

APPENDIX A

CLINICAL MANAGEMENT GUIDANCE: **OCCUPATIONAL THERAPY** **AND** **PHYSICAL THERAPY** **FOR** **MILD TRAUMATIC BRAIN INJURY**

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(see Appendix A.1)

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EXECUTIVE SUMMARY

Given the large numbers of Service members sustaining mild traumatic brain injury (MTBI) in OEF/OIF, a group of occupational and physical therapists was tasked by the Proponency Office for Rehabilitation and Reintegration to develop a *Clinical Management Guidance* document that outlines best OT and PT practices for rehabilitation of Service members with MTBI. The *Guidance* in its current form represents a prelude to a final version that includes a toolkit.

Based on reviews of existing guidelines, research literature, and with input from experts, the resultant document includes OT and PT assessment and intervention recommendations related to the following concerns associated with MTBI: Combat Readiness Check, activity intolerance, patient education, vestibular dysfunction, vision dysfunction, headache, temporomandibular disorders, cognitive dysfunction, performance of life roles, participation in exercise. We also provide a brief discussion of outcomes measurement specific to participation.

An expert panel recommended the development of a Combat Readiness Check (CRC) that could be administered by an OT or PT in theater. The CRC, comprised of existing instruments and a dual task test, would provide decision-makers with additional data about safety and readiness to return to duty. Stop-gap assessments were proposed but the dual-task component needs to be developed and validated, along with the entire proposed CRC procedure.

OT and PT have pivotal contributions to the recovery, rehabilitation, and reintegration of Service members with MTBI. Research is needed in every area of practice – presenting opportunities to advance outcomes for Service members and civilians alike.

SECTION I

INTRODUCTION:

The wars in Iraq and Afghanistan - Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) - have mobilized the civilian and military medical and rehabilitation communities to identify best practices in the care of Service members with mild traumatic brain injury (MTBI). Symptoms of MTBI may have immediate and long term implications for warriors' safe return to duty³¹ and veterans' ability to successfully re-establish social relationships and resume productive activities upon discharge from military service³².

Occupational and physical therapists provide adaptive and remedial interventions to address impairments, activity limitations, and social participation issues associated with MTBI. Occupational therapy (OT) and physical therapy (PT) have played an essential role to the mission of the United States Military and Veteran Affairs for the more than seventy five years. As members of the Army Medical Specialist Corps, occupational and physical therapists contribute to the Corps mission by applying their "...unique skills to maximize the health and enhance the readiness of Warriors across the full spectrum of operational missions and environments" (retrieved December 9, 2007 from <https://amsc.amedd.army.mil/> , Army Medical Specialist Corps). Occupational and physical therapists are also members of the United States Veterans Affairs (VA) health care team. As such, they provide rehabilitation Services to military veterans in order to ensure maximum level of functioning and quality of life. This commitment to the health and wellbeing of active duty soldiers (including activated Reservists and National Guard) has helped maintain troop levels, return soldiers to duty, and ensure the best possible recovery and rehabilitation for those who are unable to return to duty. Outcomes of care are optimized as occupational and physical therapists use evidence-based guidelines to inform the assessment and treatment of MTBI across the military and VA eight levels of care - from point of injury to community reintegration.

OVERVIEW:

In September 2007, The Proponency Office for Rehabilitation and Reintegration (PR&R) of the Office of the Surgeon General charged a team of two occupational therapists and three physical therapists (two military and three civilians) to develop OT/PT clinical practice guidance for MTBI by December 31, 2007. Specifically, the MTBI Clinical Management Guidance was to summarize and help establish, "...state-of-the-art rehabilitative care for Soldiers with mild traumatic brain injuries...[by] completing a critical review of current research and clinical rehabilitative care practices in the assessment, treatment and management of mild TBI at all levels of care (from acute theater to long term life care" (Statement of Work, 2007). The work team was further charged to convene a MTBI Rehabilitative Care Summit with OT and PT subject matter experts from the Department of Defense, VA, and the civilian sector to review, refine and reach a consensus on the OT/PT clinical management recommendations. This final document is a result of the above stated charge and is an updated version of two earlier drafts.

This document has eight sections: introduction, background, overview of the OT and PT recommendations, OT and PT recommendations for assessment and intervention for MTBI, references, and appendices.

For convenience, the term "Service member" will be used throughout the Clinical Guidance document – referring generally to active duty, Reservists, National Guard, and veterans of all Services.

METHODS:

The document development process consisted of four phases (see Figure A.1): Phase 1 – Identifying best practices; Phase 2 – Drafting and refining assessment/treatment recommendations for each level of care based on expert input; Phase 3 – Writing a full draft of the document and obtaining expert review; Phase 4 – Finalizing algorithms, references, and recommendations for next steps and submitting the Clinical Management Guidance document. Each phase of development is described below.

Figure A.1



Figure A.1: Overview of Clinical Management Guidance development process.

Phase 1: Identifying best practices

During this phase, the team completed a literature review on the assessment and treatment of MTBI. The literature review consisted of exploring existing evidence-based reviews and research from a variety of rehabilitation disciplines. Disciplines involved in the treatment of MTBI include occupational therapy, physical therapy, speech and language pathology, neuropsychology, counseling psychologists, physicians, nurses, vocational counselors, recreational therapists, and kinesiotherapists. The scope of practice of the various professionals is typically

determined by state licensure and practice setting. There was a heavy reliance on literature specific to the MTBI incurred in civilian contexts (e.g., sports or traffic accidents) as little literature exists about rehabilitation after MTBI sustained in combat. The work team also reviewed existing practice guidelines pertinent to MTBI including the following: Practice Management Guidelines for the Management of Mild Traumatic Brain Injury: the EAST Practice Management Guidelines Work Group ³³; Veterans Health Initiative: Traumatic Brain Injury ³⁴; WHO Collaborating Centre Task Force on Mild Traumatic Brain Injury (see *Journal of Rehabilitation Medicine*, Supplement 43, February 2004); Guidelines for Field Management of Combat-Related Head Trauma ³⁵; Traumatic Brain Injury: Diagnosis, acute management, and rehabilitation ³⁶; Defense and Veterans Brain Injury Center (DVBIC) Working Group on the Acute Management of Mild Traumatic Brain Injury in Military Operational Settings: Clinical Practice Guideline and Recommendations ⁷. It should be noted that none of these guidelines specified OT or PT practices. Additionally, team members contacted therapists who are members of the military/VA healthcare system to identify current standards of practice and request information about what may be needed to enhance outcomes. Civilian programs specializing in MTBI and brain injury rehabilitation were also contacted to identify best practices.

Phase 2: Drafting recommended practices

During Phase 2, the team synthesized information obtained from the literature and facility discussions to begin drafting recommendations for OT and PT practice. The draft of assessment and treatment guidelines across the eight levels of care included a number of general assumptions regarding treatment of MTBI as well as assumptions specific to setting and level of care. Overarching goals appropriate for specific settings were also outlined. These recommendations were documented and a multidisciplinary expert panel was identified and invited to participate in a one day Summit (November 15, 2007) to provide feedback on both the process and content of the draft proposal. During the Summit, minutes were taken and a post-Summit meeting was used to summarize and discuss the various suggestions.

Phase 3: Synthesizing feedback and writing a full first draft

During this phase, the OT/PT MTBI work team continued to revisit the literature and utilize their contacts at the various treatment settings to refine and formalize practice recommendations. Writing of the document began at this phase and a revised draft of the complete document was sent to subject matter experts with a feedback form for in-process feedback.

Phase 4: Finalizing and submitting the Clinical Management Guidance document

Feedback from subject matter experts was pooled and modifications were made to the Guidance document. In addition, sample level-of-care algorithms for specific recommendations were developed, references compiled, and the final draft of the Guidance completed. Suggestions for implementation and further work were identified and documented and Draft 1.0 of the Guidance was submitted to the PR&R on January 1, 2008.

In early 2009, Draft 1.0 was further edited, resulting in the current version of the document (Draft 2.0). Draft 2.0 was then updated in May 2010 so that this final version of the Guidance is compatible with the companion OT-PT MTBI Toolkit.

SECTION II

BACKGROUND:

In this section, we discuss definitions of MTBI, outline the typical course of recovery, and describe the implications for MTBI sustained in a military context.

Definitions of Mild Traumatic Brain Injury

There is no consensus on a definition of MTBI, nor is there a symptom complex that demonstrates diagnostic specificity³⁷. Three definitions were used to inform this work: the one currently used by the Department of Defense (DoD) (released October 1, 2007); one identified by the World Health Organization (WHO); as well as the definition adopted by the Defense and Veterans Brain Injury Center⁷. While the current DOD definition is the basis of this Clinical Practice Guidance, the literature that has been instrumental in the development of other guidelines often uses alternative definitions for MTBI.

According to the WHO Collaborating Centre for Neurotrauma Task Force on MTBI, MTBI is "... an acute brain injury resulting from mechanical energy to the head from external physical forces. Operational criteria for clinical identification include one or more of the following; confusion, loss of consciousness for 30 min or less, post traumatic amnesia less than 24 hours and other transient neurological abnormalities such as focal signs, seizures, and an intracranial hemorrhage not requiring surgery. Deficits cannot be due to drugs, alcohol, medications, or other injuries or problems (psychological), or by penetrating craniocerebral injury" (Carroll, 2004, p. 114).

The Defense and Veterans Brain Injury Center (2006) developed a definition that incorporated many of the elements outlined in the WHO definition. They stated, "... MTBI is an injury to the brain resulting from an external force and/or acceleration/deceleration mechanism from an event such as a blast, fall, direct impact, or motor vehicle accident (MVA) which causes an alteration in mental status typically resulting in the temporally related onset of symptoms such as: headache, nausea and vomiting, dizziness/balance problems, fatigue, insomnia/sleep disturbances, drowsiness, sensitivity to light/noise, blurred vision, difficulty remembering, and/or difficulty concentrating" (p. 2).

In an attempt to better diagnose and provide treatment to the troops in the theater, the DoD updated the definition of traumatic brain injury and how it classifies severity of injury. According to a memo released by the Assistant Secretary of Defense on October 1, 2007, a traumatic brain injury is "... 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:

- Any period of loss of or a decreased level of consciousness;
- Any loss of memory for events immediately before or after the injury;
- Any alteration in mental state at the time of injury (confusion, disorientation, slowed thinking, etc.);
- 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" (p. 1).

While acknowledging that cognitive symptoms associated with post traumatic stress may look similar to MTBI, they further characterize MTBI as meeting one or more of the following criteria: loss of consciousness for 0 – 30 minutes; alteration of consciousness/mental state for a moment or up to 24 hours; post-traumatic amnesia for up to one day.

Natural History of Mild Traumatic Brain Injury

Individuals who sustain MTBI typically become symptomatic at the time of incident (McCrea, 2008). Initial symptoms often include headache, dizziness, nausea and vomiting, sleep disturbances, sensitivity to noise and light, slowed thinking and reaction time, memory problems, irritability, depression, and visual changes ³⁸. During the acute phase of recovery, symptoms are thought to be explained by a short-term neurometabolic process that renders neurons temporarily dysfunctional but not destroyed ³⁹.

Some Service members with MTBI do not report symptoms until later in their medical care (especially if they suffer concomitant life-threatening injuries) or after deployment. In their post-deployment screening study, Terrio and colleagues (2009) reported that for some Service members, memory problems and irritability were first identified after the acute phase, possibly when they are faced with challenging novel tasks and/or feedback from loved ones. Again, MTBI symptoms vary in severity and may or may not impact activity and social participation. In the majority of cases, symptoms resolve within three months of injury ⁴⁰. However, for 10-30% of those with MTBI ⁴¹⁻⁴⁴, problems persist and impact the individual's ability to resume multiple life roles and activity.

The group of individuals who present with persistent problems after three months may have post-concussion syndrome (PCS) ^{40,45}. A person with possible PCS has a history of head trauma with LOC and experiences symptoms in at least three of the following categories: headache, dizziness, malaise, fatigue, noise intolerance; irritability, depression, anxiety, emotional lability; subjective concentration, memory, or intellectual disabilities without neuropsychological evidence or marked impairment; insomnia; reduced alcohol tolerance; preoccupation with above symptoms and fear of brain damage ⁴⁵. There are a number of possible explanations for the difficulties experienced by the subgroup with protracted MTBI symptoms ⁴⁰. One explanation is that these people have sustained microscopic brain damage that is responsible (in part) for the physical, cognitive, and emotional sequelae of MTBI ⁴⁶. Others suggest that PCS is likely not a neurologic condition stemming from MTBI ³⁹. PCS may be the result of a vicious

cycle in which cognitive inefficiencies, distractions from physical symptoms, and situational stressors interact to compound the challenges presented by the MTBI ⁴⁷. As explained by Montgomery (1995), extra effort is required as the person resumes everyday activities and becomes alarmed by inefficiencies and errors in performing premorbidly mundane tasks. The resultant hypersensitivity to error and anxiety mix with misattributions regarding the root cause of deficient performance, further sabotaging self-confidence and subsequent performance. The long term consequences of issues surrounding MTBI and PCS can lead to long term depression, social isolation, behavioral issues, and family burden.

Mild Traumatic Brain Injury in a Military Context

An estimated 10-15% of Service members returning from OEF/OIF may have sustained a MTBI ⁴⁸. A critical problem in addressing the needs of Service members with MTBI is that the injury itself is difficult to diagnosis or identify. Unlike that of soldiers who sustain severe TBI, military personnel who, are exposed to single or multiple blast explosions from improvised explosive devices (IEDs) may sustain mild head trauma with no immediate outward signs of injury. Their symptoms may initially present themselves as a brief alteration of consciousness (AOC) or behavioral changes ⁴⁹. There is no way of identifying the number of mild traumatic brain injuries at this time as many are initially masked with other more dire diagnoses such as limb loss, burns, spinal cord injury, or fractures.

Service members who present with MTBI fall into one of the following four categories: the warrior who sustained a MTBI only; the warrior who has sustained MTBI and also presents with post traumatic stress disorder (PTSD); the warrior who presents with MTBI and polytrauma; the warrior who presents with all three (MTBI, polytrauma, and PTSD). These multiple variables introduce a number of factors that make initial diagnosis and assessment difficult such that MTBI may often not be detected until well after the incident(s). Furthermore, the concomitant injuries and conditions must be considered in occupational and physical therapy regimens across all levels of care.

Mild Traumatic Brain Injury and Stress Disorders

Similar to MTBI, many Service members experience stress disorders associated with deployment to combat operations and witnessing atrocities ⁵⁰, with combat injuries increasing the risk for PTSD ⁵¹. The mechanism of injury (over half from a blast) and the combat environment place the Service member who has sustained a MTBI at high risk for an ASR/PTSD overlay ⁵². Cognitive symptoms associated with acute stress reaction (ASR) and post traumatic stress disorder mirror many of those apparent in mild traumatic brain injury ⁵³. These include sleep disturbances, difficulty with attention, concentration, and memory, irritability, and social isolation (Table A.1).

Table A.1 Symptom Comparison MTBI vs ASR/PTSD⁷

Symptom	MTBI	ASR/PTSD
Memory, attention, concentration	X	X
Irritability	X	X
Sleep disturbances	X	X
Visual changes/disturbances	X	
Balance and Vestibular Issues	X	
Psychological distress with cues that symbolize traumatic event		X
"Flashbacks" during day, night or during sleep		X
Impaired functioning limiting participation in activities	X	X
Nausea and/or vomiting (at time of incident)	X	
Chronic headache	X	

Symptoms associated with MTBI are more evident and persistent in individuals who present with PTSD^{53,54}. PTSD, like MTBI has become a key issue for returning OEF/OIF veterans. According to Matthew S. Goldberg, Deputy Assistant Director for National Security, in a report to Congress on October 17, 2007, "Post-traumatic stress disorder (PTSD) is also difficult to diagnose. Among OIF and OEF veterans who have received VA medical care, about 37 percent have received at least a preliminary diagnosis of mental health problems, and about half of those (17 percent) have received a preliminary diagnosis of PTSD. The overall mental health incidence rate may be lower to the extent that OIF and OEF veterans who have not sought VA medical care do not suffer from those conditions. On the other hand, some veterans with PTSD or other mental health problems may not seek care because they fear being stigmatized" (retrieved on 12/8/08 from <http://veterans.house.gov/hearings/Testimony.aspx?TID=7260>).

