gordon, 2009).

Comprehensive-holistic programs provide individual and group rehabilitation treatments to improve cognitive function, increase awareness, and address interpersonal, social, and emotional concerns. Involvement of significant others is highly encouraged, and community activities and vocational trials should be incorporated when appropriate to promote generalization (Cicerone et al., 2008; Tsaousides & Gordon, 2009).

Clinical experience with military and veteran populations suggests that a comprehensive-holistic approach supports the rehabilitation of cognitive and emotional sequelae of chronic symptomatic mTBI. Group therapy in addition to individual therapy promotes unit cohesion and recovery within a supportive context. Involvement of family members, the SM's Command, or the veteran's employer can optimize rehabilitation outcomes.

Rehabilitation of cognitive processes and functional skills training should be combined to facilitate application of compensatory strategies to real life situations (Hartley, 1995). Treatment should be embedded in meaningful contexts and individualized to fulfill the unique needs of each SM/veteran and ensure generalizability from controlled situations in therapy to natural environments and daily routines (Cicerone et al., 2008).

Clinicians should be systematic in their treatment planning and should realize that every SM/veteran learns differently and requires individually-tailored instructions or strategies (Ehlhardt et al., 2008). Methods involved in selecting instructional targets and presenting and reinforcing target information can facilitate learning and directly influence learner outcomes. Sohlberg, Ehlhardt, and Kennedy (2005) formulated a checklist for deliberate, systematic treatment planning for individuals with cognitive impairments with instructional practices supported by research, including direct instruction combined with strategy instruction and errorless learning techniques.

Instructional practices that have been experimentally validated and are key to promoting learning for individuals with memory impairments include:

- Clearly delineating intervention targets with use of task analyses when training multi-step procedures;
- Limiting errors when teaching or re-teaching information and procedures;
- Providing sufficient practice;
- Distributing practice within sessions and across sessions;
- Using stimulus variation or multiple exemplars;
- Using strategies to promote more effortful processing (e.g., verbal elaboration, imagery);
- Selecting and training ecologically valid targets (Ehlhardt et al., 2008).

Structuring or modifying the individual's environment and generating management strategies can be helpful in reducing the load on attention, memory, and organizational abilities. Strategies include:

- Organizing and labeling storage cabinets
- Setting up filing systems
- Creating message centers
- Establishing bill payment systems

- Reducing clutter
- Eliminating distractions
- Posting signs to inform others in the environment about management strategies (Sohlberg & Mateer, 2001).

6.4.2 Therapeutic Alliance

BACKGROUND

Cognitive-communication rehabilitation is a dynamic process that involves a collaborative relationship between clinician and patient. The World Health Organization (WHO, 2008) strongly recommends patient-centered care with continuity and an enduring relationship of trust between patients and their providers. A detailed case history including information about physical, emotional, and social concerns, the SM's/veteran's past and future, and environment contribute to understanding the individual and the disorder, and can positively affect the therapeutic relationship.

A patient-centered approach that integrates goal-directed counseling for eliciting behavior change can promote positive health outcomes and improved quality of life for patients and their families. Aspects of supportive counseling include (a) caring and empathy (e.g., perceived sincerity, ability to listen, viewing issues from the perspectives of others); (b) competence and expertise (e.g., perceived intelligence, training, experience, professional attainment, knowledge); (c) dedication and commitment (e.g., perceived altruism, involvement, diligence in pursuit of health goals); and (d) honesty and openness (e.g., perceived truthfulness, candidness, fairness, objectivity) (VA/DoD, 2009).

While the prognosis after mTBI is favorable and the overwhelming majority of individuals with mTBI are expected to experience complete recovery of cognitive symptoms within the first several months after injury (Lannsjo, Geijerstam, Johansson, Bring, & Borg et al., 2009; McCrae, 2008), persisting symptoms may result from neurologic abnormality or inefficiency related to the injury (Sohlberg & Mateer, 2001). Persistent cognitive symptoms may also arise from a variety of secondary factors including pre-injury psychiatric history (Vanderploeg, Belanger, & Curtiss, 2006), misattribution of pre-injury characteristics to the injury (Mittenberg et al., 2001), expectation of significant symptoms after concussion that may be amplified by subsequent stress and anxiety (Mittenberg, DiGiulio, Perrin, & Bass 1992), and the influence of compensation for symptoms (Hoge, Goldberg, & Castro, 2009). These factors may contribute to an exaggeration of symptoms in individuals with mTBI.

While engaging in intervention for cognitive-communication symptoms, it is important to emphasize expectancy of recovery by providing education regarding positive outcomes in mTBI, highlighting skills and abilities shown by the SM/veteran with mTBI, and engaging in risk communication whereby, the language used in delivering treatment creates the expectation for recovery (e.g., avoiding terms such as brain damage, impairments, post-concussion syndrome) (Borg et al., 2004).

The challenges in mTBI management, including the difficulties of determining the etiology for the symptoms or most effective treatment, reinforce the need to build strong alliances based upon trust and credibility among the clinician, the SM/veteran, and their family. Patient's concerns and experiences should be validated by allowing adequate time for building a clinician-patient alliance and applying an effective risk communication approach (VA/DoD, 2009).

ACTION STATEMENT

A strong therapeutic alliance should be established with patients to optimize rehabilitation outcomes.

RECOMMENDATIONS

Establishing a therapeutic alliance and employing risk communication techniques are essential to effectively address the emotional and psychosocial needs of patients and families. Strategies include:

1. Demonstrating a commitment to understanding the patient's concerns and symptoms,
2. Encouraging an open and honest transfer of information to capture a comprehensive representation of the patient's concerns and medical history,
3. Presenting information regarding a positive outcome and symptom remission to create an expectation of recovery,
4. Avoiding open skepticism or disapproving comments in discussing the patient's concerns (VA/DoD, 2009).

DISCUSSION

Therapeutic working alliance refers to the partnership between clinician and patient in their efforts to achieve change through the therapy process. The alliance is built upon agreement on the goals of therapy, agreement of tasks to achieve these goals, and the development of a personal bond between the clinician and the SM/veteran. A strong therapeutic working alliance can positively influence outcomes in post-acute brain injury rehabilitation (Bordin, 1979; Schonberger, Humle, & Teasdale, 2006, 2007; Sherer et al., 2007).

Sherer et al. (2007) surveyed 69 patients with acute brain injury, their families, and medical caregivers to identify factors influencing the strength of therapeutic alliance for patients with TBI enrolled in post-acute brain injury rehabilitation, and to examine the association of therapeutic alliance with outcome. Higher levels of family discord were associated with poorer therapeutic alliance. Greater discrepancies between family and clinician ratings of patient functioning were associated with poorer therapeutic alliance and poorer effort in therapies. Productivity status at discharge was predicted by functional status at admission and degree of therapeutic alliance. The authors concluded that family perceptions and family functioning are important determinants of therapeutic alliance for patients in post brain injury rehabilitation.

6.4.3 Individual Treatment

BACKGROUND

Individual therapy is a critical component of cognitive-communication rehabilitation programs for SMs/veterans with mTBI. The cognitive consequences of mTBI are complex, and effects on individuals are variable. Therefore, intervention must be individualized to address the myriad of functional problems that emerge as a result of the mTBI.

Cognitive-communication rehabilitation at the post-acute stage is focused on enabling SMs/veterans to resume a productive life based on individualized goals, functional needs, and personal interests and preferences.

ACTION STATEMENT

Individual therapy is a keystone of cognitive-communication rehabilitation.

RECOMMENDATIONS

1. Cognitive-communication intervention must be individually tailored to achieve short-term objectives and long-term functional outcomes.
2. Individual therapy provides the environment for clinicians to develop a strong working alliance with SMs/veterans that can optimize the process and outcomes of therapy.

DISCUSSION

Individual therapy provides a milieu for developing functional goals to address cognitive-communication deficits and for implementing an individualized, patient-centered program. The goals of cognitive rehabilitation are to enhance the SM's/veteran's capacity to process and interpret information and to improve his/her ability to function in all aspects of life. Instructional methodologies can be implemented to establish targets in a structured environment to minimize errors, control stimuli and responses, and provide repetitive practice. There is strong evidence to support the effectiveness of individualized systematic instruction (e.g., errorless learning, method of vanishing cues, spaced retrieval/spaced presentation) (Elhardt et al., 2008; NIH, 1999).

Treatment should be matched to the functional needs, strengths, and capacities of each SM/veteran and modified as those needs change over time. As SMs/veterans attempt to resume their usual daily activities, additional challenges may emerge with increasing environmental demands. Intervention strategies must be individualized to reestablish appropriate and adaptive behaviors within functional contexts and actual life situations to address these challenges (Hartley, 1995; NIH, 1999).