In summary, it is clear that many Service members experience a confusing constellation of symptoms associated with MTBI, PCS, ASR, or PTSD. Therapists appreciate that presenting symptoms may have a dual or even multiple underlying causes, especially in those instances where symptoms continue for more than the typical three month period post-injury. Occupational and physical therapists rely on mental health professionals to diagnose the cause of symptoms (MTBI, ASR/PTSD or a combination of both) - information critical for the occupational and physical therapist when they choose their assessment and treatment methods.

MECHANISM OF INJURY:

The mechanisms of injury for deployment-related MTBI include 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.

The most common mechanism of injury in OEF/OIF has been secondary to improvised explosive devices (IED) or mines⁵⁵. IEDs are often placed roadside, hidden within walls, or placed in small confined buildings. When detonated they cause an explosion sending both physical matter and blast waves that travel for hundreds of yards at speeds up to 1,600 feet per second. These blast waves occur in multiple phases with varying injury noted at each phase⁵⁶. The primary phase refers to direct exposure to over pressurized air waves. This may cause diffuse axonal injury and a coup-counter-coup type injury. The secondary phase can be described as the phase where debris follows the air waves often causing penetrating or non-penetrating wounds. The tertiary blast is when the individual is thrown or displaced and hits his or her head on a stationary object, and the quaternary blast injury consists of burns or inhalation of toxic fumes. Many warriors are exposed to multiple blasts and symptoms may or may not be apparent after the first exposure. The minimal neuronal damage that occurs with a single blast is compounded and symptoms may emerge as exposure proximity and frequency increase. To date, there is no way of knowing the risk of MTBI associated with a number of or proximity to blast exposures⁵⁶.

Functional Implications for Service Members

As discussed previously, initial symptoms associated with MTBI include headache, dizziness, nausea and vomiting, sleep disturbances, sensitivity to noise and light, slowed thinking and reaction time, memory problems, irritability, depression, and visual changes³⁸. These deficits significantly impact the duties of a deployed Service member and may interfere with the veteran's attempts to resume life outside the military system. For example, for warriors, visual disturbances will impact their ability to see the enemy, identify possible IEDs hidden within the brush, read maps and drive safely and effectively in a war zone. Dizziness will hamper use of weapons, negotiating difficult terrain, and tolerating position changes. Decreased processing and reaction time place soldiers and their comrades at risk when quick decisions must be made. If a warrior who has sustained a MTBI remains on duty, the symptoms associated with the injury may place the warrior and their comrades and the mission at risk.

On the home front, persistent symptoms associated with MTBI or PCS often lead to long term activity limitations and social participation restrictions. The long term disability often associated with MTBI may lead to anxiety, stress, depression, and social issues⁵⁷, especially if concomitant with other injuries. Activities such as returning to work or school may be challenging or impossible depending on the extent of symptoms. Returning to roles such as a spouse or parent presents challenges as irritability and decreased frustration tolerance impact relationships. Cognitive inefficiencies, such as problems with attention and memory, make seemingly easy daily tasks like medication management a challenge⁵⁸. Given the potential impact of persistent MTBI symptoms on Service members' recovery and

reintegration, evidence-informed occupational and physical therapy services are needed at all levels of care.

SECTION III

REHABILITATION AFTER MILD TRAUMATIC BRAIN INJURY WITHIN A MILITARY CONTEXT:

Eight levels of care have been defined to describe medical and rehabilitation resources across the continuum of care – in combat theater through return to community. A Service member may enter the rehabilitation system at any one of the 8 levels or “ports of entry”. Furthermore, Service members may enter and exit the Levels of Care multiple times throughout their lifetime.

Rehabilitation Segments of the Levels of Care

The overarching goals of rehabilitation are described within level segments below.

In Combat Theater: Levels I - III

Level I: Buddy Aid to Battalion Aid Station (BAS)

Level II: Forward Support Medical Company/Forward Surgical Team

Level III: Combat Support Hospital (CSH) and Combat Stress Unit

Occupational and physical therapists address symptoms of MTBI for Service members remaining in theater. They may have roles in providing patient education about MTBI and contribute to identifying MTBI symptoms that may interfere with combat readiness. OTs and PTs in theater are advocates for establishing activity tolerance before safe return to duty.

Acute Medical Rehabilitation: Level IV

Level IV: Evacuation Center (Landstuhl Regional Medical Center [LRMAC])

Occupational and physical therapists may begin therapy plans of care during the relatively short episode of care at LRAMC before injured Service members are evacuated to CONUS (continental United States). Therapists continue to evaluate and treat MTBI symptoms, address functional limitations and concomitant impairments, provide education about MTBI, and work with the medical team to identify MTBI.

Single-Service and/or Interdisciplinary Rehabilitation Programming: Levels V - VIII

Level V: Military medical treatment facility (MMTF) - Inpatient and Outpatient

***Level VI: Inpatient Rehabilitation
(non-MMTF, such as Veteran’s Affairs Medical Center and community partner facilities)***

Level VII: Outpatient rehabilitation

(non-MMTF, such as Veteran's Affairs Medical Center and community partner facilities)

Level VIII: Lifetime care

(as Veteran's Affairs Medical Center, a community partner hospital or outpatient facility)

Occupational and physical therapists are part of a larger interdisciplinary team at Levels V – VII, where they work closely with rehabilitation physician, speech pathologist, rehabilitation nurse, therapeutic recreation specialist, chaplain, neuropsychologist, counseling psychologist, and vocational rehabilitation counselor. Occupational and physical therapy specialists (in vision rehabilitation, vestibular rehabilitation, driving) may also be available at these levels.

Inpatient rehabilitation therapies typically focus on helping injured Service members regain basic self-care and mobility skills. They continue to address MTBI-related impairments such as vision, vestibular, and balance problem, provide patient education, and begin to teach Service members with MTBI compensatory techniques. Family members may become involved in the therapy process as well. Therapists provide input regarding return to duty and discharge decisions. Community re-entry readiness will also be addressed, including driving.

Outpatient therapies (at MMTF or VA facilities) tend to address increasingly high-level cognitive, motor, and everyday tasks and functioning. Occupational therapists continue to teach patients to learn to use compensatory cognitive strategies, helping them apply those strategies to home, work, education-related tasks. Occupational therapists are also equipped to help Service members improve communication and emotional control in ways that help with their transition back to family and social life. Physical therapists address MTBI-related symptoms and high-level motor skills needed for return to leisure and fitness activities. Outpatient therapies may be clinic-based or incorporated into the Warrior Transition Units.

SECTION IV

RECOMMENDED OCCUPATIONAL AND PHYSICAL THERAPY PRACTICES:

In this section, we outline recommended OT and PT practices that are supported by the literature and/or by consensus among the work team and advisers. First, assumptions underlying these recommendations are explicated and we then present guiding principles for clinicians treating Service members with MTBI that are applicable across all levels of care. Finally, we orient the reader to the structure and format of the OT and PT recommended practices before describing them according to rehabilitation segment/level of care.

Overarching Assumptions

In order to develop the *Guidance* for occupational and physical therapy across the continuum of care (the military, VA, and lifetime care), the work team

made a number of working assumptions about the recipient of therapy services (i.e., Service members) and the potential user of this document (i.e., therapy practitioners).

Assumptions about the Service member receiving OT and/or PT after MTBI (based on DoD definition above):

- 1) He or she may have suffered a MTBI concomitant with other physical injuries; MTBI may or may not have been identified upon initial medical assessment.
- 2) Onset and duration of disability associated with MTBI-related symptoms vary across individuals. Sometimes MTBI symptoms may be transient but for some Service members, symptoms are significant enough to impact functioning on the activity level or social participation level, interfering with performance of military duties or civilian life ⁴⁰.
- 3) Symptoms of combat stress often mirror that of MTBI, making it difficult to determine which factors are contributing to performance problems. A differential diagnosis is required for accurate treatment.
- 4) Beyond a possible MTBI, functional performance may be affected by fatigue, stress/mental state, medications, sleep habits, and or other injuries and illnesses.
- 5) Service members with MTBI may enter the system of rehabilitative care at any level (i.e., in theater, within a formal rehabilitation program, or upon completion of tour of duty). Many individuals may not need or be provided with continuous care over time.
- 6) Rehabilitation benefits and access to rehabilitation services may vary depending on branch of service, type of warrior (active duty, national guard, reservist), and/or state of residence.

Assumptions about the practitioners using this Clinical Management Guidance:

- 1) **Occupational and physical therapists plan and provide intervention based on an individual Service member's unique set of circumstances, goals, and functional performance problems rather than based primarily on diagnosis.**
- 2) Recommendations in this document are written for the general practice therapist – that is, licensed occupational and physical therapists that do not have specialty training in various aspects of neurorehabilitation.
- 3) Scope of practice for the occupational therapist and physical therapist may vary depending on the level of care, the location of the facility, and access to other health care providers and be different from that of civilian practice.
- 4) Occupational and physical therapists typically work within a larger interdisciplinary team and within such settings, therapists seek out the expertise of other team members including neuropsychologists, counseling psychologists, speech language pathologists, physicians, nurses, therapeutic

recreation specialists, nurses, and other rehabilitation and medical professionals.

Guiding Principles of OT and PT Assessment and Treatment After MTBI

Ruff (2005) outlined a patient-centered approach to rehabilitation for MTBI that informs the recommended guiding principles for delivery of OT and PT services across all levels of care.

- 1) In their interactions with Service members with MTBI, therapists communicate an optimistic expectation for warriors' full recovery. As stated by Ruff, "...clinicians must avoid fostering the belief that the 'brain damage' subsequent to concussion always leads to permanent deficits" (p. 16).
- 2) Therapists help Service members identify their strengths and resources as well as their challenges and limitations so that those assets may be harnessed in the rehabilitation and recovery process.
- 3) Therapists incorporate formal or informal assessment of the Service member's goals and priorities into the evaluation process along with evaluation of MTBI-related symptoms, impairments, and inefficiencies. What does he or she want to be able to do that he or she is unable to do now? Symptoms are treated in the context of realistic goals linked with everyday life.
- 4) The Service member with MTBI and therapist collaborate on therapy goals and the steps needed to achieve them. That is, interactions with patients are collaborative and not directive.
- 5) Throughout the treatment process, the therapist "...should gently allow the patient to understand where he or she has misattributed symptoms to the brain injury" ^{40(p15)} and help him or her see the link between performance problems and personal, situational, or other contributing factors. ⁴⁷

Structure and Format of Practice Recommendation Descriptions

Practice recommendations are organized by problem area because typically, this is the manner in which clinicians approach assessment and treatment. Discussions of problem areas loosely follow the sequence in the rehabilitation process in which they might most likely be assessed and/or addressed. Within each problem area, we describe the objective of assessment or treatment, provide background information based on the literature; specify our recommendations; and discuss implications in terms of rehabilitation practices and Service members. We also provide qualifications as to which practitioner(s) and level of care to specific recommendations pertain, along with the strength of our recommendations (and rationale). The strength of a recommendation is characterized as either a Practice Standard or a Practice Option. *Practice Standards* are supported by existing MTBI Guidelines and/or published evidence-based reviews. *Practice Options* do not have such support but are consistent with current theory, literature, and/or expert opinion.

In addition to the above, we indicate the components of the World Health Organization (WHO) International Classification of Functioning, Disability and Health

(ICF) taxonomy⁵⁹ that are addressed in assessment and treatment associated with each problem area. The ICF is a framework that depicts how an individual's health condition interacts with other environmental and personal factors to influence his or her physical-emotional status (body structures/function), activity level, and participation in social roles. Similarly, the framework depicts an array of ways in which clinicians may intervene in order to improve patients' health -by removing environmental or social barriers to participation; instruction in compensatory techniques that enable a person to carry out every day activities; or remediating an impairment to restore a functioning of an organ system pertaining to, for example, vision. By including the ICF domains relevant to each problem area, we aim to promote an appreciation of all the possible avenues through which clinicians advance Service members' health and functioning.

Combat Readiness Check

In-Theater Assessment of Combat Readiness after MTBI

Objective: To employ rehabilitation expertise to inform decision-making regarding fitness for return to duty for Service members with possible MTBI.

Practitioner: Occupational or physical therapist (depending upon setting and availability)

ICF component(s): Body function & structure and Activity

Strength of recommendation: Practice Standard (MTBI-symptom based screen); Practice Option (task observation under dual task conditions)

Rationale: There is evidence to support the clinical relevance and use of standardized tools to identify MTBI-related symptoms but no evidence as yet regarding task observation under dual-task conditions in this context.

Background: It is critically important to identify possible MTBI as early as possible after it occurs. Persons with MTBI need to be monitored for any deterioration in functioning that might indicate a more severe injury or complications⁶⁰.

Furthermore, MTBI-related symptoms have the potential to interfere with warriors' safety and competence in executing their responsibilities, putting themselves and their comrades at risk. Symptoms such as dizziness, visual disturbances, and headache may impede reaction time and other aspects of physical performance and also likely interfere with the warrior's concentration, memory, and problem solving⁴⁷.

Experts participating in the OT/PT MTBI Summit (11-15-07) suggested that, in order to optimize warrior safety, there is a need for more sophisticated assessments of functional performance related to combat readiness in-theater. Some participants reported that some warriors rehearse elements of the Military Acute Concussion Evaluation (MACE)⁷ in advance of possible injury to optimize the

likelihood that they can “pass” the test and return to duty, if injured. Experts at the OT/PT MTBI Summit recommended an expanded role for OT and PT in this realm.

Occupational and physical therapists are educated and trained to assess physical, cognitive, and emotional impairments in order to make extrapolations as to how those impairments may impact functioning in everyday life. In theater (Levels I, II, III), therapists have the potential to use their knowledge and skills to help quantify possible MTBI-related symptoms and to observe functional performance to further inform medical decisions about return to duty, evacuation, or rest.

As suggested by the aforementioned expert panel, a brief but comprehensive combat readiness assessment conducted by OT or PT should include the following dimensions: a) a screen for possible MTBI-related symptoms; b) observation of functional performance under dual task conditions; c) a screen for possible stress disorder. This proposed process is referred to as the OT/PT Combat Readiness Check (CRC). Each element of the proposed CRC is described.

A screen for possible MTBI symptoms:

Therapists should identify and quantify MTBI-related symptoms that might present barriers to fitness for duty and inform therapy treatment planning. The following instruments address MTBI-related symptoms and have established reliability and validity (although not all of them have been validated on adults with MTBI):

- *Westmead Post Traumatic Amnesia (PTA) Scale* –Revised . PTA is a widely used index of severity of brain damage and is also an indicator of when concussion is resolved ⁶¹. To administer the Westmead PTA Scale, a clinician asks the patient a series of 7 orientation questions followed by a set of new learning-recall tasks (remembering a face, name, and pictures of objects). It was originally designed to be readministered over a period of days. Ponsford and colleagues ⁶² modified the procedure such that it is readministered on an hourly basis and found it to be sensitive to MTBI.
- The 5-question subtest of the *Dizziness Handicap Inventory* ⁶³ – see later discussion
- *Dix-Hallpike Test* ⁶⁴ – see later discussion
- *Dynamic Visual Acuity Test* ⁶⁴ – see later discussion
- *Balance Error Scoring System (BESS)* ^{65,66} – see later discussion

Functional performance under dual-task conditions

Members of the Expert Panel suggested that skilled observation of task performance simulating the demands typically placed on warriors could provide critical information for decision-makers about return to duty. Real-life demands could be best simulated by critical common warrior tasks (as specified in the Soldier’s Manual of Common Tasks [SMCT]) performed under dual-task conditions. Inclusion of critical common tasks, such as assembling a weapon or donning/doffing gas mask while timed, adds to the face validity of the assessment (to warriors and commanders); inclusion of the dual-task condition assures that warriors are able to

perform highly proceduralized tasks while retaining their ability to process information – critical to safety in theater. (See a discussion of dual task procedures [“Attention and Dual Task Performance”] later in the *Guidance*.)

A procedure of this nature should be developed and validated that involves a set of critical common tasks from the SMCT and a set of cognitive tasks (such as counting backward from 100 by 7’s, naming all of the states that start with the letters “A” and “M”, or reciting the Soldier’s Creed [http://www.army.mil/SoldiersCreed/flash_version/] or Army Values [http://chppm-www.apgea.army.mil/co2/CO2_book/Values.htm]). During a CRC with a given soldier, the therapist would select from the sets of common soldier tasks and cognitive tasks, making pre-morbid task learning difficult.

A screen for stress disorder

Because stress is a significant element in combat-related MTBI, the expert panel recommended inclusion of a screen for acute stress reaction and/or post traumatic stress disorder. The specific tool to incorporate into the CRC should be selected by experts this area.

Recommendations:

- 1) PT and/or OT use standardized instruments to screen for MTBI-related symptoms in theater. This portion of the proposed CRC could be implemented by OT and/or PT in theater immediately (Practice Standard).
- 2) PT and/or OT use informal methods for evaluating Service members’ ability to perform dual cognitive and motor tasks in order to inform return-to-duty decision-making in theater (Practice Option).

Discussion: Based on these recommendations and the ongoing need for a tool to measure progress towards return to duty, a consortium of researchers from the Sister Kenny Research Center, the United States Army Institute of Environmental Medicine, University of North Carolina, University of Minnesota, and Riverbend LLC was awarded funding from the Army Medical Research Materiel Command in September 2009 for Phase I development of a Combat Readiness Check.

Activity Intolerance/Progressive Return to Full Activity

Assessment

Objective: To ensure Service members’ safe return to full activity through consistent use the DVBIC assessments and recommendations⁷ when evaluating and treating Service members in theater during the acute period following MTBI.

Practitioner: Physical Therapist and Occupational Therapist
ICF components: Activity and Participation
Strength of recommendation: Practice Option
Rationale: Use a symptom checklist and neurocognitive assessment to monitor activity tolerance (DVBIC Guidance 12-06, Prague Consensus: McCrory et al., 2005). This information does not relate specifically to PT and OT interventions.
Applicable level(s) of care: Levels I-III

Background: A review of the issues regarding immediate post concussion management and activity restrictions following MTBI is available in the DVBIC Working Group Clinical Practice Guidelines ^{7,8} and is not repeated here. A number of neurocognitive assessment tools are described in this guideline including the *Military Acute Concussion Evaluation* (MACE) tool developed by the Defense and Veteran's Brain Injury Center. The purpose of this section of the guidance paper is to encourage the physical and occupational therapists who are evaluating and treating Service members in Levels I-III to remain cognizant of activity and exercise restrictions when designing exercise programs for orthopedic or other morbidities in the presence of a concussion diagnosis. As well, therapists are encouraged to use observation of symptom reoccurrence and neurocognitive assessments when monitoring their patient's tolerance to any therapeutic intervention.

Recommendations:

- 1) Use observation of symptom reoccurrence, a symptom checklist and neurocognitive assessments when monitoring a Service member's tolerance to any therapeutic intervention in the presence of a concussion co-morbidity.
- 2) Be aware of the DVBIC guidelines ^{7,8} with regard to the acute management of mild traumatic brain injury.

Discussion: Updated guidance for the acute management of MTBI in Levels I-III is available from the Proponency Office for Rehabilitation and Reintegration (November 2007).

Intervention

Objective: To promote an awareness of limitations for activity intensity when treating Service members for orthopedic or other injuries requiring Occupational and Physical Therapy intervention when concussion is a co-morbidity. These recommendations are reiterated here only and the reader is referred to the DVBIC guidelines ^{7,8} for further information.

Practitioner: Physical Therapist and Occupational Therapist
ICF components: Activity and Participation
Strength of recommendation: Practice Option
Rationale: Recommendation is for rest and activity restriction until symptom free at rest with a slow and monitored return to full activity or full duty ⁷⁻⁹.
Applicable level(s) of care: Levels I-III

Background: Therapists are reminded of the recommendation for the slow progression for return to duty as is used for sport⁹, which encourages rest until symptom free and then a daily stepwise progression with a regression of the intensity of activity with any symptom return. During the Summit (November 15, 2007) there occurred extensive discussion regarding the need for extreme caution about returning Service members to full activity too soon after mild TBI. No specific information was found regarding restrictions of Physical or Occupational Therapy exercise programs in the presence of acute mild traumatic brain injury.

Studies in rats suggest that exercise in the first 7 days after concussion is detrimental to formation of neurotrophic factors and other molecules that enhance brain plasticity and improve cognitive status after the brain injury⁶⁷. As discussed in Leddy et al.⁶⁸, the metabolic and physiologic changes in the brain of an individual post concussion may worsen during physical or cognitive exertion when the cerebral blood flow alters. Exercise in the acute post concussive period may increase brain metabolic requirements when brain metabolism is compromised. Certainly, the activity requirements of full combat duty can be of high intensity with heavy physical loads of rucksacks and safety equipment.

There is much discussion and controversy regarding the issue of post concussion activity and development of post concussion syndrome. A review of that discussion is

beyond the scope of the *Guidance* and the reader is encouraged to review sports concussion literature.

Recommendations:

- 1) Physical and occupational therapists advocate for early rest following mild TBI or concussion with a slow return to activity.
- 2) Therapists must be aware of this restriction in making recommendations and treatment plans for post concussion issues alone and when treated orthopedic or other injuries and when designing home programs in the presence of acute concussion.
- 3) Athletic or other risky activity should not resume until after the physical signs and symptoms of concussion are no longer present at rest or with physical exertion and cognitive deficits are fully resolved.

Discussion: Updated guidance for the acute management of MTBI in Levels I-III is available from the Proponency Office for Rehabilitation and Reintegration (November 2007).

Patient Education about MTBI

Objective: To provide information, counseling, and instruction to Service members who have a history of MTBI so that they a) establish realistic expectations for recovery; b) make correct attributions for temporary changes in performance and c) enact any necessary compensatory strategies.

Practitioner: Occupational and/or physical therapist
ICF component(s): Activity, Participation
Strength of recommendation: Practice standard
Rationale: Supported by evidence reported in Borg et al., 2004
Applicable level(s) of care: All

Background: People with MTBI need information and instruction both early on and throughout their recovery. Immediately after the incident, individuals with suspected MTBI need to be informed of symptoms that might indicate the presence of potentially life-threatening pathology such as intra-cranial hemorrhage or cerebral edema including: vomiting, worsening headache, developing amnesia or evidence of short term memory loss, worsening mental status, neurologic signs such as loss of motor function, vision or speech; seizure⁶⁰. They also need verbal and written information about typical sequelae and likely course of recovery⁶⁹. Most experts recommend the provision of verbal and written educational information about MTBI symptoms (headache, difficulties with memory and/or attention) as well as reassurance that these are likely to recover over a period of weeks or a few months^{57,70}. As people are helped to understand their symptoms, they are less likely to overreact to them or misattribute them to significant brain damage⁵⁷. Mittenberg and colleagues demonstrated that patients with mild TBI who reviewed and discussed extensive written instructions with a therapist before leaving the hospital had significantly shorter symptom duration and fewer symptoms than those receiving routine discharge information (written information and an advised period of rest)⁷¹.

People who experience protracted cognitive or neurobehavioral symptoms also appear to benefit from information about how to understand and manage the consequences of MTBI, even those who experience distress and disability for months to years afterwards^{40,47}. Experts suggest that PCS may be averted or ameliorated as people with MTBI learn to appreciate how personal and situational factors may interact with typically transient symptoms of brain injury⁴⁷ and implement compensatory strategies that optimize their effectiveness. By incorporating a discussion about the influence of stress on performance, survivors of MTBI begin to understand and normalize their own experience^{72,73}. Occupational therapy aimed at the patient's acquisition and employment of cognitive compensatory strategies will be discussed later in this section but a therapist-patient conversation about the influence of stress on cognitive functioning might go something like this:

"People can concentrate on or pay attention to a finite number of things at one time. On average and under normal circumstances, people can simultaneously pay attention to between 5 and 9 things at a conscious or semi-conscious level. This capacity is hard-wired from birth. After a MTBI, people may have a variety of distracting physical symptoms (dizziness, headache, musculoskeletal pain) that they can't help but think about. In a sense, these distractions take up space in our thinking process, using up some of our 5 – 9 'slots'. As a result, people with MTBI have a hard time

remembering information, concentrating, and even problem solving. Stress and worry can have the same effect. Worry and negative thinking also take up mental space that could otherwise be used in the process of remembering information. This is why we recommend using compensatory strategies like writing things down. If the 'slots' are full (with symptom-related distractions or worries), you can still keep track of information that you need to stay in control of your life."

There are materials available through the VHA, PR&R, and commercial vendors that could be used to provide more in-depth information about consequences of MTBI and what to do about them.

- The PR&R has created a series of downloadable/printable MTBI-related patient education handouts that are available at their website (<http://www.armymedicine.army.mil/prr/edtraining.html>).
- "*Recovering from Head Injury: A Guide for Patients*"³⁴ is a 10-page information packet that is incorporated into an Independent Study Course for practitioners designed by the Department of Veterans Affairs. This material was used in the cognitive behavioral intervention described above⁷⁴. Designed as a patient-education resource related to TBI in general, it offers useful information about symptom management specific to TBI. It does not provide information about normal human information processing in ways that fully enable the Service member to both normalize and understand his or her challenges associated with MTBI. A new Quick Series booklet is also available entitled *Recovering from Traumatic Brain Injury* (see <http://www.quickseries.com/government/veterans/veterans.asp>).
- *The Mild Traumatic Brain Injury Workbook*⁷⁵ is a 192 page self-study developed for civilians with MTBI that could be incorporated into therapy. It should be noted that there is no evidence that a more in-depth workbook is any more effective than a handout. Clinicians should be sensitive to unintended messages that are communicated by recommending a workbook to individuals with mild symptoms that are likely to resolve.

Recommendations (Practice Standards):

- 1) Service members should receive written information and one-on-one instruction with a therapist in theater if MTBI is suspected based on OT/PT Combat Readiness Check or if by other medical personnel. An occupational or physical therapist should review the written description of symptoms that, if present, should prompt the Service member to seek medical attention. The therapist also should review information describing possible short-term consequences of mild TBI, tips and strategies for compensating for these challenges, while emphasizing the fact that most people no longer report symptoms by 3 months post injury³⁹.
- 2) As part of their rehabilitation program, Service members with MTBI are helped to normalize brain-injury related challenges by receiving in-depth and individualized information about how personal and situational factors impact

their information processing abilities. The occupational therapist provides information regarding normal human information processing ⁷⁶ and the finite capacity of working memory ⁷⁷ in order to help Service members to better understand the how distractions associated with MTBI symptoms make it difficult to concentrate and remember information. Together in therapy, the occupational therapist works with the Service member to identify the physical, emotional, and situational factors that may be interacting with typically short-term symptoms associated with MTBI and contributing to declines in functioning. This educational effort informs the development of compensatory strategies during the treatment process (see discussion later in the Guidance).

Discussion: While patient education is recommended after MTBI, there is nothing published in the literature about the specific roles of OT and PT in doing so.

Vestibular Dysfunction

Complaints of Dizziness/Vertigo, Disequilibrium and Visual Blurring

INTRODUCTION:

Vestibular deficits that arise in conjunction with MTBI can have complex etiologies and so treatment is individualized and specific to the cause. The OT/PT MTBI work group recognized that the types of vestibular damage caused by blast injuries are not yet fully understood. The recommendations in this *Clinical Management Guidance* presume damage similar to that resulting from MTBI in a civilian population. At the 2006 American Physical Therapy Association's Combined Sections Meeting, Laura Morris (Centers for Rehab Services, Pittsburgh, PA) presented a review of causes, assessments and treatment strategies related to MTBI and dizziness. She described eight categories of differential diagnosis for the etiologies of dizziness following MTBI. Hoffer, Gottshall and colleagues categorized the types of dizziness patterns in service personnel with MTBI as one of four categories ²³. These categories include migraine-associated dizziness, spatial disorientation, BPPV or exercise induced dizziness. These categories helped the OT/PT MTBI work group to describe response to treatment.

Obviously, vestibular rehabilitation is complex and an area of specialization within Physical and Occupational Therapy. The OT/PT MTBI work group, in consultation with PT experts at the Minneapolis VA and at the Summit, suggest two of the several types of vestibular deficits resulting from MTBI may be treated by a general practice physical therapist within the military framework in a combat support hospital or similar war zone setting. These two types of vestibular deficits include benign paroxysmal positional vertigo (BPPV) of the posterior canal (and lateral (horizontal) canal as recommended by Bhattacharyya, 2008) and unilateral vestibular hypofunction (UVH). Episodic dizziness that is associated with migraine headache was also considered an appropriate diagnosis for intervention by a general practice therapist when circumstances require it. General practice therapists who have not previously seen vestibular patients may need education in

the techniques and assessments beyond what is described in this *Guidance*. For other more complex etiologies such as perilymphatic fistula, bilateral vestibular hypofunction, Meniere's disease, or other etiologies for dizziness complaints, Service members should be referred for further specialty evaluation (ENT/Otolaryngologist) and for treatment by therapists with specialized vestibular training.

The OT/PT MTBI work group assumes that not all Service members with vestibular deficits following a blast or other exposure that results in MTBI-type symptoms are evacuated to higher levels of care. Sometimes Service members reportedly stay with their units in theater, either minimizing their symptoms or allowing space in evacuation vehicles for other more seriously injured persons. However, it would be best for these individuals with exposure to explosion or other incident causing MTBI (dizziness/vertigo, disequilibrium or visual blurring) to be evacuated or allowed to rest until symptom free at rest and with activity. If these Service members remain in theater, the work group and other experts consulted recommended that military PT's (and OT's who are at Combat Stress Units) be encouraged to assess and treat the vestibular diagnoses, as circumstances require. It is further assumed that PT's and OT's in the field are taking a full and appropriate patient history and that they are aware of "red flags" and other precautions that would prompt further questions or referral for neurology evaluation.

Service members at MMTFs or Polytrauma VA's with other serious medical issues may also have vestibular deficits. Medical issues such as burns, fractures, internal injuries or amputations, may prevent easy intervention for the vestibular deficits. Referral to experienced vestibular specialists is recommended in these cases as these specialists may have clinical experience and novel suggestions for interventions that can alleviate the Service member's vestibular symptoms without using standard treatment protocols.

Benign Paroxysmal Positional Vertigo (BPPV) of the posterior semicircular canal

Assessment

Objective: To identify vestibular dysfunction that can be treated by a general practice PT in a war zone or stateside medical facility to reduce complaints of dizziness, imbalance or visual blurring; to screen for BPPV of the posterior or lateral canal; to identify individuals in need of referral to specialists.

Practitioner: Physical Therapist (or Occupational Therapist with specialized training)
International Classification of Functioning: Body Structure/Body Function
Strength of recommendation: Practice Standard
Rationale: Dix-Hallpike test is the most commonly used test to confirm the diagnosis of BPPV of the posterior semicircular canal (SCC) refer to ^{13,14}. The 5-question subtest of the DHI can be used to determine those persons likely to have BPPV ¹⁵. Use the supine roll test to diagnose lateral (horizontal) canal BPPV ¹³ is considered a Practice Option.
Applicable level(s) of care: All levels when applicable

Background: Persons including Service members with concussion or MTBI may report the common complaints of imbalance or unsteady walking (postural instability), dizziness or vertigo and blurred vision. These complaints may begin immediately following a MTBI or concussion or may occur after a time delay. Dizziness is a common symptom in patients with post-concussive syndrome. Of 100 patients ages 10-66, 26% reported dizziness on the Rivermead Symptom Scales 3 months after a mild head injury ⁷⁸.

Benign paroxysmal positional vertigo is the most common cause of vertigo. In a retrospective chart review, Whitney et al. ⁷⁹(2005) reported that 22.5% of subjects presenting at a balance and falls clinic between September 1998 and March 2003 at the University of Pittsburgh and who had completed the *Dizziness Handicap Inventory* (DHI) were found to have BPPV. Hoffer et al. ²³(2004) reported that 28% of 58 active-duty and retired military personnel with dizziness following MTBI had BPPV. The most common semicircular canal involved in BPPV is the posterior canal. Herdman and Tussa ¹⁰ reported that of 200 consecutive patients with BPPV seen in their Dizziness and Balance Center Clinic, 76% were found to have posterior canal involvement.

The DHI is a commonly used tool to assess a patient's perception of handicap in the functional, emotional, and physical domains that result from dizziness complaints ⁶³. This tool has been shown to be reliable, and is frequently used as an outcome measure in persons with dizziness as it has been demonstrated to show change over time with rehabilitation ⁸⁰. A higher score on the DHI indicates greater handicap with a maximum score of 100. The DHI has been shown to correlate with *Dynamic Visual Acuity Testing* (DVAT) in active duty military personnel who had suffered a MTBI ¹⁹. It has been used to show improvement in handicap from dizziness in patients with vestibular disorders with and without migraine headaches following a customized physical therapy program including vestibular rehabilitation ⁸¹.