Individual therapy provides the context to address factors that influence a SM's/veteran's cognitive-communication functions such as physiological state, perceptual skills, emotional status, motivation, and social skills. Cognitive-communication rehabilitation is most effective when the focus is on the subsystems that are assumed to be important in cognition (e.g., attention, comprehension, learning, memory, social communication, problem-solving, creative thinking) as well as aspects of an individual's life that can affect cognition such as emotions, nutrition, health, stress, and social functioning (Parente & Herrmann, 2002).

6.4.4 Group Treatment

BACKGROUND

Group therapy is a valuable component of cognitive-communication rehabilitation programs for SMs/veterans with mTBI. Group sessions provide a forum to practice skills in real-life situations, and opportunities for peer interaction, feedback and support. Treatment outcomes may include social and emotional benefits in addition to improvement in cognitive-communication skills.

Group therapy may focus on reinforcing and generalizing strategies and techniques established in individual therapy to improve skills such as concentration/attention, memory, organization, planning, goal setting, decision making, problem solving, reading comprehension, test-taking, and social communication.

Group therapy enables participants to learn from other participants' prior experiences and their proposed solutions to problems. Participants have an opportunity to give advice to each other and practice strategies suggested by their peers.

The group context may be effective in teaching executive function and problem-solving skills because participants have an opportunity to apply strategies and processes in challenging situations and to other participants' problems as well as their own.

Interactions within the group provide a meaningful context for improving social communication skills, including opportunities to apply strategies and practice conversational skills with multiple communication partners.

ACTION STATEMENT

Group therapy should be considered as an integral component of cognitive-communication rehabilitation.

RECOMMENDATIONS

1. Group intervention should be considered throughout the rehabilitation process when appropriate and available.
2. Group therapy may be particularly helpful in generalizing skills established in individual therapy, practicing social communication skills, receiving feedback from other participants, and providing peer support when addressing psychosocial issues.
3. The group format may be more effective than individual therapy when presenting general patient education information.

DISCUSSION

Group therapy can serve as a forum for education to develop the SM's/veteran's understanding of brain injury and rehabilitation, cognitive and emotional problems following brain injury, and how to cope with and compensate for changes (Malia et al., 2004).

A pilot study was conducted with survivors of brain injury to evaluate the effectiveness of group cognitive skills training as a precursor to vocational placement and re-entry into the workforce. Data indicated that 76% of those patients who completed training and group therapy were placed into competitive employment compared with the overall rehabilitation rate of 58% for patients who received comparable services but did not participate in the cognitive skills group (Parente & Stapleton, 1999).

In a study that examined the efficacy of a structured group memory rehabilitation program for adults following brain injury, participation significantly increased the use of memory aids and strategies, increased knowledge of memory and memory strategies, and reduced self-rated behaviors indicative of memory impairment (Thickpenny-Davis & Barker-Collo, 2007).

A randomized treatment and deferred treatment controlled trial design was used to evaluate the efficacy of a group intervention program to improve social communication skills following TBI. Results indicated that although overall social participation measures did not demonstrate improvement, specific individual communication deficits and overall satisfaction with life measures showed improvement over baseline (Dahlberg et al., 2007).

The group format has been used effectively in treating veterans with other neurogenic communication disorders. A study involving five VA Medical Centers compared individual with group treatment for veterans with aphasia. Results indicated that both individual and group treatment yielded positive outcomes, with veterans in both groups demonstrating significant improvement in language abilities (Wertz et al., 1981).

The therapeutic power of group psychotherapy is considerable and may be a critical component in post-acute brain injury rehabilitation. The group milieu can enhance self-awareness of deficits and provide a place where safe confrontation can occur (Peppings, 1998).

6.4.5 Cognitive-Communication Interventions for Active Duty Service Members and Veterans

BACKGROUND

Comprehensive, integrated, and collaborative efforts of the IDT are directed toward enabling and empowering SMs to return to duty – able, confident, and competitive to meet the challenges of their vocational ambitions. These efforts support the ideals of the Warrior in Transition Battalion:

> "I am a Warrior in Transition. My job is to heal as I transition back to duty or continue serving the nation as a Veteran in my community.
> This is not a status, but a mission. I will succeed in this mission because...I am a Warrior and I am Army strong."

In preparation for return to duty or work, treatment must consider and include personal and contextual factors that can enhance or hinder job performance. Contextual factors include the physical, social, and attitudinal surroundings in which SMs/veterans function (e.g., work space, perceptions and expectations of the unit or place of employment, Command climate). Personal factors include features of the individual that are not part of a health condition or functional state (e.g., coping styles, social background, education, past and current experiences) (Cornis-Pop et al., 1998).

For SMs/veterans with disabilities, the process of transition and community reintegration is vital to return successfully to college and the workforce, and critical for financial independence and quality of life (Ruh, Spicer, & Vaughan, 2009).

Assessment for community reintegration may include the following:

- Social and support systems (e.g., immediate and extended family, friends, co-workers, supervisors; spiritual, religious, and cultural beliefs and networks);

- Availability of medical, mental health, and rehabilitation services and support;
- Co-existence of psychological or physical conditions that may influence or preclude ability to participate in rehabilitation (e.g., PTSD, depression, anxiety, sleep deprivation, headaches, pain, vertigo, tinnitus, decreased vision);
- Home/family role expectations and responsibilities;
- Career/employment goals, responsibilities, and demands including assessment of actual work tasks;
- Job-site environmental challenges (e.g., noise, distractions, lighting, distance, position in room);
- Geographic location (e.g., access to and distance from resources and assistance);
- Driving or transportation needs (e.g., restrictions, safety, anxiety related to driving);
- Financial stress or hardship that may impact participation in rehabilitation.

To the extent possible, SLPs should assess functional cognitive-communication skills in simulated complex tasks to:
- Validate (or invalidate) and augment test findings;
- Identify the impact of strengths and weaknesses that can support or compromise rehabilitative, social, educational, and vocational activities and participation, all critical to successful return-to-unit and duty;
- Generate hypotheses on the SM's/veteran's ability to fulfill his/her MOS or school and work requirements;
- Identify underlying processes or contextual variables that contribute to successes or failures in activities or participation;
- Identify functional and critical needs and develop functional objectives to perform duties safely and competently;
- Determine generalization and effectiveness of intervention procedures including strategies, supports, and environmental modifications.

SMs/veterans with persistent mTBI symptoms may require accommodations to facilitate return to duty or work place. These may include:
- Gradual work re-entry,
- Flexibility in time and length of the work shift,
- Adjustment of job responsibilities or conditions,
- Environmental modifications (VA/DoD, 2009).

Treatment principles to prepare SMs/veterans for return-to-duty and vocational success include:
- Individualized interventions that target personally meaningful real-world goals;
- Training that begins with existing strengths or needed support to ensure success (as skills and performance improve, supports are faded and complexities of tasks are increased to maintain level of challenge);
- Training with different stimulus modalities;
- Strategies using strengths to compensate for weaknesses;
- Coaching and feedback to shape, chain, and reinforce use of compensatory strategies;
- Environmental modifications (e.g., quiet work environment, highly organized work space);
- To the extent possible, complex and functional tasks in real-world settings and simulations that create a meaningful context for skill and strategy development;

- Coordinated and integrated services with other providers addressing complementary issues (e.g., joint OT and SLP sessions to plan, organize, and prepare for a group outing).

Counseling and consultation are essential components that address the nature and impact of the disorder or difference, and engage the SM/veteran, family/caregiver, and others (e.g., Command, employers, teachers, peers) in the clinical process, as appropriate. Vocational interventions may be beneficial, including working with the SM's Command or veteran's employer.

Services may include: (a) advocacy and information on legal rights against discrimination on the basis of cognitive disability including academic adjustments and reasonable accommodations to facilitate success in educational and work settings (Americans with Disabilities Act, 2008), and (b) instruction of key individuals interacting with the SM/veteran on how to facilitate functioning, remove communication barriers, and enhance participation.

The impact of persistent cognitive-communication symptoms can be addressed by including spouses/partners in individual and/or group sessions to promote better understanding and offer opportunities to discuss challenges. A support group or spouse session within a cognitive-communication rehabilitation group provides a forum for families to receive information and advice, and learn strategies for coping with day-to-day difficulties (VA/DoD, 2009).

ACTION STATEMENT

During all phases of recovery, intervention is directed at maximizing the SM's/veteran's potential to attain real-world goals including successful return to duty, employment, academic achievement, and community reintegration. The determination of duty status is based on the recommendations of the IDT members following a period of patient assessment, education, and intervention.