Specific questions on the DHI seem to be related to the complaints of persons with BPPV. Typical complaints that characterize BPPV include brief episodes of vertigo that last less than 1 minute and that are triggered by certain movements such as lying down, rolling over in bed, bending over and looking up. Whitney and colleagues⁷⁹ looked at a two or 5-question subtest of the DHI. The 2-question subtest asks about dizziness when rolling over in bed and getting out of bed; and the 5-question subtest asks about symptoms when the person is looking up, getting out of bed, making quick head movements, rolling over in bed and bending. The authors found that the five-item subtest of the DHI was a significant predictor of the likelihood of having BPPV. The 5-question subtest of the DHI would be easy to complete quickly and would assist the general practice physical therapist in screening for BPPV.

The *Dix-Hallpike* test is the most commonly used test to confirm the diagnosis of BPPV of the posterior SCC. The specific techniques for this test can be found in the Herdman text (2007) or in the clinical practice guideline for BPPV published by the American Academy of Otolaryngology - Head and Neck Surgery¹³. This clinical practice guideline strongly recommends the diagnosis of posterior canal BPPV using the Dix-Hallpike maneuver. Additionally, a recommendation is made for clinicians to diagnose lateral (horizontal) canal BPPV using a supine Roll Test. Lateral canal BPPV is the second most common type of BPPV with an incidence of approximately 10-15 percent. Lateral canal BPPV can occur as free-floating material migrates from the posterior canal to the lateral (horizontal) canal during a repositioning maneuver (see Bhattacharyya et al., 2008 for a review).

A cervical range of motion screen is done prior to *Dix-Hallpike* testing. The general practice physical therapist should be aware of contraindications to the Dix-Hallpike maneuver, although active duty military personnel are less likely to exhibit some of the contraindicated diagnoses, especially those that are age-related. These contraindications are reviewed by Humphriss et al.⁸² and include history of neck surgery, severe rheumatoid arthritis, recent neck trauma and various proximal cervical instabilities and cervical or brainstem pathologies. Modification of the procedure to a sidelying assessment is recommended for those Service members with contraindications to the Dix-Hallpike maneuver⁸².

Recommendations:

- 1) To assist in determining if the Service member's vertigo or imbalance results from BPPV of the posterior SCC, the 5 question subtest of the Dizziness Handicap Inventory (5 questions--looking up, getting out of bed, quick head movements, rolling over in bed and bending) can be a significant predictor of the likelihood of having BPPV. This brief subtest should be used in situations where assessment time is limited such as Levels I-III.
- 2) The Service member with dizziness complaints in a stateside setting should complete the entire DHI.
- 3) If BPPV is suspected, the Dix-Hallpike Test, which is commonly used to confirm diagnosis of BPPV of the posterior semicircular canal, is then administered. A positive test results in an upbeat rotational nystagmus (in the direction of the dependent ear) that corresponds with the duration of the

Service member's symptoms of dizziness/vertigo. The Service member with BPPV typically complains of episodic vertigo or dizziness (with associated nystagmus) that lasts less than 1 minute and that occurs specifically with position changes.

- 4) Nystagmus can be suppressed by visual fixation. Therefore, it is important to have a means of viewing eye movements in darkness or without any visual fixation stimuli present in order to preserve the nystagmus. Ideally, the Dix-Hallpike test is done while the patient is wearing goggles or Frenzel lenses.
- 5) If the patient has a history compatible with BPPV and the Dix-Hallpike test is negative, a recommendation is made for clinicians to diagnose lateral (horizontal) canal BPPV using a supine Roll Test.
- 6) Therapists who are unfamiliar with the assessments described and other vestibular issues should obtain a copy of the Herdman ¹⁰ and review pertinent sections. Additionally, the Clinical Practice Guideline on BPPV published by the American Academy of Otolaryngology--Head and Neck Surgery ¹³ provides an explanation of the Dix-Hallpike test as well as the supine Roll Test.
- 7) When the Service member's condition warrants and when specialized services are available, therapists are encouraged to provide referral for further specialized testing and treatment by therapists with specialized vestibular training.

Discussion: The choice of specific measurement tools to use in evaluating a Service member with dizziness following MTBI depends on the specific clinical presentation of that person. The tools suggested here are for use by a general practice PT. Given the potential scope of this problem among Service members, it is advised that the DoD/VA ensure that therapy specialists are available as resources system-wide.

Intervention

Objective: If the screening evaluation is found to be positive for BPPV of the posterior semicircular canal (posterior canal canalithiasis), the therapist carries out the canalith repositioning procedure (CRP), educates the Service member in precautions and provides home exercises as appropriate. If the supine Roll Test is found to be positive for lateral canal BPPV, the therapist carries out the roll maneuver (bar-b-que roll maneuver), and continues with education and home programming as appropriate. In cases of poor response to initial attempts at intervention, or when the complexities of the vestibular findings warrant, the therapist will provide referral for further specialized testing and for treatment by therapists with specialized vestibular training.

Practitioner: Physical Therapist (or Occupational Therapist with specialized training)

ICF component: Body Structure/Body Function

Strength of recommendation: Practice Standard

Rationale: CRP for posterior canal canalithiasis results in 83-93% rate of remission^{1,2}. The effectiveness of the bar-b-que roll maneuver in treating lateral canal BPPV is approximately 75%. See the 2008 Clinical Practice Guideline on BPPV published by the American Academy of Otolaryngology--Head and Neck Surgery¹³.

Applicable level(s) of care: All levels when applicable

Background: The CRP is used to treat BPPV of the posterior semicircular canal (posterior canal canalithiasis). An 83% to 93% rate of remission of the BPPV has been reported by several authors following one or multiple CRP treatments depending on the specific positions used^{2,83}.

Home instructions for precautions following the CRP and instruction in Brandt-Daroff habituation exercises for milder residual complaints of dizziness or vertigo have been suggested¹⁰. Herdman also suggests instructing patients in the CRP so that they may repeat the treatment on their own as long as they are experiencing vertigo during treatment. It has been suggested that posttraumatic BPPV is different from the idiopathic form. Gordon et al. reported that 67% of patients with traumatic BPPV required repeated treatment before complete resolution of symptoms compared to 14% of patients with idiopathic BPPV. This group also reported that the posttraumatic groups had significantly more frequent recurrences⁸⁴.

Yardley et al.⁸⁵ conducted a randomized controlled trial with 146 patients with dizziness from a variety of causes and compared a customized home exercise program of vestibular exercises to a control group. This group found a significantly greater improvement in a shortened version of the *Vertigo Symptom Scale* and other measures of symptom severity, on a measure of anxiety, during provocative movements, and on the sharpened Romberg, in the subjects who were on the vestibular habituation program compared to the control group.

The Roll maneuver (bar-b-que roll maneuver) is used to move canaliths from the lateral canal into the vestibule to treat lateral (horizontal) canal BPPV. The effectiveness of this maneuver is approximately 75% according to summary information provided in the Clinical Practice Guideline on BPPV¹³.

Recommendations:

- 1) If assessment results indicate a BPPV of the posterior canal, the canalith repositioning procedure for the posterior semi-circular canal is then administered (see Herdman, 2007, page 243 for specifics or the 2008 Clinical Practice Guideline on BPPV published by the American Academy of Otolaryngology--Head and Neck Surgery¹³).
- 2) If assessment results indicate a BPPV of the lateral (horizontal) canal, the bar-b-que roll maneuver) is used to move canaliths from the lateral canal into the vestibule (see Herdman, 2007 or see the 2008 Clinical Practice

Guideline on BPPV published by the American Academy of Otolaryngology--Head and Neck Surgery ¹³).

- 3) Therapists who are unfamiliar with the canalith repositioning procedures and vestibular exercises should obtain a copy of Herdman ¹⁰ and review pertinent sections.
- 4) Further home exercise recommendations and activity restrictions are provided to the Service member with follow-up with the physical therapist at approximately one month ^{10,13}.
- 5) If balance does not improve with the treatment of the BPPV and reduction of dizziness complaints, then further balance and postural stability exercises should be provided (see separate sections of the *Guidance* for information on balance complaints).
- 6) Service members with MTBI or PCS may also have memory problems along with the dizziness or instability complaints that influence their follow through with exercises. Use of a compliance work sheet or instruction of family members or fellow Service members may enhance adherence to home exercise programs.

Discussion: It is important for the general practice PT to recognize and treat BPPV of the posterior canal as that is the most common canal involved in canalithiasis. While more specialized, the additional assessment maneuvers for the lateral (horizontal) canal are considered important due to the potential for conversion from the posterior to the lateral canal canalithiasis during the CRP. Therapists who are interested in or require further knowledge in vestibular assessment and intervention are encouraged to attend continuing education specialty training in vestibular rehabilitation and to obtain the Herdman, 2007 text. Additionally, therapists are encouraged to review the Clinical Practice Guideline on BPPV ¹³.

Unilateral Vestibular Hypofunction

Assessment

Objective: To identify vestibular etiologies, specifically unilateral vestibular hypofunction (UVH), that can be treated by a general practice PT in a war zone or stateside medical facility to reduce complaints of dizziness, imbalance or visual blurring; to identify individuals in need of specialized testing and treatment by therapists with specialized vestibular training.

Practitioner: Physical Therapist

ICF components: Body Structure/Body Function, Activity

Strength of recommendation: Practice Standard

Rationale: The DHI and DVAT were described as objective tests as outcome measures for Marines and Navy personnel with concussive injuries ¹⁹.

Applicable level(s) of care: All levels when applicable

Background: The vestibulo-ocular reflex (VOR) is a reflex eye movement that stabilizes images on the retina during head movement. The image is maintained on the center of the visual field as the VOR produces an eye movement in the direction opposite to head movement. In order for people to have clear vision, the VOR must be fast and must compensate for head movements almost immediately. The semicircular canals send information as directly as possible to the eye muscles. Damage to one side or the other of the peripheral vestibular apparatus will result in a mismatch of signals and slipping or blurring of the visual image with head movement. Persons with unilateral vestibular hypofunction that is not yet compensated, complain of visual blurring (oscillopsia) because of the decrease in gain of the VOR ¹.

One way of assessing the VOR that is used clinically, is the *Dynamic Visual Acuity Test* (DVAT), which compares a person's ability to read a series of letters or detect orientation of a letter (ototypes) in a line chart when the head is stationary to his/her ability to do the same task when the head is moving. Dynamic visual acuity is then calculated by subtracting the number of errors when the head is stable to the number of errors when the head is oscillating ⁸⁶. This test was developed clinically with manual oscillation of the head reading an eye chart ^{87,88}. While there have been a number of design problems with this manual methodology, it is used as a screening tool for dynamic visual acuity as an indication of vestibular hypofunction.

In settings where available, specialized laboratory based measures of vestibular function are used to quantify the extent and location of vestibular loss. Among these assessments are the caloric test, rotary chair test, the vestibular evoked myogenic potential test (VEMP), and a computerized dynamic visual acuity test (DVAT) ¹⁰. In a war zone, the computerized version of the DVAT is likely not available and in such instance, the clinical (manual) DVAT is the best available test to use. Venuto et al. ⁸⁹ reported that the sensitivity of the clinical DVAT for vestibular deficits is approximately 85% and its specificity is approximately 55%.

Herdman et al. ⁸⁶ assessed 42 normal subjects (29 with unilateral vestibular hypofunction and 26 with bilateral vestibular hypofunction) between 19 and 87 years of age to assess the reliability, sensitivity and specificity of the computerized DVA test. The sensitivity of the computerized DVA test was 94.5% and the specificity was 95%.

The head-impulse test (also referred to as the head-thrust test) is used to test the function of the vestibular system. It involves an unpredictable, high-velocity, small amplitude head thrust in the horizontal plane. The head-impulse test can assist in confirming the side or sides of the vestibular hypofunction ¹⁰.

The Head-shaking Nystagmus (HSN) Test is a clinical test which assesses for dynamic asymmetry in the vestibulo-ocular reflex (VOR). It would be used in a patient with suspected vestibular hypofunction. This is a simple screening evaluation for peripheral vestibular system disease. It is used as part of a vestibular examination for imbalance, dizziness, vertigo and oscillopsia (blurred vision with head movement.) ^{90,91}.

Recommendations:

- 1) Clinical DVAT is a functional test that can be used to assess Service members with unilateral and bilateral vestibular hypofunction. The Service member is asked to read the smallest possible line on a Snellen chart with the head at rest. This smallest line read is then compared to the smallest line that can be read while the examiner manually oscillates the Service member's head horizontally at 2 Hz for 1-2 inches in either direction. The Service member should be able to read the same line or one line above that read with the head at rest. If the Service member has a greater than two line change from the static to dynamic condition, then he or she likely has a vestibular deficit.
- 2) If available, a computerized version of the DVAT is the recommended mode of testing.
- 3) A head impulse test (head thrust test) is administered for confirmation of the side or sides of the vestibular hypofunction. The Head-shaking Nystagmus Test is also used as part of a vestibular examination in a patient with suspected vestibular hypofunction.
- 4) Specific position and testing instructions for the clinical DVA test and the head-thrust test are found in the Herdman text ¹⁰. Therapists who are unfamiliar with these assessment techniques should obtain a copy of Herdman, 2007 and review pertinent sections.

Discussion: Service members with acute UVH, typically have severe nausea, and spontaneous nystagmus seen in room light during the first several days to a week or two following the onset or causative incident. Service members may also have bilateral vestibular hypofunction with one side more involved than the other.

In a MMTF or VA setting (Level V through Level VIII), specialized equipment such as computerized *Dynamic Visual Acuity Testing* and specific medical specialty personnel (i.e. ENT/Otolaryngology physicians) should be available for more specific and reliable evaluation for persons with complaints of dizziness, vertigo, disequilibrium, and visual blurring or other symptoms of a vestibular nature. The general practice PT should continue to screen via a basic evaluation as described above for BPPV of the posterior SSC and for UVH. If however, findings indicate vestibular pathology that is not responsive to initial treatments or that is complex, the Service member with dizziness/vertigo should receive further specialty evaluation.

Decrements in visual acuity during head movements could potentially contribute to decreased safety in driving, scanning the environment, and other military or job related tasks. When findings indicate visual blurring or acuity issues, therapists in Levels I-III are encouraged to discuss their findings with the Service member in terms of these safety issues.

Intervention

Objective: If the screening evaluation identifies UVH, the therapist provides therapeutic intervention including a vestibular rehabilitation program and home

instruction for exercises that reduce the dizziness or visual blurring complaints. In cases of poor response to initial attempts at intervention, or when the complexities of the vestibular findings warrant, therapists provide referral for further specialized testing and for treatment by therapists with specialized vestibular training.

Background: Typically, physical therapy intervention cannot alter the underlying pathology in a case of vestibular hypofunction. Intervention for this disorder includes exercises designed to facilitate central nervous system (CNS) compensation or adaptation rather than alter underlying vestibular disease. Service members can learn to compensate for UVH with appropriate vestibular rehabilitation and gaze stability exercises.

Practitioner: Physical Therapist

ICF components: Body Structure/Body Function, Activity

Strength of recommendation: Practice Standard

Rationale: Vestibular rehabilitation is considered an appropriate treatment approach for patients with vestibular hypofunction ¹⁴.

Applicable level(s) of care: All levels when applicable

Vestibular rehabilitation has been shown to be efficacious in the recovery of dynamic visual acuity even if started some time after symptom onset for those with vestibular hypofunction. In a prospective, randomized, double-blind study of 21 patients aged 20-86 years with unilateral vestibular hypofunction, Herdman et al. ¹ showed that time since symptom onset and age were not factors in recovery of dynamic visual acuity when vestibular exercises were initiated within 12 months after onset of the vestibular loss. Herdman and colleagues ¹ also described the type of gaze adaptation exercises used in a vestibular rehabilitation program and mentioned that non-specific balance and gait activities were part of the rehabilitation program. Additionally, vestibular rehabilitation has been shown to reduce fall risk as measured by the *Dynamic Gait Index* (DGI) in patients with UVH ⁹².

In a study designed to characterize and classify patterns of dizziness in 58 active duty and retired military personnel with dizziness following a MTBI, Hoffer et al. ²³ reported that 84% of patients classified in the posttraumatic vestibular migraines category showed improvement following vestibular rehabilitation. All subjects in their positional (or BPPV) category recovered following treatment. Only 27% of the group categorized as having posttraumatic spatial disorientation improved following vestibular rehabilitation and this group required more than 3 months to return to work. This study is limited by lack of a control group. Hoffer's group does describe a vestibular rehabilitation program that was composed of "individualized programs of vestibulo-ocular reflex, cervico-ocular reflex, and somatosensory exercises combined with aerobic activity" ²³.

Most vestibular rehabilitation programs involve exercises to increase the gain of the vestibular system (X1 and X2 exercises), habituation and adaptation exercises, substitution exercises and gait, balance and aerobic components.

Herdman ¹⁰ provides descriptions of interventions for the patient with vestibular hypofunction.

Recommendations:

- 1) If a unilateral vestibular hypofunction is indicated, therapists institute a progressive vestibular rehabilitation program initially including gaze stabilization exercises with progressive postural challenge (sitting, standing, gait), adaptation and compensation exercises, and a progressive aerobic activity program ¹⁰.
- 2) Further home exercise recommendations and activity instructions are provided.
- 3) Service members who are found to be unresponsive to these adaptation exercises after 10-14 days, are referred for further specialty evaluation and treatment by therapists with specialized vestibular training.
- 4) The Service member's response to intervention is monitored. DVAT can be used to monitor for improvement in visual stability and decrease in visual blurring for those military personnel who are reticent about admitting their symptoms.

Discussion: Improvement in dizziness following a vestibular rehabilitation program may not alleviate complaints of postural instability. Those Service members with ongoing complaints of imbalance or postural instability will need a progressive balance activity program. The assessment and intervention recommendations for residual postural instability complaints are discussed in another section of the *Guidance*.

Migraine Associated Dizziness

Assessment

Objective: Identify dizziness associated with migraine headache that can be treated by a general practice physical therapist in the combat theater and throughout the higher levels of care to reduce complaints of dizziness associated with migraine.

Practitioner: Physical Therapist
ICF components: Body Structure/Body Function, Activity
Strength of recommendation: Practice Standard
Rationale: Gottshall and colleagues ²¹ used standard vestibular assessments for subjects with posttraumatic migraine associated dizziness.
Applicable level(s) of care: All levels when applicable

Background: Migraine-associated vertigo has been reported to occur in 32% of cases in a retrospective sample of 363 patients presenting with headache to an otology practice⁹³. Dizziness by itself has been shown to affect the self-perceived health status of persons with vertigo, but persons with headache (or migraine) associated dizziness have been found to have even lower self-perceived health status scores in the areas of role limitations (emotional), mental health, and social function on the SF-36,⁹⁴. Use of the SF-8 to compare those with migrainous vertigo (MV) with controls also showed lower scores in those with MV⁹⁵. By treating headache associated dizziness, the quality of life of Service members can be enhanced.

Gottshall et al.²¹ categorized 34 consecutive patients with migraine-related vestibular symptoms into four groups including patients with idiopathic migraine-associated dizziness (MAD) either with or without BPPV and patients with post-traumatic MAD either with or without BPPV. They used the DHI, the *Activities Specific Balance Confidence Scale* (ABC), the *DGI*, head-thrust test and *Fukuda step test*²¹ in their assessment.

Recommendations:

- 1) A history should be obtained from these Service members confirming dizziness associated with migraine headache. It is assumed that the majority of Service member's with MAD will have received a diagnosis from a physician after appropriate medical assessment.
- 2) Assessments including the DHI, ABC and the testing for BPPV and UVH should be done. (These assessment tools are described in other sections of this paper.)

Discussion: The therapist is referred to the section on posttraumatic dizziness for further information. Herdman¹⁰ provides further information on migraine-associated dizziness.

Intervention

Objective: If migraine-associated dizziness is identified, provide vestibular rehabilitation to reduce the dizziness associated with the migraine-headache.

Practitioner: Physical Therapist

ICF components: Body Structure/Body Function, Activity

Strength of recommendation: Practice Standard

Rationale: Gotshall et al.'s work²¹ demonstrated that a vestibular rehabilitation program produced improvement in patients with post-traumatic dizziness.

Applicable level(s) of care: All levels when applicable

Background: The use of medication and control of dietary triggers is found to be helpful in the control of MAD ⁹⁶. Vestibular rehabilitation has also been suggested as an intervention for persons with MAD ^{96,97}. Whitney et al. ⁹⁸ concluded that patients with MAD improved with physical therapy intervention. There appeared to be an improved outcome if a patient was taking an anti-migraine medication in conjunction with physical therapy intervention. Gotshall et al. ²¹ demonstrated that a vestibular rehabilitation program produced improvement in all four groups of patients with migraine-related vestibular symptoms (patients with idiopathic migraine-associated dizziness either with or without BPPV and patients with post-traumatic MAD either with or without BPPV). This group described a rehabilitation strategy that included habituation exercises, balance retraining, and daily aerobic exercises.

Recommendations:

- 1) Incorporate vestibular rehabilitation program in treatment plan of persons with migraine associated dizziness. Treat for BPPV if identified.
- 2) Preventatively manage headaches.
- 3) Refer for specialty vestibular evaluation if the Service member is unresponsive after 10-14 days of vestibular rehabilitation program.
- 4) If available, and not contraindicated, recommend utilizing anti-migraine medications in conjunction with vestibular physical therapy intervention to improve outcomes of physical therapy.

Discussion: The reader is referred to *Guidance* sections on BPPV and UVH for further information on interventions.

Balance and Functional Activities

Assessment

Objective: To provide assessment for Service members with complaints of postural instability or balance difficulties both immediately following concussion or MTBI and in follow-up.

Practitioner: Physical Therapist

International Classification of Functioning: Body Structure/Body Function and Activity

Strength of recommendation: Practice Standard

Rationale: Multiple measures including both subjective and objective measures of balance or postural instability are recommended for persons with dizziness and balance issues ¹⁰⁻¹².

Applicable level(s) of care: All levels, specialized equipment used at levels V-VIII

Background: One of the signs of concussion or mild traumatic brain injury is poor balance. Impaired balance following concussion in sport is one of the signs used to restrict return to play for athletes and has been recommended for use as a restrictive sign for return to duty for soldiers (^{7,8}; Clinical Guidelines for Primary Care, Proponency Office for Rehabilitation and Reintegration 11-2007). Persons, including Service members, with concussion or MTBI may complain of imbalance (postural instability), or unsteady walking in addition to their complaints of dizziness or vertigo, blurred vision, and/or headache. These complaints may begin immediately following a MTBI or concussion or may occur after a time delay.

Given that the symptoms of vestibular dysfunction can strongly influence a person's quality of life, a measure of confidence in his or her balance and the impact on his or her life is important. The *Activities-Specific Balance Confidence* (ABC) Scale was developed to assess balance confidence in high functioning senior citizens ⁹⁹. The ABC has been used to assess balance confidence in patients with vestibular deficits ^{81,94}. The ABC is a 16 item scale that allows the patient to provide a subjective rating of their balance from 0% as "no confidence" to 100% as "complete confidence". Higher-level tasks are queried such as the person's confidence in stepping off an escalator while holding packages and walking on icy sidewalks. Scores below 50% indicate a low level or homebound level of functioning and those above 80% indicate a normal level of functioning. It is unclear how responsive to change this measure would be in military members undergoing treatment for residual balance deficits; it has been used to describe balance confidence in studies of military personnel with MTBI ^{19,23}.

Williams et al. (2004) developed the *High Level Balance and Mobility Test* (HiMAT) for persons with TBI, to assess high-level mobility important for "participation" in leisure, sporting and social activities ¹⁰⁰. The test is focused on "high-level mobility" rather than "functional mobility". This test measures 13 items using a 0-5 rating scale that is based on time, with a total possible score of 54. To assess validity, 103 patients with TBI were concurrently scored on the HiMAT, motor *Functional Independence Measure* (FIM) and gross function *Rivermead Motor Assessment* (RMA). Correlation between the HiMAT and the motor FIM was only moderately strong due to a substantial ceiling effect of the motor FIM. The motor FIM was unable to discriminate motor performance for 90 (87.4%) of the 103 patients, yet these patients had a mean score on the HiMAT of only 32.6/54 ¹⁰¹. The HiMAT and gross function RMA had a much stronger correlation ($r = .87$, $p < .01$), but the gross function RMA also had a substantial ceiling effect when compared to the HiMAT. Fifty-three patients (51.5%) scored the maximum score of 13/13 on the gross function RMA, yet had a mean score of only 41.7/54 on the HiMAT ¹⁰¹.

The HiMAT can be used to follow change over time. Williams and colleagues (2006b) reported the 95% confidence interval for clinically important change (improvement or deterioration) required improvement by 4 points or deterioration by at least 2 points ¹⁰². Intra-rater and inter-rater reliability were tested and found to be excellent ¹⁰². Full information on the High Level Mobility Assessment Tool can be found on the website for *The Center for Outcome Measurement in Brain Injury* (www.tbims.org/combi/himat).

As mentioned above, one of the signs of concussion post injury is poor balance. The *Balance Error Scoring System* (BESS) was developed to assess balance at the sideline of a game or sports event¹⁰³. "The BESS is a quantifiable version of a modified Romberg test for balance, consisting of 3 tests lasting 20 seconds each, performed on firm and foam surfaces"¹⁰⁴. Timing of administration of the BESS is important. It has been suggested that the BESS may be useful in determining postural instability problems that would assist clinicians in making return to play decisions when a computerized dynamic posturography system is not available⁶⁵. Clinicians using the BESS should be aware that physical exertion would affect performance on the BESS. Susco et al.¹⁰⁵ found that 20 minutes of rest was required after exertion before performance returned to baseline levels. Clinicians should also be aware of the practice effect that occurs with multiple administrations of the BESS¹⁰⁶. While this may make it difficult to determine improvement that occurs with recovery versus practice effect, it should be recognized that the practice effect of multiple administrations of an assessment tool has not been routinely studied in assessments used in balance and gait. In general, the BESS has been used as a concussion screening tool, but some therapists report using it clinically. This tool is being recommended for inclusion in a *Combat Readiness Screen*.

The *Functional Gait Assessment* is a 10-item gait assessment based on the *Dynamic Gait Index* with "modifications made to capture those younger patients with vestibular deficits who showed ceiling effects on the DGI and to improve on the ambiguous instructions for some of the DGI items"¹⁰⁷. The *Dynamic Gait Index* is used in a number of studies that monitor fall risk and functional gait in persons with vestibular diagnoses.

Gait velocity has been demonstrated to be valid and reliable in patients with traumatic brain injury¹⁰⁸. Gait speed measured in meters per second is an easy measure to obtain and improvements in speed-based classifications are considered meaningful¹⁰⁹. Comfortable or fast walking speed would be an easy outcome measure to assess for therapists at any of the eight levels of care.

The modified *Clinical Test of Sensory Integration and Balance* (CTSIB)¹¹⁰ can be included to assess somatosensory and visual contributions to postural stability. The modified test no longer uses the dome to attempt to assess vestibular contributions to stability. Patients with uncompensated vestibular loss will have difficulty maintaining balance when somatosensory and visual inputs are altered. In practice settings where *Computerized Dynamic Posturography* equipment is unavailable, the CTSIB can be used. *Computerized Dynamic Posturography* (CDP) is a quantitative means to assess sensory contributions to postural stability while manipulating directions and forces of externally applied perturbations. This testing system cannot diagnose vestibular disorders, however, it can illustrate common patterns in test performance and the sensory situations that result in these specific patterns of response. CDP incorporates a number of testing situations including the *Sensory Organization Test* (SOT) and the *Motor Control Test* (MCT), which are described in Herdman, 2007.

Patients with mild brain injury often complain of balance impairment and feelings of postural instability when there was no evidence on clinical examination

of a neurologic deficit. Computerized posturography has been able to demonstrate abnormalities in postural responses to changing sensory conditions and perturbations that are not detected on clinical examination. Dehail et al.¹¹¹ found that center of pressure displacement and area were significantly increased in subjects with brain injury who were enrolling in a vocational program even when they demonstrated no clinical abnormality.

The *Sensory Organization Test* (SOT) was significantly lower for a group of 10 patients with mild TBI who had normal neuromuscular exams and scores on the *Tinetti Balance Assessment* that were not significantly different from a control group¹¹. There remain issues of correlating changes or improvements in tests on posturography platforms with changes in clinical tests and patient report of improved functional stability. Again, it has been recommended that multiple assessment tools be combined to fully characterize a person's balance and mobility status and improvement.

The Five-Times-Sit-to-Stand Test (FTSST) is a physical performance test initially developed to measure lower extremity muscle strength¹¹². It may be considered as an option to use as a functional strength test in addition to other strength screening manual muscle tests. It has been used to examine functional status, balance, and vestibular dysfunction and to distinguish between fallers and non-fallers^{79,113-116}. Other versions are Timed Stands Test, Ten Chair Stands Test (10TSTS).

Recommendations:

- 1) To be consistent with the Defense and Veterans Brain Injury Center Working Group Recommendations⁷, the Balance Error Scoring System (BESS) can be used to assess Service members following concussion or MTBI when in a war zone setting. This can be repeated over several days to monitor standing balance changes although a practice effect may occur. This information may be used in part, for determining readiness for return to duty similar to its use in determining readiness for return to sport.
- 2) In a stateside setting, it is recommended that multiple assessments be used to establish baseline status and follow change over time that occurs from natural recovery and following intervention strategies for Service members with complaints of postural instability or balance difficulties.
- 3) Assessments should include self-reports of confidence in balance including the *Activities-Specific Balance Confidence* (ABC) Scale for more highly functioning persons such as Service members with MTBI.
- 4) If a Service member is to be followed over time for high-level balance and mobility skills, the *High-Level Mobility Assessment Tool* (HIMAT) can be used to assess high-level mobility skills. The HIMAT does not require sophisticated equipment beyond a stopwatch, a level 20-meter walkway area, and stairs and could potentially be used in a war zone setting, as well as in stateside medical facilities. Some parts of the HIMAT such as skipping may lack face validity or seem irrelevant to the Service member, however, these items may be useful in assessing coordination and functional strength.

- 5) Additionally, *Computerized Dynamic Posturography*, can assist the clinician to identify subtle abnormalities in postural control, specific sensory impairments, and can follow change over time for persons with vestibular disorders. Specifically, the SOT measures postural sway under conditions in which the visual and somatosensory feedback is altered. The MCT uses sudden, brief displacements of the support surfaces to measure automatic postural responses that are normally used in the recovery of balance.
- 6) In settings that lack equipment for computerized Dynamic Posturography, the modified CTSIB (eyes open/closed, with and without foam) can be used to provide some information on sensory contributions to postural instability.
- 7) The *Functional Gait Assessment* is used to assess gait skills during tasks such as head turns that would challenge the vestibular system and is used to assess postural stability in persons with vestibular disorders. This test was developed to avoid the ceiling effect of the *Dynamic Gait Index* in high functioning patients.
- 8) Gait velocity should be determined in meters/second for both comfortable and fast walking speeds. This is considered a gold standard assessment in many studies.
- 9) The therapist is encouraged to incorporate a measure of a Service member's speed in completing an obstacle course. No recommendation for a specific obstacle course assessment is made at this time. Development of an assessment that tests military level tasks would be beneficial.
- 10) Repeated testing to monitor change over time is recommended.

Discussion: In a war zone or similar setting, clinical measurement tools that do not require a lot of equipment and time are more reasonable and likely to be done. In a stateside setting, more time, personnel with specialty training, and sophisticated equipment are potentially available.

Intervention

Objective: To provide intervention and instruction in a home exercise program for Service members with complaints of postural instability or balance difficulties both immediately following concussion or MTBI and in follow-up.

Practitioner: Physical Therapist

International Classification of Functioning: Body Structure/Body Function and Activity

Strength of recommendation: Practice Standard

Rationale: Descriptive studies have shown that balance retraining programs improve symptoms in military personnel with dizziness associated with TBI²³

Applicable level(s) of care: All levels, specialized equipment use at levels V-VIII

Background: Posturography platforms are also used in treatment situations to provide practice in situations with altering platform stability and sensory conditions. Posturography or similar unstable balance platforms have been used as part of an exercise regime for military personnel with balance disorders that are categorized as having posttraumatic spatial disorientation ¹¹⁷.

An extensive discussion of specific suggestions for treatment of postural instability that occurs with dizziness after brain injury can be found in Chapter 28 on Balance and Dizziness in the 2007 edition of Brain Injury Medicine ¹². These types of interventions have been shown to improve symptoms.