RECOMMENDATIONS

1. If combined assessments of the IDT suggest that the SM/veteran is cognitively, emotionally, and physically fit for duty/return to work, a trial-of-duty/work should be considered before return-to-full duty/work. Ideally, this trial is structured, supervised, supported, and modeled after a "community services only" reintegration program (Helmick, 2010).
2. During this trial period, SMs/veterans should continue to have access to the SLP and other team members for on-going support and intervention until it is determined that discharge from treatment is indicated.
3. Intermittent follow-up visits should be scheduled as warranted. At this phase of recovery, the individual should be empowered to control his or her own activity by means of effective decision-making, strategic thinking, self-regulation of behavior, and self-regulated control over environmental contingencies (Cornis-Pop et al., 1998).
4. If a trial of duty is not recommended, alternative considerations should include continued treatment, referral for other specialty care, change in MOS, or the Medical Evaluation Board (MEB).

DISCUSSION

The emphasis of SLP intervention at this phase is to reduce the disability associated with cognitive-communication symptoms that restrict functioning in home, social, and career roles. Treatment focuses on both improving patient function while modifying and adjusting the environment in which he/she is expected to function (VA/DoD, 2009).

During this transition, it is key for the SLP to collaborate and coordinate services on an on-going basis with mental health providers, social work/case managers, vocational rehabilitation counselors and others involved in treatment to facilitate optimum attainment of the SM's/veteran's potential (Malia et al., 2004).

6.4.6 Assistive Devices

BACKGROUND

The effectiveness of assistive technology, including cognitive aids for improving the daily function and independence of persons with cognitive impairments is well documented in the scientific literature (Cicerone et al., 2000 & 2005; Quemada et al., 2003; Sohlberg & Mateer, 2001; Sohlberg et al., 2005 & 2007; Wilson, Emslie, Quirk, & Evans, 2001).

Assistive devices discussed in the early TBI literature included low-tech or no-tech devices such as memory notebooks, checklists and planners, or cueing devices such as pagers and alarms for single-task guidance (Burke et al., 1994; Schmitter-Edgecome, Fahy, Whelan, & Long, 1995; Zencius, Wesolowski, & Burke, 1990). Since then, a number of specialized devices have been designed specifically to address the problems encountered by people with cognitive disabilities.

Simultaneously, the use of electronic memory and organization devices designed for the general population has grown exponentially. This has resulted in more individuals having familiarity and expertise in the use of these devices. The development of more sophisticated assistive devices that help with the complex array of activities encountered in work and school settings and the advantage of pre-injury experience with technology have led to the use of electronic cognitive aids as a practical and functional intervention in cognitive rehabilitation.

In working with SMs/veterans with mTBI, the goal of cognitive interventions is to minimize the negative impact of cognitive symptoms on daily living and work settings with an emphasis on return to normal function. Whether the person is a candidate for a direct treatment approach or more indirect services for residual cognitive symptoms, cognitive aids can offer the necessary support to encourage independence and promote positive experiences in the recovery process.

ACTION STATEMENT

The use of cognitive assistive technology is recommended to facilitate compensation for cognitive symptoms, including problems with attention, memory, initiation, planning, organization and execution that may be associated with mTBI. Training and use of cognitive aids may take place in the context of direct treatment for confirmed cognitive deficits, or as a component of an education-based intervention to support functional activity and promote successful return to duty and community re-entry.

RECOMMENDATIONS

1. An individualized assessment is the first step in determining need for cognitive assistive technology.
2. Device selection and prescription is a complex process that forms an integral component of cognitive rehabilitation for mTBI.
3. All SMs/veterans receiving cognitive assistive devices must be involved in a training program that is systematic, goal-oriented, and designed to help them use the cognitive aids as a strategy to optimize function in daily activities.
4. The benefit of cognitive aids must be measurable and should show functional improvement in day-to-day functioning, including the ability to achieve a desired level of productive life while using the device.

DISCUSSION

No single assessment of cognitive functioning can serve as a prescriptive guideline for cognitive assistive devices. Generally, the evaluation should include a combination of global cognitive measures and domain-specific assessments. However, the lack of ecological validity of standardized cognitive tests creates a need for additional evaluation methods that expand beyond the clinical presentation.

Assessment in the form of history/intake interview and self-report and/or questionnaire adds relevant information for determining the needs of the SM/veteran with mTBI. Scherer and Craddock (2002) describe the Matching Person & Technology (MPT) process, a systematic approach to the cognitive aids needs assessment. The MPT includes measures that match abilities and needs of the individual, with the various vocational and avocational contexts in which the device may be used, and ensures that the evaluation and selection process is an objective and collaborative effort between the individual and the provider. Ultimately, the combined results of standardized and non-standardized methods of the individualized needs assessment will drive prescription for the cognitive aid.

There are many special considerations when determining what device or devices may best benefit the person with mTBI. Single and multi-function devices can be beneficial in certain situations or for certain individuals, but not everyone can benefit from the same device in the same way. Devices that offer multiple features may offer the benefit of meeting multiple needs within an all-encompassing system, but may be too cognitively demanding for individuals with high levels of anxiety or that have trouble multi-tasking.

Aspects of current and expected cognitive functioning, and the settings in which the device will assist the individual now and in the future, need to be considered. Special considerations, such as low vision, upper limb amputations or paresis/paralysis and hearing loss also must be taken into account to ensure that the selected device will be effective. Prior experience with cognitive aids also should be considered to take full advantage of pre-injury familiarity and exposure to electronic systems.

Device selection can be time consuming. To facilitate this process, the SM/veteran should be encouraged to become involved in the search for an appropriate device, as this will also promote a sense of ownership and involvement in treatment.

SMs/veterans with mTBI, who are likely to present with minimal learning challenges or who have previous expertise with cognitive aids, may require very little or no training in the use of a particular cognitive device. In fact, many SMs/veterans with mTBI can become a skilled user of cognitive aids in a short amount of time.

However, even people who are familiar with the technology will need training in the effective use of cognitive aids as a strategy for daily living in the face of cognitive disability. This training may be implemented simultaneously with other cognitive therapies or as part of an educationally-oriented program.

Scientific evidence suggests that training procedures must be goal-oriented, systematic, and individualized to the situation and learner's characteristics (Sohlberg, 2005). The general training sequence described by Sohlberg and Mateer (1989) provides a useful framework to guide training in the use of cognitive aids. In their three-step training process, the individual must first become familiar with all aspects of the device, followed by analysis of how and when the device may be most effective as a cognitive strategy, and finally by practicing and gradually moving into systematic use in real-life situations.

The first phase of the training is likely to be completed quickly, while the emphasis is placed on strategy development and functional use of the cognitive device in real-life situations. Initial treatment sessions should be scheduled regularly, with a focus on strategic planning (i.e., statement of the problem, development of an action plan and outcomes measurement). In the final phase of the training program, it is appropriate for sessions to decrease in frequency to allow opportunities for the SM/veteran to test action plans and identify any obstacles to goal achievement in his/her own situation. To reduce the chances of failure, follow-up sessions are a necessary part of the final phase of cognitive aid training.

The ultimate measure of the benefit of a cognitive aid is a demonstration of the ability to return to a previous level of productive life while using the device. Review of the initial needs-assessment and plan of care may serve as an objective basis for outcomes measurement. Perceived satisfaction with goal achievement may be just as significant for the SM/veteran, as is evidence of improved daily functioning. This can be determined with the use of questionnaires, by self-report, and by report of family, friends, co-workers, and superiors. For the SM/veteran who may perceive residual cognitive symptoms, concrete evidence of improvements in daily functioning with cognitive assistive technologies using pre and post comparisons, and comparisons of self and others' reports may be useful.

Cognitive assistive technologies can provide viable treatment options to facilitate return to everyday functions.

6.5 Treatment by Specific Domain

6.5.1 Attention

BACKGROUND

Attention impairments can impact outcomes in a variety of ways. The moderate-severe TBI literature indicates that patients with attention impairments have diminished participation in rehabilitation (Novack, Caldwell, Duke, Bergquist, & Gage, 1996), and are less likely to return to driving (Lengenfelder, Schultheis, Al-Shihabi, Mourant, & DeLuca, 2002), work (Brooks, McKinlay, Symington, Beattie, & Campsie, 1987), and school (Melamed, Stern, Rahmani, Groswasser, & Najenson, 1985). SMs/veterans with persisting attention impairments characterized by slow processing, distractibility, and impairment in working memory, present with similar challenges in achieving positive functional outcomes.

Direct attention training as an intervention strategy is based on the premise that attention abilities can be improved by activating particular aspects of attention through a stimulus drill approach. Repeated stimulation of attentional systems with hierarchically organized remediation exercises is hypothesized to facilitate changes in attention functioning. Current evidence suggests that this type of treatment is most appropriate for people with moderate-severe TBI (post-acute) and people with mild TBI, who have intact vigilance. Furthermore, treatment is most effective when provided in context with functionally meaningful tasks and in conjunction with metacognitive strategy training in which feedback is provided to develop self-monitoring and strategy development (Sohlberg et al, 2003).

ACTION STATEMENT

Attention impairment is highly prevalent in mTBI and has a negative impact on functional outcomes. Attention impairment should be a target for treatment in SMs/veterans with mTBI.