Recommendations:

- 1) Improvement in dizziness following CRP does not always get rid of complaints of postural instability. Those Service members with ongoing balance or postural instability complaints will need a progressive balance activity program. A customized treatment plan is recommended for each patient as appropriate including general strengthening and stretching exercises, habituation exercises, exercises to promote vestibular compensation, gaze stabilization exercises, balance and gait training, endurance exercises and exercises to enhance the use of specific sensory inputs for balance control.
- 2) Intervention strategies that provide increasing challenge, utilizing a military context, and tasks that are important to the Service member are recommended. Activities could include progressive mobility with head turns, carrying objects, altered terrain, altered speed, and altered base of support.
- 3) Consider including use of a computerized posturography platform when available.
- 4) Many sports incorporate balance-related challenges. As well, the military requirements for fitness such as running and obstacle courses, and the common tasks such as position changes with various rucksacks could incorporate progressive challenge. Intervention strategies involving tasks that are part of assessment tools (such as portions of the FGA or the Berg Balance Scale) with progressive postural and functional challenge may also be incorporated.
- 5) A home exercise program should be provided and updated as appropriate.

Discussion: The therapist is encouraged to develop an individualized treatment program and to use previously mentioned outcome measures consistently to monitor recovery and the Service member's response to interventions.

Vision Dysfunction

Updated March 2012

Assessment

Objective: To identify visual impairments and inefficiencies experienced by Service members with possible MTBI in order to plan treatment and recommendations

Practitioner: Occupational therapist or, if not available, physical therapist

ICF components: Body structure/function, activity

Strength of recommendation: Practice option

Rationale: While clinical experts advise screening for vision symptoms after MTBI, no such recommendations are included in published evidence-based guidelines.

Applicable level(s) of care: III (Combat Stress Unit), IV, V, VI, VII, VIII

Background: Many Service members with TBI, polytrauma, and/or blast exposure experience vision difficulties and impairments^{118,119}. Although visual disturbances post-TBI are commonly associated with moderate and severe brain injury, evidence supports similar deficits in those patients who present with mild traumatic brain injury¹²⁰. In a retrospective analysis of medical records of individuals referred to optometry for vision-based symptoms, Ciuffreda and colleagues found that 90% of patients with MTBI manifested oculomotor dysfunction including accommodation dysfunction, deficits of saccades, and/or convergence insufficiency^{121,122}. Almost 40% of these individuals also presented with visual field deficits¹²³. These vision disturbances likely explain patient complaints of decreased reading ability, reduced reading duration, inability to track printed materials, or photosensitivity¹¹⁸.

TBI-associated vision problems are not well understood. Visual problems evident in Service members who have sustained MTBI may be secondary to the head injury, polytrauma such as eye injury associated with projected shrapnel, and/or blast waves¹¹⁹. Because vision problems may interfere with performance of everyday tasks and confound efforts to identify and treat other problems (e.g., cognition), Service members with possible MTBI are screened for vision complaints and receive a comprehensive low vision and visual perceptual evaluation, if appropriate.

The occupational therapist is a member of a larger team concerned with vision. Team members include, but are not limited to occupational therapists, low vision specialists, neuro-optometrists and ophthalmologists, low vision specialists, and physical therapists. Occupational therapists have expertise in the area of vision and understand the functional consequences of visual changes, critical for return to life tasks. The occupational therapist uses symptom checklists, dynamic observation, and standardized assessments to gain insight into the specific and global implications of deficits¹²⁴.

Occupational therapy vision screening

Because of the relatively high incidence of vision disturbances associated with MTBI, occupational therapists incorporate a vision screen into their initial occupational therapy evaluation. Occupational therapists perform vision screens in order to identify unrecognized visual deficits that interfere with daily life but not to diagnose ¹²⁵. The vision screen has two elements: a self-reported symptom inventory and observation of functional performance.

Self-report of vision symptoms: A screen for visual changes should include an interview or questionnaire specific to vision disturbances experienced by the Service member after MTBI. While there are no gold standards described in the literature, symptom inventories generally involve a series of yes/no questions regarding the patient's everyday experiences. Some patients can independently read and complete a questionnaire; others will need the therapist to read the questions aloud and to take note of responses. Here are some examples of questions asked to inventory symptoms ¹²⁶:

- Do you wear glasses?
- Do your glasses work as well now as before your injury?
- Do you have blurry vision? Is the difficulty at far or near?
- Do your eyes feel tired?
- Do you ever see double?
- Do you ever have to close one eye?
- Do you experience eyestrain, headaches when using your eyes?
- Do you find yourself losing your place or skipping lines when reading?
- Do you bump into chairs, objects?

Consider using a standardized self-report such as the *COVD QOL Assessment* (Daugherty et al., 2007).

Dynamic assessment of functional performance: An individual's occupational performance in any given situation is shaped by many internal and external variables including his or her innate capacities, the strategies he or she uses, the nature of the task, and characteristics of the environment ¹²⁷. When observing functional performance based on a dynamic investigative approach, the occupational therapist methodically manipulates task and environmental variables as the patient performs a selected everyday activity in order to determine under what conditions that individual functions at his or her best ^{128,129}. To observe the impact of possible vision disturbances, the occupational therapist asks the Service member to perform familiar tasks that involve the following components: moving around a room to find and retrieve items under variety of lighting conditions; reading; visually attending during mobility; bending and reaching; and visually scanning. The occupational therapist makes note of behaviors such as squinting, over-reaching for items, difficulty reading, missing items placed in the periphery, inability to visually attend when ambulating or changing position, complaints of dizziness with position changes, or complaints of visual changes over time. Service members wear their glasses or contact lenses during functional performance, as they would in any other everyday activity. Occupational therapists often use a

checklist of the aforementioned behaviors and/or a stopwatch as they observe performance.

Occupational therapy comprehensive vision assessment

If potential vision disturbances are evident during either component of the vision screen, the occupational therapist performs a comprehensive vision assessment using an array of existing standardized tools and methods. The purpose of the comprehensive vision assessment is two-fold: 1) to specify components of vision dysfunction requiring occupational therapy intervention; 2) to identify individuals needing referral to vision specialists (e.g., optometrist with expertise in TBI). In general, an occupational therapy comprehensive vision assessment includes the following elements: visual acuity (distance); accommodation; convergence; eye alignment; saccades/pursuits; visual fields; binocular vision; glare/photophobia. We now describe a number of evaluation options reflect that standard assessment methods used in occupational therapy for visual impairment. Note that occupational therapy comprehensive vision assessment is not intended to replace a comprehensive vision evaluation by a neuro-optometrist/opthamalogist. We now describe a number of evaluation options reflect that standard assessment methods used in occupational therapy for visual impairment. (Readers are referred to Zoltan [2007] and Scheiman [2002] for excellent discussions of evaluation and treatment of vision problems in occupational therapy.)

Practice Options include the following:

- Distance visual acuity using Chronister Pocket Acuity Chart
- Accommodation using the Accommodative Amplitude Test (Chen & O'Leary, 1998)
- Convergence using the Near Point Convergence (Scheiman, 2011)
- Eye alignment and binocular vision using the Eye Alignment Test (Scheiman, 2011)
- Saccades using the Developmental Eye Movement Test – Adult (Sampedro, Richman, & Sanchez Pardo, 2003)
- Pursuits using the Northeastern State University College of Optometry Oculomotor Test (Maples & Ficklin, 1988)
- Visual fields using confrontation testing (Scheiman, 2011)
- Binocular vision using the Viewer-free Random Dot Test (Scheiman, 1997)
- Brain Injury Visual Assessment Battery for Adults (biVABA) (Warren, 1998)

Recommendations

- 1) Occupational therapists provide a vision screen consisting of vision symptom inventory and dynamic assessment of function on all Service members with diagnosed or suspected MTBI (Practice Option).
- 2) If vision symptom inventory and/or observations of function suggest possible vision disturbances, occupational therapists conduct a comprehensive vision assessment using standardized batteries (such as the biVABA) or individual tests of visual acuity (distance); accommodation; convergence; eye

alignment; saccades/pursuits; visual fields; binocular vision; glare/photophobia (Practice Option).

- 3) If comprehensive vision assessment in occupational therapy suggests vision deficits, the Service member is referred to the optometrist and/or vision specialist on the rehabilitation team for further diagnostic testing (Practice Option).

Discussion: Visual changes are a common complaint post MTBI. They may be mild such as blurred vision or difficulty focusing in high or low light or they may be severe such as visual field cuts, diplopia, or total vision loss. The functional consequences of visual changes for soldiers in-theater are particularly significant as they may be unable to see hazards that place themselves and others at risk for injury or attack. The occupational therapist is educated to evaluate visual changes, identify potential activity limitations associated with visual dysfunction and provide strategies to compensate and exercises to remediate problems. The findings from an occupational therapy vision assessment may result in referrals to other specialized vision Services and contribute to the diagnostic process. While many of the symptoms associated with MTBI mirror PTSD, this is not the case with visual changes. Therefore, findings from an assessment of visual functioning may help the Service member's physician rule out combat stress and PTSD in the Service member's symptom presentation.

Intervention

Objective: To provide remedial training or adaptive strategies in order to restore premorbid level of functioning and decrease symptoms associated with visual deficits.

Practitioner: Occupational therapist ICF components: Body structure/function, activity, participation Strength of recommendation: Practice option Rationale: Existing guidelines and evidence reviews do not specify interventions for vision problems after MTBI. Applicable level(s) of care: III (Combat Stress Unit), IV, V, VI, VII, VIII
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Background: Efficacy of treatment for visual disturbances associated with MTBI is limited, although there is some evidence that interventions may improve convergence and visual scanning¹³⁰. Treatment methods may be restorative or adaptive and the strategies employed will vary depending on the underlying issue as well as the individual's needs and goals. In general, occupational therapists work with optometrists/opthalmologists who have TBI expertise to develop an intervention plan (incorporating the treatment suggestions described above) based on the individual Service member's vision deficits, specific goals, and level of care. The Service member's treatment plan should be coordinated across the

rehabilitation team. For example, everyone on the team should work to reinforce adaptive vision strategies to help the Service member master the strategies and build new habits. Open communication between team members will help to provide this continuity of care.

An array of vision-related intervention strategies are described below. Note that the biVABA also provides a number of suggested treatment strategies, both adaptive and remedial for visual attention, scanning, and low vision.

Visual acuity

In the case of visual acuity deficits, occupational therapists refer patients to eye specialists for appropriate prescription for corrective lenses. Additionally, occupational therapists provide patient education associated with use of compensatory strategies such as increased illumination and contrast; decreasing background pattern and clutter; using magnification.

Visual scanning and tracking

Scanning deficits may be secondary to a number of underlying issues including saccadic eye movement problems, balance issues, hyperactive nystagmus, or weak extraocular musculature. Intervention strategies must address the underlying issue. For example, intervention for deficits secondary to saccadic eye movements may include pointing to letters that have been written on opposing sides of a page, engaging in activities that require gross motor movements such as looking over left shoulder then right and identifying objects or visual targets, as well as computer retraining software¹³¹. Other compensatory techniques include use of visual anchors while reading and decreasing the amount of visual stimuli that may be present during task engagement¹³¹.

The Dynavision has been used to address visual scanning and reaction time and also as a tool to advance driver rehabilitation in an occupational therapy setting. Once again there is no empirical support for these intervention strategies but have been suggested by experts in the field of brain injury rehabilitation.

Accommodation

Individuals with impaired accommodation may complain of discomfort and eye strain with near tasks and difficulty changing focus from near to far and far to near. Patients are referred to staff optometrist/ophthalmologist with expertise in TBI and vision. Occupational therapists provide education, compensatory intervention, and if recommended by vision specialist, support performance of eye exercises (Scheiman, 2011).

Convergence

Kapoor and colleagues¹³² described the use of visual exercises to increase oculomotor control and improve convergence. These exercises may include the use of a Brock string or exercises that promote visual fixation and identification of objects placed close to the nose (at the end of a spoon placed in the mouth)¹³¹. As supervised by vision specialist, patients may benefit from patching and/or exercises such as pencil push-ups.

Diplopia

Individuals who present with diplopia should be referred to a vision specialist for suggestions regarding use of full eye occlusion, partial occlusion or use of prisms. The occupational therapist shares information with the specialist regarding the Service member's functional performance associated with vision changes¹³¹. If the therapist is in-theater and no vision specialist is available, patching one eye should remediate diplopia but this is a "quick fix" only. Additionally, occupational therapists instruct patients in compensatory strategies including increasing illumination and contrast; decreasing clutter and background pattern; using visual markers or anchors; limiting time doing visual tasks that take concentration and taking frequent breaks.

Recommendations (Practice Options):

- 1) Occupational therapy-based interventions for vision consist of both remedial and adaptive approaches and must occur in the context of a larger team.
- 2) Occupational therapists refer patients with vision impairments to eye specialists and collaboratively develop the treatment plan.
- 3) Rehabilitation for visual deficits should use activities that are of interest and need for the Service member. This may help to provide motivation and reinforcement.
- 4) Restriction of activities may be necessary as part of the treatment program. For example, driving restrictions or restrictions on some sports may be recommended for safety.
- 5) Therapy should take place in multiple environments including the home and community whenever possible at the higher levels of care or in theater in the case of the deployed Service member. Practice in multiple contexts will assist with generalization of newly-acquired skills.

Discussion: Visual disturbances associated with MTBI potentially have a significant impact on the Service member's ability to resume military activity safely and efficiently. More research is needed to both identify the nature of vision disturbances after MTBI as well as to identify the most effective intervention methods for this population.

Post Traumatic Headache (PTH)

Assessment

Objective: Identify headache etiologies secondary to mild TBI that can be treated by a general practice physical therapist. Monitor progress and response to treatment of contributing factors.

Practitioner: Physical Therapist

ICF component(s): Body structure/Body function, (if HA becomes chronic may include Activity and Participation)

Strength of recommendation: Practice standard

Rationale: Recommended assessment tools suggested here have been shown to be reliable and valid for their specified conditions, such as neck pain, TMJ disability, or pain. None of the assessment tools recommended have been developed specifically for patients with MTBI. The numeric pain scale or visual analog pain scale is used to classify headache pain levels^{24,25}. A visual analog scale may be used to monitor limitation resulting from headache. If cervical spine or TMJ issues are contributing to headache pain, assessments including the *Neck Disability Index*^{26,27}, the *Jaw Functional Limitation Scale* (JFLS)^{20,28}, the *Temporomandibular Index* (TMI)²⁹ may be used. Use of the *Patient-specific Functional Limitation Scale* should be considered³⁰.

Applicable level(s) of care: All

Background: Post traumatic headache (PTH) is defined as a headache that occurs 1 week after regaining consciousness, or within 1 week of head trauma¹³³. Most of these resolve within 6-12 months and are associated with cervical muscle tenderness and postural abnormalities. Lew et al. (2006) found that many patients with PTH presented clinically with symptoms similar to tension headache (37%), migraine (29%), and cluster headaches (6-10 %).

The number of individuals who develop PTH following a MTBI usually ranges from 30% to 50%¹³⁴. In a recent survey of army infantry soldiers, 3-4 months after return from a yearlong deployment in Iraq, about 30%, who had been injured with loss of consciousness, also described headache as a disability affecting their overall health⁴⁸. Paradoxically, many researchers have found that the milder the brain injury, the more "frequently severe" is the post traumatic headache^{134,135}. These authors also conclude that PTSD may mediate chronic pain but that traumatic brain injury has an independent association with chronic pain. Based on a retrospective review of the literature, the prevalence of chronic pain after brain injury for veterans is 43.1% (95% CI, 39.9%-46.3%)¹³⁵.

In situations where patients sustain whiplash injuries, 82% will experience headache immediately following the injury¹³⁴. These headaches have a higher association with light and sound and are aggravated by movement¹³³. Whiplash

injury may also aggravate the temporomandibular joint (TMJ) due to tearing and stretching of ligamentous structures. TMJ injury is unlikely a sole cause of headache, but may be a contributor to overall discomfort and disability¹³⁴.

Direct trauma to the face, head, or neck can also result in supraorbital, infraorbital or occipital neuralgias. Structures innervated by C1/C2 cervical segments including sternocleidomastoid, trapezius, structures of the atlantoaxial and atlanto-occipital joint, prevertebral and paravertebral cervical muscles as well as the vertebral arteries may contribute to headache. According to Packard (1999), these types of neuralgias are often mistakenly attributed to trigeminal nerve injuries. Identification of trigger points in upper cervical region is a key clinical sign of these types of neuralgias.