RECOMMENDATIONS

1. Treatment may focus on compensatory strategies to improve attention skills in functional contexts.
2. Direct treatment techniques may be employed in the context of functional tasks to improve performance on these tasks.

Strength of Recommendation: Attention training has been the subject of well-designed research and numerous studies have confirmed its benefit (Helmick, 2010). Recent evidence-based reviews recommend treatment of attention using direct and metacognitive training to promote development of compensatory strategies and foster generalization to real world tasks during post-acute recovery from mild or moderate TBI. Repeated use of computer-based tasks without intervention by a clinician is not recommended (Cicerone et al., 2011).

DISCUSSION

Positive results of treatments for attention skills have been reported for people with mTBI.

- Mateer (1992) reported on the impact of a post-acute treatment program designed specifically for people with mTBI. Components of the program included cognitive rehabilitation, psychosocial counseling, and vocational services. Results were reported for five cases of mTBI with symptoms persisting beyond one year. Subjects made significant improvements on 60% of the neuropsychological measures of attention, memory and general intellectual functioning used for clinical assessment.
- Cicerone (2002) investigated attention treatment in four individuals with mTBI and persisting attention impairment 7 to 8 months post injury. Treatment focused on strategies to better allocate attentional resources (e.g., rehearsal, self-pacing) as well as strategies to minimize anxiety and frustration related to high-level working memory demands. Results indicated that individuals who received treatment demonstrated improvements in neuropsychological measures (Continuous Performance Test; Paced Auditory Serial Addition Test) as well as a subjective self-report measure of functional attention skills whereas a similar control group did not show such improvement.

The larger cognitive rehabilitation literature that includes moderate-severe TBI provides support for the efficacy of treatment for both direct treatment procedures (Sohlberg, McLaughlin, Pavese, Heidrich, & Posner, 2001) as well as development of compensatory strategies to cope

with time pressure and overstimulation (Cicerone et al., 2000; Fasotti, Kovacs, Eling, & Brouwer, 2000) and distractibility (Webster & Scott, 1983).

6.5.2 Speed of Processing

BACKGROUND

While cognitive dysfunction for individuals with mTBI tends to be partial, even in the acute recovery period (Lange, Iverson, & Franzen, 2009), one of the most frequent complaints is slowed thinking and difficulty concentrating (Cicerone, 1996). Speed of processing of complex information (semantic processing) yielded significant differences between mTBI and control groups on measures of reaction time (Tombaugh et al., 2007). Slowness of information processing has been found to account for most of the attention deficits present after TBI (Gentilini, Nichell, & Schoenhube, 1989). Cicerone (1996) found that processing speed was related to acquisition and recall ability in neuropsychological measures six months after mTBI, which may reflect the underlying contribution of information processing speed to memory functioning.

Contrary to approaches that aim at increasing processing capacity and speed through practice by gradually increasing the amount and complexity of information to be processed, the types of intervention for SMs/veterans that experience these difficulties after mTBI should focus on emotional and social adjustment. Development of educational tools, compensatory strategies specific to limitations and situations, environmental modifications, and coping mechanisms for managing changes in processing speed may be needed (Vanderploeg et al., 2009).

ACTION STATEMENT

Treatment for deficits in capacity and efficiency of information processing should address the use of compensatory techniques for the underlying cognitive and emotional symptoms.

RECOMMENDATIONS

1. Identification and assessment of information processing deficits after mTBI should include formal evaluations and informal data gathering during tasks that require effortful cognitive processing and that exceed the SM's/veteran's available cognitive resources.
2. Underlying language impairments and/or impairments in attention, organization, working memory and new learning, reasoning, and visuo-spatial skills, may contribute to perceived changes in speed of information processing and should be examined concurrently. Hearing, auditory processing, and vision deficits should be ruled out.
3. Interventions for the management of deficiencies in speed and capacity of information processing in most cases will take the form of counseling, education, and the development of and training in appropriate compensatory strategies that are specific to the SM's/veteran's situation and limitations.

DISCUSSION

Difficulty with efficiency of the information processing loop can have a negative impact on lower order functions of the cognitive processing system such as arousal and attention to higher order functions such as abstraction and problem solving (Vanderploeg, 2000). As these

cognitive functions are interrelated and impossible to separate, problems with any of the cognitive functions will inevitably result in deficits in the efficiency of the information processing loop. For example, while the expected relationship between information capacity for complex information and working memory is well understood, difficulties with information processing and speed also have significant negative effects on new learning ability (Chiaravalloti, Christodoulou, Demaree, & DeLuca, 2003). Studies have also reported subtle, long-term cognitive symptoms after TBI on measures of attention targeting complex information that may impact speed (Vanderploeg, Curtiss, & Belanger, 2005).

In addition to the underlying cognitive functions that impact processing speed, careful consideration must be given to other contributing factors to cognitive slowing such as stress, sleep deprivation, PTSD and other mental health conditions (Belanger, Kretzmer et al., 2009), and pain (Etherton, Bianchini, Heinly, & Greve, 2006). Reading and writing skills, pre-injury psychosocial and educational factors, and integrity of vision and hearing systems must also be considered. Collaborative evaluation and treatment with audiologists, vision specialists, psychologists and neuropsychologists, and vocational rehabilitation specialists may be needed.

Brief psychoeducational interventions with an emphasis on reducing the presence of functional limitations caused by difficulties with information processing speed are recommended to reduce the severity and duration of symptoms (Belanger, Uomoto, & Vanderploeg, 2009; Cicerone, 2002). The aim is to promote better understanding of the cognitive demands of high-level everyday tasks, the impact of contributing factors on cognitive stamina, and awareness of techniques that may ease their complexity and temporal demands.

Early intervention in the form of education and support with suggested coping strategies for problems in processing speed contributes to reducing anxiety and ongoing problems after mTBI (Ponsford et al., 2002). Education should include helping the individual to identify and eventually anticipate situations likely to result in cognitive overload so that they can be modified. Minimizing distractions, preparing for situations ahead of time, allowing ample time to complete tasks, taking rest breaks and reducing simultaneous demands may be beneficial strategies in some situations. A variety of cognitive assistive technologies also is available to facilitate fast-paced activities such as note taking in a classroom (e.g., digital audio recorder, smartpen).

The pre-existing use of strategies, as well as modality strengths and preferences (auditory and/or visual) will also influence the selection of compensatory strategies and the amount of training that will be required to employ them successfully. Although education and training in these techniques should only take a few sessions for the SM/veteran with mTBI, some individuals may require a more direct strategy training in order to achieve mastery of the techniques. Using role-play related to work or school, and rehearsing use of appropriate strategies in the clinical setting may be necessary for some to carry over the techniques into their target environments.

6.5.3 Memory

BACKGROUND

The ability to retain and learn new information can be inhibited due to deficits in working, episodic, and semantic memory. Baddeley (1992) describes working memory as the temporary storage and maintenance of information. Giovanello and Verfaellie (2001) describe episodic memory as the conscious recollection of experiences from one's personal past, and semantic memory as the acquisition and retention of

generic factual information that is not referenced to a specific learning context. Therefore, if any of these memory systems is impaired, the information cannot be accurately retained for long-term storage.

Internal memory strategies such as mnemonics, visual imagery, and repetition may be used to encode information and improve retrieval. There is evidence that imagery may be helpful to patients by teaching them to elaborate and expand on the information that is to be recalled (Kaschel et al., 2002).

External memory aids include daily planners, calendars, memory books, use of environmental anchors (designated areas at home or work to keep specific items or lists), and electronic devices. Cicerone et al. (2005) reported that external devices could require extensive training before they are used effectively. However, if the memory aid is used consistently, procedural (motor) memory skills will be utilized to assist the SM/veteran in using the device(s) routinely.

ACTION STATEMENT

Memory impairments must be addressed during cognitive-communication therapy in support of functional everyday activities.

RECOMMENDATIONS

1. Techniques and compensatory strategies to improve memory should be selected to accommodate the individual needs of the SM/veteran.
2. SMs/veterans are encouraged to identify, individualize, and generalize the use of techniques and compensatory strategies that are most beneficial to functional everyday activities.
3. Sufficient training opportunities for the use of techniques and strategies should be provided during therapy sessions.
4. These techniques and strategies should be constantly evaluated and incorporated in a variety of functional situations and environments for successful generalization.

Strength of Recommendation: Training in the use of memory compensation strategies as applied to real-life tasks is supported by empirical evidence {Cicerone, 2000 #817;Cicerone, 2005 #818}. According to guidance provided by members of the DCoE/DVBIC consensus conference (Helmick, 2010), "efficacy has been demonstrated for memory training techniques derived from cognitive neuroscience" (p. 245) particularly for patients with mTBI and mild memory impairment.