Cervicogenic headache overlaps with whiplash and cervical strain injuries. The trigeminal nociceptive system converges with upper cervical pain pathways and may play a role in PTH. A proposed set of guidelines to describe cervicogenic headache has been published. A main criterion is that neck movement exacerbates headache or that sustained movement or awkward postures cause headache symptoms¹⁷.

The clinical presentation of the various types of headache disorder can mimic or co-exist with each other, making it difficult to distinguish between the different types of headache. High levels of muscle tenderness, postural and mechanical abnormalities all have been reported in tension headaches, migraine, whiplash syndromes and cervicogenic headaches^{17,134}.

The heterogeneity of clinical presentations for disability due to neck and jaw pain, and headache is large. The diversity of clinical presentation also makes it difficult to include all possible functional items that can be impacted by patients' injuries or conditions that can result in headache. As mentioned, neck pain, temporomandibular joint disorders (TMD), and shoulder pain are three common complaints reported in conjunction with MTBI, all of which contribute to PTH. Measurement tools used to assess headache include both general measures of the frequency, severity, and limitations caused by headache pain, as well as condition-specific measures that are used to determine the disability and severity of that disability related to the neck, jaw and headache.

Given the overlapping nature of headache and TMD following MTBI, it is important for the therapist to distinguish disability related to the physical and biomechanical factors that contribute to the origins of headache. This distinction will guide the clinical decision-making process to develop a specific and therefore, effective treatment program. The main criterion involves an assessment of how neck and jaw movements exacerbate headache. For the appropriate assessment tools for the TMD contribution to headache pain, see that section of the *Guidance*.

In the gathering of basic PT clinical measures of headache, consideration should be given to a standardized approach. Typically the numeric pain scale or visual analog pain scale is used to classify headache pain levels²⁴. For example, a numeric pain scale that assesses two dimensions of pain within a consistent time frame may be used. These dimensions include pain limitation of activity over the last 24 hours or last week, and the pain intensity in the last 24 hours, last week, or

other specific time frame. Additionally, a standardized approach includes recording of the number and type of headaches within a consistent time frame. This may be expanded to include the recording of the amount and type of headache-related medications under a standard context such as within the last 24 hours, or the amount needed to complete a worked day or any context associated with pain management.

The *Headache Disability Inventory* (HDI) is a 25-item patient self-report that measures the impact of headache on daily living¹³⁶. This inventory includes assessment of daily living issues with both functional and emotional scales that combine for a total score. The HDI can also be used to monitor the effect of therapeutic intervention for headache. The HDI has high internal consistency, reliability, content validity and good test-retest stability^{136,137}.

The *Neck Disability Index* (NDI) is a patient self-report questionnaire that measures clinical change in individuals that have acute or chronic neck pain of musculoskeletal or neurogenic origin¹³⁸. This questionnaire is designed to help understand how neck pain affects an individual's ability to manage everyday-life activities. The NDI has been studied in both acute and chronic neck pain (including those with traumatic etiology) in a variety of settings (hospital, rural clinics, urban settings, tertiary care). A recent systematic review of the studies on the NDI indicate that there are important limitations²⁷, although the NDI is considered the gold standard for assessment of the impact of neck pain and for following change resulting from treatment interventions.

The *Patient Specific Functional Scale* (PSFS) is a patient-specific outcome measure, which investigates functional status³⁰. Patients are asked to nominate up to five activities with which they have difficulty due to their condition and then rate the functional limitation associated with these activities. The PSFS is intended to complement the findings of generic or condition-specific measures. The PSFS has been shown to be valid and responsive to change in musculoskeletal conditions such as neck pain, cervical radiculopathy, knee pain, and low back pain^{26,139,140}. When compared to other fixed-item instruments, the PSFS has been shown to be more responsive than the *Neck Disability Index*²⁶, the *Pain Rating Index*, and the *Roland Morris Questionnaire*¹³⁹. In pain-focused patients, the PSFS is useful to redirect questioning towards function and ability rather than pain and disability. In a patient population of workman's compensation patients the PSFLS was associated with timely recovery. Use of the PSFLS would be appropriate in the condition of headache resulting from MTBI.

Recommendations:

- 1) Basic PT clinical measures of PTH should involve a standardized approach, including:
 - a. A numeric or visual analog pain scale that assesses two dimensions of pain within a consistent time frame:
 - b. Pain limitation due to activity during the last 24 hours or last week, etc.
 - c. Pain intensity in the last 24 hours or last week etc.

- d. Recording the number /type of headaches within a consistent time frame.
 - e. Recording the amount and type of headache related medications under a standard context such as within the last 24 hours; or the amount and type of medication needed to complete a worked day or any context associated with pain management.
- 2) The PSFLS is a unique tool to assist with an individualized approach by the PT and should be considered for patients with headache resulting from MTBI. It is a patient-specific outcome measure, which investigates functional status
 - 3) Condition specific measures should be used to determine disability and severity of disability related to the neck/jaw/headache. These measures can be administered before and after an episode of care to determine the degree of significant improvement. Data can be aggregated to inform overall treatment program effectiveness. These condition specific measures may include the *Neck Disability Index*, *Jaw Functional Limitation Scale* and/or the *Headache Disability Inventory*.
 - 4) A standard musculoskeletal evaluation of the head and neck and related structures should be included.

Discussion: Therapists are encouraged to complete a thorough initial evaluation that includes evaluation of any orofacial pain, TMJ disorders, cervical spine, thoracic spine and upper quadrant to include upper extremities. Frequently headache pain is caused by dysfunction and referred pain from another area of dysfunction. Neck pain, back pain, or upper extremity pain are all areas that may affect a Service member's ability to perform duties safely in a field environment. The Service member's primary military occupation and duty requirements must be taken into consideration when determining fitness for duty.

Intervention

Objective: To alleviate pain and minimize activity limitations due to headache after MTBI.

Practitioner: Physical Therapist
International Classification of Functioning: Body structure/body function
Strength of recommendation: Practice option
Rationale: Physical therapy appears to have at least a modest impact on outcome in patients experiencing headache¹⁷. Multimodal approaches that include manipulation and/or mobilization in combination with exercise are generally more effective. Patient education on medication management and avoidance of headache triggers is considered essential.
Applicable level(s) of care: All

Background: Pharmacologic treatment is common for headache, as is its use preventatively. This type of treatment is not typically within the scope of civilian physical therapy practice. In a field environment with no access to imaging, the initial medical treatment for headache is acetaminophen ONLY until intracranial bleeding has been ruled out through appropriate imaging. Physical therapists at this level should advocate to Service members of the need to avoid other headache-related medication, as Service members often "self-medicate" and do have access to over-the-counter pain medications. Medication reconciliation and notation of medication changes during an episode of care are important considerations for PTs, especially with the increasing use of alternative and complimentary therapies.

Reconciliation of medication can also assist in the overall management of analgesic rebound headache. This is a situation where patients that have used medications to manage their chronic daily headache, become dependent on these medications such that once medications are stopped the patient can experience a rebound headache ¹³⁴.

As with other joint dysfunction, patient education regarding PTH and appropriate exercise program handouts are effective intervention techniques. Unique to headache, is the inclusion of environmental triggers for headache that include sleep patterns, use of caffeinated beverages, stress, inconsistent exercise and irregular diet ¹⁴¹. All of the above listed "triggers" are present in the combat environment.

A structured review of the literature that examined physical treatment for headache ¹⁷ concluded that physical therapy appears to have a modest impact on outcome in patients experiencing headache. This review included studies that examined headache etiologies that were both traumatic and non-traumatic. The quality of the studies was generally low and the author emphasizes that individualized evaluation and intervention is the best approach. Bondi (2005) notes that these conclusions are in the context of common clinical presentations that include pronounced muscle tenderness of neck, face and shoulder associated with neck pain and headache.

PT interventions with the strongest evidence include specific training in exercise, stretching and ergonomics at home and in the workplace. Multimodal approaches that include manipulation and/or mobilization in combination with exercise are generally more effective ¹⁴². In a case series of 20 patients whose headache pain was of muscular origin, treatment included posture training at home/workplace, isotonic home exercise, massage, stretching of cervical muscle. The patients were seen once a week for six weeks. ¹⁴³. In a case report on cervicogenic headache, interventions including exercise and functional instruction were successful in improving functional and work related activities as well as improving sleep and decreasing the number of pain medications. Outcomes for this case report included headache frequency/intensity and the *Neck Disability Index* ¹⁴⁴.

Recommendations:

- 1) Physical Therapists in theater educate Service members with MTBI about the dangers associated with taking over-the-counter medications NOT prescribed

by medical personnel.

- 2) Physical Therapists provide education and handouts regarding “red flags”^{7,34}, triggers for headache, and exercise programs (to include postural re-education).
- 3) Individualized goal setting (as with the Patient-specific Functional Limitation Scale) has shown promise in developing a more positive tone to the PT episode of care, focusing on change in function that is most important to an individual patient.
- 4) Symptom management of head/neck pain is best applied using a multimodal approach that includes self-care instruction, stretching /strengthening exercise, manual therapy and application of therapeutic modalities.
- 5) The general overall approach should be to address physical deficits (including movement related disabilities, postural deficits and muscle tenderness) that result in increased head/neck and jaw pain.
- 6) Monitor response to treatment using assessment tools such as the NDI, TMI, pain scale, and other pain and disability indexes to track recovery and effectiveness of treatment techniques used.
- 7) Develop well-designed randomized controlled trials in the treatment of post traumatic headache in those with mild TBI or concussion to establish definitive treatment standards for both Service members and the civilian patient population.

Discussion: Therapists are encouraged to design individualized intervention strategies based on findings in the evaluation. It is assumed that general practice physical therapist’s in military settings have a strong knowledge base in orthopedic and pain-related assessments and interventions.

Temporomandibular Disorders (TMD)

Assessment

Objective: Identify temporomandibular joint (TMJ) disorders with etiologies that can be treated by a general practice physical therapist in the combat theater and throughout the higher levels of care to reduce complaints of TMJ pain and dysfunction.

Practitioner: Physical Therapist
ICF component(s): Body structure/Body function
Strength of recommendation: Practice standard
Rationale: The assessment tools recommended were not specifically developed for patients with MTBI. The *Jaw Functional Limitation Scale* (JFLS) measures functional limitations that is independent of pain related behaviors ²⁰. The *Temporomandibular Index* (TMI) is a physical assessment of the TMJ joint and surrounding musculature that provides information regarding the severity of TMD ²⁹. Use of the *Patient-specific Functional Limitation Scale* should be considered ³⁰.
Applicable level(s) of care: All

Background: Temporomandibular Disorders (TMD) are defined as a subgroup of craniofacial pain problems that involve the temporomandibular joint (TMJ), muscles of mastication, and associated head and neck musculoskeletal structures. Common symptoms can include ear pain and stuffiness, tinnitus, dizziness, neck pain, and headache. TMD disorders, as well as neck and shoulder pain complaints, are commonly seen in conjunction with concussion, and may be contributing to the headaches that the person is experiencing ¹³⁴. Common impairments found in persons with TMD include joint mobility restrictions, muscle length limitations, as well as postural limitations and neuromuscular deficits.

The prevalence of at least one sign of TMD is reported in 40-75% of adults in the United States ⁵. Temporomandibular joint sounds and deviation on opening the jaw occur in approximately 50% of otherwise asymptomatic persons and usually do not require treatment. Other signs such as decreased mouth opening and occlusal changes occur in 5% of the population. The TMD are most commonly reported in persons aged 20-50 years of age, affecting females in proportionately greater numbers ⁵.

Epidemiological studies conclude that despite the high prevalence of TMD, up to 40 % of those who experience signs/symptoms of TMD dysfunction resolve spontaneously ⁵. It should be noted however, that some studies that show that patients with post traumatic TMD "mildly" differ from those with nontraumatic disorders on reaction time testing, neuropsychological testing, clinical testing of TMJ and on results from single-photon emission computerized tomography (SPECT) ¹⁴⁵. Packard (1999) discusses the epidemiology of headache in the US population that experience PTH and states that there is evidence that TMJ disorders may contribute to PTH. Packard further concludes that TMD disorders are not a causative but rather an associated factor in mild TBI headaches.

Given the high prevalence of TMD in the general population, the impact of PTH in mild brain injury and the association between the two, implementation of a physical therapy program by a general practice PT requires a focused assessment and evaluation of the severity of TMD.

The *Jaw Functional Limitation Scale* (JFLS) and the *Temporomandibular Index* (TMI) are clinical assessment tools that provide information regarding the severity of TMD. The JFLS is a relatively simple patient report that measures functional limitation (related to body structure/function) that is independent of pain related behaviors. It is a new tool and requires pencil and paper administration. It is easy to use, responsive to change²⁸, but has not been used extensively in outcome studies.

The TMI is an extensive measurement protocol grounded in epidemiological data and associated with the Research Diagnostic Criteria (RDC/TMD) (see¹⁴⁶ for information on international research consortiums and reliability). The benefit of this system is that it determines levels of severity for TMD that separates patients with physical disability from patients that experience chronic pain and pain-related behaviors (see¹⁴⁷ for outcomes following comprehensive care; and definitions of levels of severity).

The TMI is a physical assessment of the TMJ joint and surrounding musculature. The tool has the added advantage that it is used by the dental community at large and would facilitate communication and referral between the general practice PT and chronic pain teams²⁹. The use of the TMI does require training (studies report 30-50 hours) to achieve reliability between testers. The TMI has also been responsive to change following typical interventions employed by physical therapists in patients with chronic pain¹⁴⁸.

Recommendations:

- 1) Conduct a standard assessment of TMJ joint mechanics, muscle tenderness, and symptom occurrence. The most comprehensive tool available is the *Temporomandibular Index*. Use of this tool requires training of up to 30 hours and helps to define the type and severity of TMJ dysfunction.
- 2) Use the *Jaw Functional Limitation* scale to determine how TMD is affecting the patient's daily activity. This tool would also be useful to determine functional goals.
- 3) Use of the *Patient-specific Functional Limitation Scale* should be considered (see Headache section of this Guidance document for more information). This tool is easy to use, clinically relevant as well as sensitive to change. It is not a good tool to gather aggregate data on patient outcomes, however is useful for the individual patient.
- 4) Refer to dental services when needed and if available.

Discussion: It is assumed that general practice physical therapists in a military setting may or may not be experienced in working with Service members with specialty issues such as TMD. They are encouraged to use a team approach.

Intervention

Objective: Provide interventions that address TMJ dysfunction and pain issues; to encourage referral for dental services and specialty treatment for complicated

cases. The interventions must fit into the skill set of the general practice physical therapist.

Practitioner: Physical Therapist
ICF component(s): Body structure/Body function, Activity
Strength of recommendation: Practice standard
Rationale: No studies specifically address TMJ disorders that occur as a result of MTBI. Several systematic reviews of TMD interventions are available ³⁻⁶. Symptom management of TMD is best applied using a conservative and multimodal approach. Evaluation and treatment should also include other areas of the head, neck and upper trunk that demonstrate any deficits in posture or function or pain. The majority of TMD respond to symptom management techniques but for those who experience chronic pain, referral and collaboration with dentists and/or a multidisciplinary chronic pain center may be needed.
Applicable level(s) of care: All

Background: In randomized controlled trials (RCT) that have controlled for severity, TMD patients with mostly physical limitations have shown improvement with patient education on self-care. This approach included use of heat/cold packs, jaw exercises, guidance in activities to avoid (i.e. chewing gum, eating hard candy) and progressive muscle relaxation ⁶.

Systematic reviews of the literature, indicate that the majority of TMD can be treated with noninvasive interventions ^{3,5}. Medlicott & Harris ⁴ reviewed 30 articles, noting many methodological limitations to the studies, and made the following recommendations: 1) active exercises and manual mobilizations may be effective, 2) postural training may be used in combination with other interventions, 3) programs involving relaxation techniques and biofeedback, electromyography training and proprioceptive re-education may be more effective than placebo treatment and occlusal splints, 4) combinations of active exercises, manual therapy, postural correction, and relaxation techniques may be effective.

Wright and colleagues ¹⁴⁹ studied patients with a primary muscle disorder of the TMJ and used a combination of self-care and posture training compared to a group that did self-care management only. The recommended exercise protocols included neck and upper trunk stretching activities in supine and in sitting. Self-care instructions included education on resting masticatory muscles; avoiding parafunctional habits that increase pain (chewing hard candy/gum); applying heat/cold to most painful areas and the use of anti-inflammatory medications. This group found that posture training and TMD self-management instructions were significantly more effective than TMD self-management instructions alone for reducing TMD and neck symptoms.