DISCUSSION

Memory strategy training that assists patients in developing techniques to enhance registration and encoding of information and to improve memory retrieval has been shown to be successful. External memory aids in combination with strategy training resulted in improvement that extended into patients' everyday memory function, while repetitive memory drills (e.g., memorizing word lists, faces or designs without explicit strategy training) have been shown to have little or no efficacy (Helmick, 2010).

Visual imagery may be helpful to patients with mTBI. However, the use of internal memory techniques may actually require more cognitive effort to retain items and need to be taught systematically (Ehlhardt et al., 2008).

External devices are often used for memory impairment. However, certain memory aids can require extensive training and practice for everyday use (Cicerone et al., 2005).

The SM/veteran and clinician should complete continual on-going assessment and feedback of the effectiveness and adequacy of the memory techniques and strategies. Additional feedback can also be obtained from the SM's/veteran's co-workers, Command or supervisors, and friends and family to determine if the SM's/veteran's memory skills are adequate for duty, job, school, social, and daily living requirements.

6.5.4 Executive Functions

BACKGROUND

Executive functions refer to the set of skills related to the achievement of goal-oriented activity. Intervention in this domain often focuses on two subskills commonly impaired after TBI: metacognition (self-monitoring and control of one's own cognitive functions) and problem solving.

Metacognitive strategy training focuses on teaching the SM/veteran to self-regulate thoughts and actions, and self-monitor his/her performance during an activity, in order to control and optimize his/her learning and behavior (Sohlberg & Turkstra , 2011). Individuals with mTBI typically have good self-awareness to self-monitor their performance. Therefore, direct treatment for unawareness of impairment, as conceptualized in the cognitive rehabilitation literature, is typically not indicated. In fact, treatment for unawareness in mTBI may be contraindicated as it may foster an expectation of poor recovery, resulting in iatrogenic occurrence of persisting cognitive symptoms.

A systematic review of studies indicated that step-by-step metacognitive strategy instruction with young to middle aged adults with TBI improved problem solving skills, planning, and organization for personally relevant activities or problem situations (Kennedy et al., 2008). Although various sets of skills were emphasized across studies, immediate positive changes were reported in functional activities, and to a lesser extent in impairment-level outcomes (e.g., standardized test scores). The most frequent approaches used for the remediation of metacognition and problem solving deficits included: (a) acknowledging and/or generating goals, (b) self-monitoring and self-recording performance, and (c) making strategy decisions based on performance-goal comparisons in which individuals adjusted or modified a plan based on self-assessment and/or external feedback.

ACTION STATEMENT

Deficits in executive functions should be addressed in cognitive-communication therapy since they are likely to affect functional activities and participation in everyday life events.

RECOMMENDATIONS

1. The clinician and SM/veteran should consider step-by-step metacognitive strategy instruction to improve executive function skills.
2. Step-by-step intervention procedures can include: (a) acknowledging and/or formulating goals related to the everyday needs of the SM/veteran, (b) determining how to initiate the goals, (c) self-monitoring and self-recording of performance, (d) choosing and revising strategies based on goals and performance, (e) reformulating decisions or plans based on self-assessment, and (f) reviewing what was successful and what was unsuccessful (Kennedy et al., 2008; Kennedy & Coelho, 2005).
3. Remediation of executive functions should initially include external strategies and explicit instruction and feedback, but gradually shift to the internalization of self-regulation strategies through self-instruction and self-monitoring (Cicerone et al., 2005; Kennedy & Coelho, 2005).

Strength of Recommendation: Training in the use of problem solving and organization strategies as applied to real life tasks is supported by empirical evidence {Cicerone, 2000 #817;Cicerone, 2005 #818}. According to guidance provided by members of the DCoE/DVBIC consensus conference (Helmick, 2010), "a robust literature supports the use of metacognitive strategy training as an intervention for executive function impairments due to TBI" (p. 246).

DISCUSSION

Kennedy et al. (2008) reported that in the studies they reviewed, results from using the step-by-step intervention procedures indicated positive changes in executive function skills for everyday activities. However, these changes were not identified on standardized testing.

Rath, Simon, Langenban, Sherr, and Diller (2003) used a similar therapy approach to target problem solving in group therapy. Groups consisted of patients with mild to severe brain injuries. Patients were taught problem-orientation and problem solving skills. Group members were taught to accept the increased time needed to solve daily functional problems and use systematic structured choices to formulate solutions (Rath et al., 2003). Results from this study indicated significant changes in standardized test scores in the areas of memory and perseveration of responses using the Wisconsin Card Sorting Test.

If unrealistic self-appraisal exists in which an individual overestimates his/her skills, a brief period of awareness training using a "predicted vs. actual performance" paradigm may be helpful (MacLennan & MacLennan, 2008; Rebmann & Hannon, 1995). For example, a SM/veteran presenting with poor awareness of difficulties involving concentration and prospective memory, may overestimate his/her learning capacity and risk failure by enrolling in a full time college course load. Having the SM/veteran predict his/her ability to learn information in a classroom-like setting, and then compare the predicted vs. actual performance may serve to highlight difficulties in learning new information. Where cognitive difficulties are confirmed, compensatory cognitive strategies can be developed that will maximize the potential for success.

6.5.5 Social Communication

BACKGROUND

Social communication involves a complex interaction of cognitive abilities, awareness of social rules and boundaries, and emotional control (Dahlberg et al., 2007). For individuals with concussion/mTBI, impairment in attention, concentration, memory, speed of information processing, judgment, abstract thinking and executive control can interfere with language and communication (VA/DoD, 2009).

Social communication impairments may be appropriately viewed as one of the common consequences of behavioral impairment after TBI. Persisting irritability and anger may manifest as negative self-talk, verbal abusiveness to others, or physical aggression that can negatively impact social interactions (Raskin & Mateer, 2000). Post-deployment military personnel may be especially vulnerable to the effects of anger as this is a symptom of "battlemind" (Munroe, 2005), a set of psychological changes that are adaptive in a theater of war but maladaptive when returning to non-combat contexts.

Individuals with mTBI may show high levels of stress and anxiety (Ponsford et al., 2000) which have been associated with social phobia and an avoidance of social situations (Moore, Terryberry-Spohr, & Hope, 2006; Raskin & Mateer, 2000). Anxiety may be compounded by overstimulation related to significant demands on working memory (Cicerone, 2002; MacLennan & Petska, 2008) and by co-morbid PTSD (Brady, Killeen, Brewerton, & Lucerini, 2000).

ACTION STATEMENT

Problems with social communication may have a negative effect on functional outcomes and should be targeted for treatment by SLPs.

RECOMMENDATIONS

1. Social communication treatment may focus on: a) affective-behavioral impairments such as anger and anxiety that result in socially disruptive behavior or social avoidance; b) maladaptive behaviors arising from cognitive-communication impairments (e.g., diminished attention, memory, and impulsivity); and c) direct training of family and friends (who provide the circle of support) on techniques that facilitate improved communication skills for the SM/veteran with mTBI.
2. When unawareness of poor interpersonal skills is demonstrated, review of video recordings of social interactions can provide immediate feedback regarding the appropriateness of communication and can facilitate the adoption of positive communication strategies (Helffenstein & Wechsler, 1982). .
3. Treatment directed at modifying patterns of social communication in the partners of the patient with TBI may also serve to improve the communication skills of the patient (Togher, McDonald, Code, & Grant, 2004; Ylvisaker, Jacobs, & Feeney, 2003).
4. Group treatment provides a more natural communication context and should be considered as a strategy to facilitate generalization.

Strength of Recommendation: According to guidance provided by members of the DCoE/DVBIC consensus conference (Helmick, 2010) social skills training has shown effectiveness in improving problems in comprehending and responding to nonverbal social cues. Clinical experience with the military population with concussion/mTBI has supported the need to address impairments in social communication, particularly in light of co-morbidities such as PTSD.

DISCUSSION

Social communication treatment may focus on affective-behavioral impairments.

- Treatment may be directed at managing anger.

- Medd and Tate (2000) describe the effects of an anger management protocol on 16 subjects with acquired brain injury, 13 who had closed injury with severity ranging from mild to severe. Treatment involved: a) psychoeducation regarding the relationship between brain injury and anger and a model of anger; b) awareness-building exercises to explore the cognitive, physical, and emotional changes that may be contributing to anger; and c) development and rehearsal of strategies to deal with anger, including relaxation, self-talk, cognitive challenging, assertiveness training, distraction, and time-out methods. Participation in the program resulted in a significant decrease in anger on objective test measures.
- Uomoto and Brockway (1992) describe an anger management program involving two subjects with brain-injury and their families. The subjects with brain injuries were taught to use self-talk as a means of defusing tension when angry and to execute a time-out procedure when aware of significant anger escalation. Family members were trained to identify antecedent conditions to anger outbursts and to modify their communication style so as to reduce irritability in their family member with a brain injury. Both subjects showed diminished episodes of angry outbursts, and one subject showed improved social participation after treatment.

- Treatment may be directed at reducing anxiety and social avoidance.
  - Anxiety disorders, independent of TBI, may result in social discomfort and avoidance of social situations. A number of social skills treatments have been described for this population (Hambrick, Weeks, Harb, & Hemiberg, 2003; Van Dam-Baggen & Kraaimaat, 2000; Norton & Price, 2008). Cognitive therapies (e.g., cognitive-behavioral treatments) and exposure therapy alone, in combination, or combined with relaxation training, have been found to be efficacious across a variety of anxiety disorders. These techniques are likely to provide benefit for SMs/veterans with mTBI, particularly when they present with co-morbid PTSD and anxiety for specific situations that may result in social withdrawal.
  - MacLennan and Petska (2008) describe a social skills group run by SLP and psychology in which people with mTBI and co-morbid PTSD first develop relaxation strategies, then use the relaxation strategies during systematic exposure to increasingly stressful social situations.
- SLPs who possess the skill set to apply behavioral techniques in the treatment of communication are encouraged to do so. Clinicians who are not comfortable with practicing in this area, may elect to partner with psychologists and other mental health professionals to provide treatment in which behavioral change improves communication (e.g., exposure based communication group cited in MacLennan and Petska, 2008).

Where significant cognitive-communication impairments exist, most likely in patients with complicated mTBI, techniques described in the traditional treatment of social communication may be of benefit (see Struchen, 2005 for review). However, for best results, this treatment should be intensive, make extensive use of videotaped feedback, and deliberately incorporate strategies that will facilitate generalization to meaningful contexts (Ylvisaker, Turkstra, & Coelho, 2005). These strategies include use of group treatment sessions, treatment of social skills interactions in the community, and training family and other community members to communicate with the patient with brain injury.

Use of videotaped feedback should be considered as a powerful technique for behavioral
change. Video review of social interactions can provide relatively immediate feedback regarding the appropriateness of communication and allow SMs/veterans to identify problems in social interactions. This technique has been used to effect positive change in social communication that can generalize to untrained situations (Helffenstein & Wechsler, 1982). Aron and colleagues (1997) provided videotaped feedback of conversations to people with orbitofrontal brain damage who consistently engaged in inappropriate personal disclosure and showed no

awareness or embarrassment for inappropriate self-disclosure. Videotaped review of such interactions was shown to heighten awareness of inappropriate disclosure resulting in feelings of social embarrassment. Such use of videotaped review of conversational interactions to improve awareness can be the first step in developing strategies to modify that behavior.

Effective treatment may target everyday support people that interact with the person with brain injury. This includes family, friends, employers, and coworkers (Ylvisaker,et al., 2003; Togher, et al., 2004). Strategies directed at modifying social communication skills in the communication partners of the person with TBI often serve to improve the communication skills of the person with brain injury.

6.5.6 Acquired Stuttering and Other Speech Dysfluencies

BACKGROUND

SLPs working in the DoD and VA are reporting increasing numbers of referrals for fluency problems in SMs with suspected blast-related mTBI. While stuttering is not a symptom typically associated with mTBI, SLPs need to be mindful of the complex interaction of emotional and neurological consequences of combat injuries on communication and provide the most appropriate individualized services that address the SM's functional needs. The information below reviews the types and causes of adult-onset dysfluencies or stuttering as discussed in the literature and provides the SLP a starting point for conceptualizing his/her services for this unique population.

Stuttering

Speech dysfluency is typically referred to as stuttering. Stuttering is characterized by repetition of sounds, syllables, and whole monosyllabic words; prolongation of sounds; interjections; interruptions of word; silent or audible freezing or blocking; avoidance of difficult words by the use of different phrasing; and excessive physical tension accompanying the production of words.

The majority of adults who stutter have a developmental history of stuttering that began shortly after they learned to speak. There is believed to be a genetic predisposition to stuttering of childhood-onset as well as a similar predisposition to recovery from developmental stuttering that has been estimated to be as high as 80%. The majority of preschool children with stuttering-like speech dysfluencies recover before kindergarten (Ambrose, Cox, & Yairi, 1997).

Acquired Stuttering

Acquired stuttering, or speech dysfluencies that begin in adulthood may result from neurologic changes due to injury, disease, medication or in reaction to psychosocial-emotional stressors. Neurogenic stuttering typically appears following injury or disease to the central nervous system (i.e., the brain and spinal cord, including cortex, subcortex, cerebellar, and even the neural pathway regions). Drug-related side effects of some medications also can cause stuttering. In the majority of cases, the injury or disease that caused the stuttering can be identified. In a small number of cases, however, the individual may only show evidence of speech disruption without any clear evidence of neurological damage or drug effect. Psychogenic stuttering typically begins after a prolonged period of stress or after a traumatic event. Determining the

etiology of adult onset stuttering can be challenging, especially when it occurs in the context of emotionally and physically traumatic events such as combat injury.

Neurogenic Stuttering

Speech dysfluencies of neurogenic etiology are common in individuals with diagnosis of stroke, TBI, Parkinson's disease, epilepsy, Alzheimer's disease, Multiple Sclerosis, and Huntington's disease. Neurogenic stuttering can occur in isolation or in conjunction with other motor speech and language disorders (e.g., aphasia, apraxia, dysarthria). Neurogenic stuttering should be distinguished from other dysfluent behaviors that are associated with neurologic problems such as palalalia (word and phrase repetitions produced with increasing rate and decreasing loudness) (Rosenbek, 1984); and repetitions that some individuals make as they try to correct their motor speech or linguistic errors.

Acquired neurogenic stuttering differs from developmental stuttering in a number of ways: neurogenic stuttering usually has a sudden onset in adulthood; stuttering may not be restricted to initial syllables and may include context as well as function words; repeated readings of the same passage have less of an adaptation effect; many fluency-inducing conditions do not reduce stuttering; there is often awareness but without the typical anxiety, fear, or struggle evident in adults with a childhood history of stuttering. Helm-Estabrooks (1999) suggested that neurogenic stuttering also applies to adults with pre-existing history of childhood stuttering that either worsens or recurs as a result of an acquired neurological disorder.

Drug-Related Stuttering

It is common for drugs active in the central nervous system to cause changes in speech as part of a symptom complex resulting from adverse cognitive effects of the drug (Fayen, Goldman, Moulthrop, & Lurchins, 1988; Miller et al., 1988). Speech impairment including slurred speech, dysfluency, and word unintelligibility are used to describe the dysarthria reported to be related to medication usage (Bond, Carvalho, & Foulkes, 1982). Dysarthria, aphonia, mutism, and speech blockage have all been associated with administration of drugs, with various degrees of severity and duration (Bond et al., 1982).

Drugs that have been implicated in causing speech dysfluencies include: neuroleptics or antipsychotic agents including fluphenazine or chlorpromazine, benzodiazepines, antidepressants including amitriptyline, desipramine, fluoxetine, sertraline, and metrazamide, a radiopaque contrast medium used in positive contrast myelography. Other drugs that have been associated with stuttering include theophyline, prochlorperazine, methylpheniadate and pemoline, and alprazolam. It has been speculated that these drugs interact with neurochemical, neurotransmitter function in the central nervous system resulting in cognitive and/or extrapyramidal symptoms that interrupt speech fluency (Adler, Leong, & Delgado, 1987; Bertoni, Schwartzman, Van Horn, & Partin, 1981; Guthrie & Grunhaus, 1990; Lee et al., 2001; Meghji, 1994; Nurnberg & Greenwald, 1981).

Psychogenic Stuttering

Sudden-onset stuttering in adults is sometimes attributed to malingering (the conscious feigning of an illness to benefit the individual, such as avoidance of work or financial reward). However, it is more likely a form of psychogenic stuttering, a conversion symptom or a somatoform

disorder in which physical symptoms occur where there is no organic or physiological explanation found, and for which there is a strong likelihood that psychological factors are involved (Lazare, 1981; Roth, Aronson, & Davis, 1989).

Psychogenic stuttering may occur alone or in combination with other signs of psychological or neurological involvement. Baumgartner and Duffy (1997) suggested that people may be predisposed by personality, social or cultural bias, early learning, or visceral structure. If predisposed and then exposed to trauma or interpersonal difficulties, conflict and stress may then be channeled into musculoskeletal tension. Speech and laryngeal muscles are known to be susceptible to emotional stress as seen in muscle tension dysphonia and conversion aphonia (Aronson & Bless, 2009); stuttering-like behavior, infantile speech, pseudo-foreign dialect, and other speech and resonance disorders (Darley, Aronson, & Brown, 1975; Duffy, 2005).

Several authors have described the manifestations, diagnosis and treatment of psychogenic stuttering (Baumgartner, 1999; Lazare, 1981; Mahr & Leith, 1992; Roth, Aronson, & Davis, 1989). Similar to neurogenic stuttering, the stuttering pattern of psychogenic stuttering resembles developmental stuttering in terms of core behaviors, with sound and word repetitions, prolongations and blocks. In some cases, however, secondary behaviors may be unusual and occur independently of core stuttering behaviors.

ACTION STATEMENT

It is important to acknowledge and validate for the SM/veteran the presence of speech dysfluencies and to address this communication disorder through evaluation of its nature and severity, followed by therapeutic interventions to improve symptoms.

RECOMMENDATIONS

1. SMs/veterans with sudden onset of stuttering following combat-related concussion/mTBI should be seen by a SLP for evaluation and treatment.
2. A multidisciplinary approach involving neurology, psychiatry, and SLP is recommended.
3. The evaluation should include:
   - Complete case history
   - Motor speech exam
   - Speech samples under traditional fluency-enhancing conditions
   - Trial therapy
   - Analysis of stuttering behaviors to establish baseline measures of stuttering patterns and severity.
4. Treatments that have been suggested are similar to those used with developmental stuttering including: prolonged speech, fluency-shaping, easy onset, light contact, easy repetitions; diminishing extra motor behaviors and reducing physical tension associated with efforts to speak; providing education, support and reassurance; desensitization combined with vocal control therapy emphasizing adequate respiratory support, and optimal vocal resonance with gentle onsets; and finally following a hierarchy of easy to difficult situations to transfer learned skills outside of therapy (Baumgartner, 1999; Duffy, 2005; Roth et al., 1989; Weiner, 1981).

Strength of Recommendation: Acquired stuttering related to TBI is more common in individuals who sustained moderate to severe brain injuries. An early case description of combat-related acquired stuttering involved an individual diagnosed with combat-psychoneuroses (Dempsey & Granich, 1978). Other more recent case studies have described acquired stuttering in the presence of TBI and PTSD (Duffy, 2009; Duffy, Manning & Roth, 2011; Roth & Bibeau, 2011; Roth & Manning, 2009). Review of existing studies and expert consensus endorse the effectiveness of SLP involvement in cases of adult onset stuttering.

DISCUSSION

Adult-onset stuttering can have several etiologies that need to be considered: purely neurogenic, purely psychogenic, neurogenic with psychogenically-based neurologic symptoms, psychogenic accompanied by psychogenically-based neurologic signs, and psychogenic with coexisting but unrelated neurologic disease (Baumgartner & Duffy, 1997; Roth et al., 1989).

One of the first aims of an evaluation of adult-onset stuttering is to rule out a neurologic etiology. An interdisciplinary approach involving neurology, psychiatry and SLP may be the best option for assessment especially if a SM/veteran has other neurological symptoms such as headache, dizziness, or other cognitive-communication problems.

It can be difficult at times to determine etiology of dysfluencies as individuals with neurologic disease can experience depression, stress, and/or adjustment disorder. Organic disease may precede psychogenic response. It may "direct the somatization of psychodynamic conflict" (e.g., mTBI preceding psychogenic stuttering). Some individuals may be hypervigilant concerning their internal body environment ("spectatoring"). They may perceive ambiguous sensory changes in their speech (voice) mechanism as a result of trauma or emotional states as threatening or cause for alarm. Following a traumatic event, an individual may sustain motor inhibition without appropriate release leading to unnecessarily high muscular tonus, leading to partial or complete stuttering (Duffy, 2008).

Individuals who are able to decrease their stuttering in trial therapy and whose psychological adjustment is adequate are often good candidates for stuttering therapy.

An individual who is unable to improve fluency during trial therapy and/or who is dysfunctional because of psychological issues may benefit from psychotherapy concurrently with stuttering therapy. Even though an individual may need supportive or interventional psychotherapy, speech therapy may start immediately. Treatment of psychogenic stuttering can be successful with limited intervention. An individual who resists the idea that his/her stuttering may have a stress-related basis and who does not improve with trial therapy may not be a candidate for treatment or may need extended treatment.

An individual taking medications that may contribute to the onset of stuttering may respond well when the medication is eliminated or adjusted.

6.6 Discharge from Cognitive-Communication Treatment

6.6.1 Planning for Discharge

BACKGROUND

Discharge planning begins with the development of the treatment plan and long-term goals following the initial evaluation. It is a documented sequence of tasks and activities designed to achieve, within projected time frames, stated goals that lead to the timely transfer of SMs/veterans back to their Commands, into the community, to the VA System of care, to other providers in local communities, or to civilian facilities with specialized rehabilitation programs or services.

Discharge planning is undertaken in collaboration with the IDT, including the SM/veteran and family, to ensure that SMs/veterans receive health-care services, including rehabilitation therapies, for as long as medically necessary (Joint Commission on Accreditation of Healthcare Organizations, 2004).

ACTION STATEMENT

Discharge planning is conducted to ensure successful transition of the SM/veteran from the rehabilitation setting to their Commands or into the community.

RECOMMENDATIONS

1. Planning for return to AD status or transition to the VA System, and to the community involves the IDT, Command, SM/veteran and family, and includes the following:
   - Assessing the discharge destination environment and supports available;
   - Providing equipment and adaptations as needed;
   - Communicating with the interdisciplinary treatment team, the Command, the VA, or social services to ensure that appropriate follow up services are available as needed;
   - Establishing a monitoring process for tracking the SM's/veteran's progress and outcomes and providing follow-up, as appropriate;
   - Providing information about appropriate services and self-help groups in the discharge community that may be beneficial to the SM/veteran and family.
2. Discharge planning includes a written care plan outlining current needs and follow-up recommendations including:
   - Key contacts, responsible services/professionals, sources of continued information, support and advice;
   - Potential future problems and how to manage them, follow-up arrangements, the responsible service/person to contact if problems arise;
   - Services that address the SM's/veteran's and family's preferences, goals, and special needs to enhance participation and improve functioning in life activities.

3. SMs/veterans with persistent symptoms may need to proceed through the medical or disability evaluation processes. This process follows national and local regulations.

DISCUSSION

The SLP should insure that the following factors have been addressed for successful discharge planning: (a) appropriate interventional goals and objectives were specified; (b) sufficient instructional time was provided; (c) current and suitable intervention methods or materials were used; (d) meaningful and functional performance data were collected and analyzed on an ongoing basis to monitor and evaluate progress; (e) appropriate assistive technology or other supports were provided, when necessary; (f) a plan was designed and implemented as needed to address the needs and concerns of culturally/linguistically diverse families as they affect participation in communication services (e.g., use of interpreter or translator) (ASHA, 2004b); (g) relevant and accurate criteria were used to evaluate intervention; and h) health, educational, environmental, or other supports relevant to cognitive-communication interventions were provided.

Discharge planning is best conducted through IDT collaboration including, when appropriate, the SM/veteran and family member, Command, or whoever the SM/veteran chooses to include. The goal of discharge planning is to transition the SM/veteran into the setting where there is the greatest probability of performing successfully. When planning the discharge, it is the clinician's ethical responsibility to review and analyze all aspects of past services and to make recommendations for follow up.

Recommendations may include: (a) discontinuation from therapeutic services and return to Active Duty/work/community in pre-injury roles and responsibilities; (b) return to Active Duty/work/community in a new or modified position of responsibility; or (c) continuation of therapeutic services in another facility or at a different level of care.

6.6.2 Criteria for Discharge

BACKGROUND

Criteria for discharge from cognitive-communication therapy are based on the individualized treatment plan for each SM/veteran. There are no established thresholds on standardized testing that can substitute for clinician judgment, and the SM's/veteran's goals, perceptions, and preferences.

Discharge from cognitive-communication treatment ideally occurs when the SM/veteran, family, and SLP, as a team, conclude that the cognitive-communication disorder is remediated and/or compensatory strategies enable the individual to function adequately in his/her environment.

ACTION STATEMENT

Discharge from cognitive-communication rehabilitation should be considered when the SM/veteran no longer requires the facilities, skills, and therapeutic intensity of SLP services to meet the cognitive-communication challenges of their social, vocational, and avocational goals.

RECOMMENDATIONS

1. Discharge from cognitive-communication rehabilitation is recommended when one or more of the following criteria are met:
   - Cognitive-communication abilities are within normal limits or are consistent with the SM's/veteran's pre-morbid status;
   - Therapeutic goals have been met;
   - Cognitive-communication abilities are functional and no longer interfere with the SM's/veteran's ability to participate in home and community activities to their satisfaction;
   - No progress is demonstrated toward the next level of cognitive-communication independence despite repeated efforts and different treatment approaches;
   - There is a change in the SM's/veteran's medical, psychological, or other conditions preventing further benefit from therapeutic intervention at the current time.
2. Recommendations for reassessment or follow-up in the MTF, VA system, or in the community, or a referral for other services may be made at the time of discharge.
3. Discharge is also appropriate in the following situations, provided that the SM/veteran is advised of the likely outcomes of discontinuation:
   - SM/veteran is unwilling or chooses not to participate in treatment;
   - Treatment attendance has been inconsistent or poor, and efforts to address these factors have not been successful;
   - SM/veteran requests to be discharged or requests continuation of services with another provider;
   - SM/veteran is transferred or discharged to another location where ongoing service from the current provider is not reasonably available, in which case efforts should be made to ensure continuation of services at the new locale;
   - Treatment no longer results in measurable benefits. There does not appear to be any reasonable expectation for improvement with continued treatment. Reevaluation should be considered at a later date to determine whether the SM's/veteran's status has changed or whether new treatment options are available.
   - SM/veteran is unable to tolerate treatment because of a serious medical, psychological, or other condition;
   - SM/veteran demonstrates behavior that interferes with improvement or participation in treatment (e.g., noncompliance, malingering), providing that efforts to address the interfering behavior have been unsuccessful.

DISCUSSION

The restoration of quality of life after TBI is a primary endpoint of recovery and rehabilitation (Cicerone & Azulay, 2007). Treatment is expected to result in deficit reduction, and measurably enhanced functioning and participation.

In the majority of cases, a patient with mild cognitive-communication impairments may require a very limited period of intervention defined as education, counseling, and provision of functional accommodations and compensatory or support strategies with discharge occurring within a few weeks of initial contact.

In those SMs/veterans with persisting cognitive-communication deficits associated with PCS, a lengthier period of intervention may be required. In this small percentage of cases, discharge planning may benefit from collaboration of the SLP, SM/veteran/family, case manager,

and other IDT members to ensure the most successful outcomes.

6.7 Follow-Up

BACKGROUND

Each program should have established policies and procedures for following the SM/veteran after discharge. Follow-up is necessary for a variety of reasons, including the fact that circumstances may change in the SM's/veteran's environment, new treatment options may become available, or the SM/veteran may respond differently due to maturational or motivational changes or new life transitions. The discharge plan should stipulate a follow-up schedule and long-term goals that promote recovery from cognitive symptoms and prevent harm due to their persistence.

To date, evidence is not available on how long blast-related cognitive-communication symptoms typically persist. However, preliminary studies suggest that, while a single mTBI or concussion is a transient neurological event with a relatively rapid and spontaneous recovery, recurrent mTBI may be associated with longer recovery time and persistent symptoms, and may potentially increase the lifetime risk of psychiatric and neurological problems (McCrae, 2008).

ACTION STATEMENT

Follow-up interventions should be planned after discharge from cognitive-communication services with goals and on a schedule that are appropriate to the community re-integration needs of the individual.

RECOMMENDATIONS

Follow up services for cognitive-communication problems of mTBI should be considered under the following conditions:

1. SMs/veterans who present with cognitive-communication problems in the acute phase of mTBI should be seen at three months from the most recent injury event to determine if symptoms have resolved or to initiate evaluation, as necessary;
2. Follow-up interventions following discharge from treatment should be scheduled as prescribed in the discharge plan, and at times that are least disruptive for the SM/veteran so that employment and academic status are not compromised;
3. Telephone follow-up should be used to provide additional support;
4. If cognitive-communication problems are identified and the SM/veteran does not choose to engage in treatment at that time, information should be made available to facilitate contact with the appropriate VA or DoD facility for follow-up in the future;
5. The SLP should advocate for case management for SMs/veterans with complicated histories, co-morbidities, and lack of social support.

DISCUSSION

Guskiewicz et al. (2005) studied the association between prior TBI and long-term mild cognitive impairment and Alzheimer's disease in a group of retired professional football players. Results of surveys obtained from 758 retired athletes and spouses or immediate caregivers focused on memory and other cognitive problems. More than half (61%) reported sustaining at least one concussion and 24% sustained three or more previous concussions. There was a significant association between recurrent concussions and clinical diagnosis of mild cognitive impairment and

self reported memory impairments. Those with three or more concussions had a five-fold prevalence of cognitive disorder and a three-fold prevalence of reported significant memory problems compared with subjects who had no prior history of concussion. There was an earlier onset of Alzheimer's disease in retired professional football players than in the general American male population. The authors concluded that the onset of dementia-related syndromes may be initiated by repetitive cerebral concussions in professional football players.

Results of the Neurobehavioral Symptom Inventory (Cicerone & Kalmar, 1995) administered at the Durham VAMC to veterans (n=162), who screened positive to exposure to blast or blunt head trauma, indicated some level of cognitive problems, with forgetfulness (96%), concentration (95%), organization (93%), and decision making (85%) being most frequently represented. Most of these veterans were employed, seeking employment, or were students, and reported problems at work/school or in their family and social life due to cognitive problems. A significant number was over five years post exposure to multiple blast and blunt head trauma. Follow-up to address these problems and improve quality of life is imperative, although visits are difficult to schedule because these veterans are employed or seeking employment and fulfilling their responsibilities to their family and community.

7. Outcome Measurement

BACKGROUND

In an era of emphasis on evidence-based clinical practice, the employment of outcome measures is essential for validating the efficacy of cognitive-communication interventions. When appropriately used, outcome measures allow SLPs to communicate to the individuals served, persons with administrative oversight, and the public at large about the value of the services provided.

The gold standard of outcome measurement is pre- vs. post-assessment differences, including differences in functional status, the moderating variables that may affect outcome, discharge environment, and consumer satisfaction (including the SM/veteran, family, employer/Command, and referral source) (Helmick, 2010).

ACTION STATEMENT

Outcome measurement should be conducted to establish the effect of cognitive-communication interventions.

RECOMMENDATIONS

Outcome measurements should include standardized evaluation of discrete cognitive-communication skills, symptom status, and functional status.

1. Areas of objective testing and symptom reports that are measured post-rehabilitation should be consistent with those areas initially evaluated during the assessment phase.
2. Functional outcomes should be monitored on an ongoing basis. Functional areas that should be addressed in outcome assessment include:
   - Job performance (MOS, work, school);
   - Need for job re-designation and/or duty/work/school restrictions or limitations;

- Differential between pre-injury performance and current functional status;
- Performance on simulators (e.g., rifle, flight) and work trials;
- Quality of life;
- Community participation.

SLPs may benefit from collaboration with the IDT in the selection of outcome measurements that integrate cognitive-communication changes in the larger context of rehabilitation outcomes. In such cases, however, it may be difficult to establish a direct correlation between changes in specific cognitive-communication abilities and differences in global measures of function.

DISCUSSION

Analysis of the outcome measurements in cognitive-communication rehabilitation for mTBI is disadvantaged by the many unknown facts about the nature of blast-related mTBI and by the paucity of scientific evidence about the efficacy of cognitive-communication rehabilitation in both military and civilian mTBI. For these reasons, it is important to carefully describe the patients receiving cognitive rehabilitation, including identification of moderating variables, confounds, and co-morbidities of mTBI. Understanding which patients with mTBI respond to cognitive rehabilitation interventions and which do not is the key to advancing this field in medicine (Helmick, 2010).

Appendix: List of Acronyms

AD: Active Duty

ANCDS: Academy of Neurologic Communication Disorders and Sciences

ASHA: American Speech-Language-Hearing Association

CDC: Centers for Disease Control and Prevention

CONUS: continental United States

CPD: cognitive prosthetic device

CMG: Clinical Management Guidance

CSH: combat support hospital

CT: computed tomography

DAI: diffuse axonal injury

DCoE: Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury

DoD: Department of Defense

DVBIC: Defense and Veterans Brain Injury Center

FST: forward surgical team

ICD-10: International Classification of Diseases, 10th edition

IDT: interdisciplinary team

IED: improvised explosive device

JC: The Joint Commission LRMC: Landstuhl Regional Medical Center, Germany

MACE: Military Acute Concussion Evaluation

MEB: Medical Evaluation Board

MOA: Memorandum of Agreement

MOS: military occupational specialty

MPT: Matching Person & Technology
MRI: magnetic resonance imaging
mTBI: mild traumatic brain injury
MTF: medical treatment facility
MVC: motor vehicle crash
NIH: National Institutes of Health
OEF: Operation Enduring Freedom
OIF: Operation Iraqi Freedom
OT: occupational therapist
OTSG: Office of The Surgeon General
PCS: post-concussion symptoms
PNS: VA Polytrauma Network Sites
POC: point of contact
PRC: Polytrauma Rehabilitation Centers
PSC: Polytrauma/TBI System of Care
PT: physical therapist
PTSD: post-traumatic stress disorder
SAC: Standardized Assessment of Concussion
SCI: spinal cord injury
SLP: speech-language pathology; speech-language pathologist
SM: service member
TBI: traumatic brain injury
VA: Department of Veterans Affairs
VAMC: VA Medical Center
VHA: Veterans Health Administration

VISN: Veterans Integrated Service Networks

WHO: World Health Organization

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