Au and Klineberg ¹⁵⁰ examined the use of isokinetic exercise in patients with clicking of the TMJ joint. The recommended exercises include jaw movements performed at a constant speed with moderate resistance applied by the patient's hand, over a study period of 6 months. Eighty-two percent (18/22) of subjects in

the intervention group had resolution of clicking as measured by a Doppler auscultator. There were no changes in the control group reporting neither increased clicking nor development of clicking. Further, at the 2-year follow-up, 72% (16/22) remained symptom free.

Furto and colleagues¹⁵¹ published a nonrandomized study that did not control for TMD severity. The interventions included manual therapy by therapists trained under the American Physical Therapy Association and the American Academy of Orthopedic Manual Physical Therapy Fellowship Program. Intervention consisted of manual therapy techniques and exercise that included the Rocabado condylar remodeling exercise program and iontophoresis for those patients with limited range of motion. Of the 15 patients treated, 13 showed improvement on patient self-report functional measures. The discussion of this paper provides an informative description of the clinical rationale of a multimodal approach. These researchers also used patient self-report measures that have less rigor than JFLS, and TMI, (do not control for patient severity) but require less training than the TMI.

There are no published guidelines based on a consensus review process. One published guideline, based on current evidenced-based practice as implemented by one university setting, has been documented by Decker and Bromaghim, PTs at the TMD, Orofacial Pain and Oral Medicine Clinic at the University of Minnesota. The guideline is a comprehensive summary that links temporomandibular joint dysfunction with indications and contraindications for therapeutic modalities, exercise for the jaw and neck including indications for manual therapies, and treatment goals for three groups of disorders including hypomobility (myofascial pain, joint inflammation, post surgery) and hypermobility (clicking, arthralgia, muscle pain).

Recommendations:

- 1) Symptom management of TMD is best applied using a multimodal approach that includes self-care instruction, stretching exercise, manual therapy and application of therapeutic modalities.
- 2) Evaluation and treatment should also include other areas of the head, neck and upper trunk that demonstrate any deficits in posture or function or pain.
- 3) The majority of TMD responds to conservative, symptom management techniques but those who experience chronic pain may benefit from referral and collaboration with dentists (occlusal spints, evaluation of intracranial sources of pain) and/or a multidisciplinary chronic pain center.

Discussion: The majority of TMD can be treated with noninvasive interventions. It is important to utilize a team approach in treating TMD disorders where available.

Cognitive Impairments and Inefficiencies

Assessment

Objective: To identify cognitive inefficiencies and impairments experienced by Service members with MTBI in order to plan treatment.

Practitioner: Occupational therapist
ICF component(s): Body functions and structure; Activity
Strength of recommendation: Practice Option
Rationale: Existing guidelines provide little guidance as to the optimal timing or composition of cognitive assessment, although there appears to be general agreement that cognitive assessment can be of value for individuals who experience persistent cognitive complaints ¹⁸. Existing guidelines do not mention cognitive assessment performed by occupational therapists.
Applicable level(s) of care: III (Combat Stress Unit), IV, V, VI, VII, VIII

Background: As discussed earlier, some people describe decrements in their memory, attention, and information processing speed for three or more months after MTBI ⁴⁵. These cognitive symptoms may, in part, be explained by a bottleneck in terms of the brain's limited processing capacity as he or she attempts to manage distractions associated with symptom-management ⁴⁷. While highly practiced skills may be preserved, activities requiring new learning, problem solving, and self-control may be more difficult or problematic ⁴⁷. Unlike those with moderate – severe traumatic brain injury, persons with MTBI tend to be aware of decrements in cognitive performance; their self-reports of functioning are consistent with that of the appraisal of family members throughout their recovery ¹⁵². However, they may be unaware of the influence of situational factors on their performance and are at risk for misattributing symptoms and cognitive inefficiencies that most everyone experiences to the MTBI ¹⁵³. They also may have limited awareness of when and how to use compensatory cognitive strategies to optimize their performance.

Occupational and physical therapists are concerned with the impact of cognitive impairments and inefficiencies on everyday functioning, with occupational therapists typically assuming formal roles related to cognitive assessment and treatment. The primary purpose of cognitive assessment from an occupational therapy perspective is to identify (and ultimately address) possible cognitive barriers to functioning, not to diagnose neuropsychological impairment. Cognitive assessment in occupational therapy involves the evaluation of everyday functioning in order to make inferences about cognition (using dynamic investigative approach) and/or the evaluation of cognitive processes in order to make inferences about functioning (using standardized tests) ¹⁵⁴.

Interpretation of findings is as important to occupational therapists as test administration. Because cognitive assessment involves more than observation checklists and score assignment, occupational therapists consider other factors such as the patient's level of pain, fatigue, and stress and presence of environmental distracters as they interpret and document the results or findings. In fact, many

experts suggest that it is impossible to obtain a true picture of the Service members' cognitive functioning until these other factors are resolved ⁵⁵.

Examples of functional assessments of cognition

Dynamic assessment of functional performance.

As discussed in the Vision section, an individual's cognitive functioning in any given situation is shaped by many internal and external variables including his or her innate capacities, the strategies he or she uses, the nature of the task, and characteristics of the environment ¹²⁷. When assessing cognition based on a dynamic investigative approach, the occupational therapist methodically manipulates task and environmental variables as the patient performs a selected everyday activity in order to determine under what conditions that individual functions at his or her best ^{128,129}. Semi-familiar, multi-step and/or unstructured tasks (such as money-management, meal preparation, household, construction, or simulated work tasks) tend to approximate the problem solving demands of everyday performance. Typically, therapists use observation worksheets that help them track qualitative aspects of the patient's performance of an unstructured self-care, household, leisure, or work task such as number of reminders or redirections required; response to visual or auditory distractions; ability to self-monitor; speed and efficiency of performance; ability to multi-task; response to feedback; initiation of compensatory techniques; evidence of planning and/or strategy use (versus trial and error approach). See Appendix B for an example of an observation worksheet that could be used when employing this approach to assessment.

Self-reflection/self-awareness analysis.

There are no formalized procedures described in the literature specific to assessing patients' awareness of situational factors impacting performance after MTBI. However, occupational therapists may incorporate self-awareness assessment into a dynamic assessment of functional performance by adding the following elements:

- The therapist selects an assessment task that is likely to present a challenge to the patient based on suspected areas of inefficiency, impairment, or concern. Assessment tasks typically involve specific, detailed procedural instructions (memory demands), incorporate both structured and unstructured elements (problem solving demands); require at least 20-30 minutes of sustained effort (energy, concentration demands). Clerical, kitchen, craft or assembly tasks are well-suited to dynamic assessment with a self-assessment component.
- After describing the to-be-performed task, the therapist asks the patient to predict how well/easily he or she will perform the assigned task (e.g., performance time, percent accuracy, number of off-task responses to distractions, number of rest breaks required).
- The therapist establishes a plan to measure these parameters during actual task performance (with measurement/tracking performed by either the patient or therapist or both).
- The patient performs the task.

- Upon completing the task, the therapist provides actual task performance data to the patient and asks him or her to a) compare the predicted to the actual performance; b) describe situational, environmental, personal, or strategy factors that enhanced or deterred performance; and c) determine how to approach the task differently next time.

The process of task prediction and performance analysis can be incorporated into a wide array of therapy tasks and structures a process wherein the patient actively engages in self-reflective learning rather than passively receiving feedback from the therapist.

Mortera Cognitive Screening Measure- M-CSM ¹⁵⁵⁻¹⁵⁷.

The M-CSM also involves observing functional performance. It was developed as a means to assess seven selected cognitive processes - sustained attention, shifting attention, visual attention-scanning, awareness of disability, judgment relative to safety, recall, planning/problem solving - during the completion of two functional tasks (preparation of a bowl of soup and sandwich). The therapist assigns one of three scores (0 - no problem; 1 - a potential problem; 2 - evidence of a problem) to observable behaviors that objectively and operationally describe each of the seven cognitive processes underlying the functional tasks. Content validity was addressed, in part, by validating the seven cognitive processes relative to adequacy for inclusion and appropriate use of content domain and the accuracy of the cognitive descriptors or observable behaviors that indicate on what level the cognitive processes are impaired. Inter-rater reliability is very good (intraclass correlation coefficient = .83) ^{156,157}.

Examples of standardized assessments of specific cognitive domains with established reliability and validity for use with traumatic brain injury

Cognistat (Neurobehavioral Cognitive Status Examination [NCSE]) ¹⁵⁸ - a microbattery comprised of 10 subtests in areas of orientation, attention, comprehension, repetition, naming, construction, memory, calculation, similarities and judgment. The NCSE profile and process observations have been used as a cognitive screen with patients with MTBI in an acute medical setting to identify deficits and ensure patient education and treatment in patients with MTBI ¹⁵⁹.

Contextual Memory Test ¹²⁹ - test of visual memory that examines immediate and delayed recall, awareness of memory capacity, and memory strategy in which the patient tries to remember 20 objects associated with 1 of 2 themes.

Rivermead Behavioral Memory Test (RBMT) ^{160,161} - involves memory skills used in everyday life such as remembering names, faces, routes, appointments. Wills and colleagues ¹⁶² combined two of the four parallel versions of the RBMT to create an extended version (RBMT-E) which is more sensitive to subtle memory problems, as may be experienced by persons with MTBI.

Test of Everyday Attention ¹⁶³ - means of evaluating various dimensions of attention in the context of everyday tasks such as Map and Telephone Search, Elevator Counting, and Telephone Dual Task.

Recommendations (Practice Options):

- 1) For Service members with MTBI, occupational therapists assess cognition in the context of functional task performance in order to detect possible cognitive impairments or inefficiencies.
- 2) Occupational therapists coordinate their cognitive assessment efforts with other team members. In general, in-depth cognitive-behavioral assessment is deferred to neuropsychologists on the rehabilitation team, if available within rehabilitation setting/level of care.
- 3) If the results of the functional cognitive assessment suggest possible cognitive impairments/inefficiencies, the occupational therapist administers standardized assessments of memory, attention, and/or executive functions (and/or corroborating data are obtained from tests administered by clinicians from other disciplines).

Discussion: Occupational therapists within the DoD and VA systems will best serve individuals with MTBI as they are familiar with administering cognitive assessments related to everyday functioning, sophisticated in selecting the type of assessment methods to employ in specific situations, and skilled as observers who are able to link elements of functional performance to hypotheses about cognitive processes. Observations of functional performance could be formalized by creating fill-in-the-blank worksheets and/or checklists that specify the cognitive processes involved in various everyday tasks and that prompt the therapist to make note of task and environmental variables that may be affecting performance.

Intervention

Objective: To help the Service member improve his or her cognitive functioning and as a result, performance of everyday tasks

Practitioner: Occupational therapist
ICF component(s): Body functions and structure; Activity; Participation
Strength of recommendations: Practice Standard
Rationale: In their State of the Science literature review of empirical literature published between 1998 - 2004, Gordon and colleagues (2006) concluded that "training in the use of compensatory strategies seems to be effective for the remediation of attention and mild memory impairments after TBI" (p. 355). This is consistent with recommendations from resulting from two evidence-based reviews conducted by Cicerone and colleagues (2000, 2005).
Applicable level(s) of care: III (Combat Stress Unit), IV, V, VI, VII, VIII

Background: Cognitive rehabilitation involves two approaches: the effort to retrain impaired or deficient cognitive processes and the effort to help people

acquire compensatory cognitive strategies that circumvent the problem¹⁶⁴. A retraining approach involves repeatedly exposing the patient to structured, graded cognitive challenges (via work sheets and computer programs) in order to stimulate presumably damaged areas of the brain in the hope that resultant neuronal changes that will yield improved functional performance¹⁶⁵. There is little evidence to support this approach¹⁶⁶. However, many experts recommend cognitive compensatory strategy training for persons with MTBI specific to attention, memory, and executive function difficulties^{47,57,167}. It should be noted that most of the research in the area of cognitive rehabilitation has been conducted by neuropsychologists or speech language pathologists and involved subjects with moderate to severe traumatic brain injury.

Strategy training to address attentional deficits is recommended for outpatients in the post acute phase of rehabilitation¹⁶⁸⁻¹⁷⁰. Attentional strategies might include the following:

- single task completion¹⁷¹;
- initiating the removal of visual or auditory distractions¹⁷¹;
- learning to consciously monitor activities to avoid lapses in attention¹⁷²;
- performing challenging tasks during high-energy times of the day;
- pacing, planning breaks, and self-monitoring of fatigue/attention levels¹⁷²;
- using an “ideas log” so that people can capture good ideas that come to mind but want to address later¹⁷²;
- routinely double-checking work for accuracy.

Instruction in the use of memory aids (notebooks, diaries, personal digital assistants [PDAs], and internal memory strategies) is also supported by evidence¹⁶⁸⁻¹⁷⁰. Radomski and Davis (2008) described a training hierarchy that proceeds as follows: information retrieval (patient learns to find information in function-specific sections); basic planning (patient learns to use checklists to carry out daily and weekly planning routines that involve creating daily to-do lists); basic information entry (patient learns to record appointments, to-do's, lists in the correct sections of the planner or device as well as to take notes on step by step tasks); complex information entry (patient learns to take notes during conversations, meetings, classes); complex planning (patient learns project management techniques). Some people also benefit from learning to use alarm prompts for time-specific action items and/or internal memory strategies such as visual imagery and first-letter mnemonics¹⁷³, although such strategies are time- consuming to learn and effortful to employ.

Training in the use of problem solving and organization strategies as applied to real life tasks is also supported by evidence¹⁷⁰. Here are some examples of strategies that, if effectively learned and employed, may help people circumvent difficulties with executive functions:

- establishing a routine for daily and weekly planning;
- breaking multi-step or complex tasks into step-by-step checklists;

- using a problem solving mnemonic to proactively and systematically think through many aspects of the problem before initiating action. (The IDEAL Problem Solver ¹⁷⁴ outlines a five-step process – Identify the problem; Define the problem; Evaluate all possible solutions; Act; Look back.)

Finally, occupational therapists use a wide array of ongoing activities as opportunities to

help patients with MTBI become more aware of the influence of situational/environmental and strategy factors on their performance. While designed to improve self-awareness for patients with moderate to severe TBI, features of the Toglia-Kirk self awareness training model ¹⁷⁵ may have utility in advancing self-reflection after MTBI. After receiving instruction to the task at hand, Service members are asked to restate their understanding of the task procedures; predict their performance; anticipate possible errors; select strategies that might avert the errors; perform the tasks; reflect on performance.

The following principles can be applied to any area of compensatory cognitive strategy training.

- Patients who are aware of their cognitive impairments or inefficiencies are most likely to benefit from compensatory strategy training ¹⁷⁶. People tend to be engaged in the training process if they expect that it will enable them to carry-out tasks of personal significance.
- The training process should involve both supervised rehearsal and real-life application. Sohlberg and Mateer ¹⁷⁷ described a three phase approach that includes acquisition, application, and adaptation phases of training. During the acquisition phase, therapists teach patients how to carry-out the new strategy or technique. During the application phase, patients practice the new strategy while performing an array of therapy tasks. During the adaptation phase, individuals actually use the strategy to perform real-life activities of personal relevance.
- While therapists always individualize the cognitive compensatory strategies that are recommended to patients, the training process may be conducted within a one-on-one or group setting.
- The more abstract the cognitive strategy, the longer the training time needed ¹⁷⁸. Learning a concrete skill or routine (such as setting alarm prompts each morning to avoid missing medications) takes less training time than learning to use the IDEAL Problem Solver in one's daily life.
- Compensatory cognitive strategies are described to patients as cognitive energy saving techniques that buoy their everyday functioning as the symptoms of MTBI (which may derail information processing) continue to resolve. Patients are reminded that many people without MTBI use similar strategies to optimize their performance on a routine basis.
- The men and women who join the Armed Forces are conditioned to work in group environments. The feedback they receive from their comrades carries significant weight and may be a strong motivator. Therefore, therapy should

take place in both 1:1 environments with the therapist and the Service member as well as in a small group milieu. The groups should be both topical (discussion based) and task oriented and use of group activities and materials should be presented in such a way as to challenge participants. Time for group process at the end of the session is essential for self-reflection and improving awareness of situational and environmental factors that impact their performance.

Recommendations (Practice Standards):

- 1) If Service members with MTBI report or demonstrate problems with attention and concentration during everyday activities, occupational therapists incorporate attention strategy training into their treatment plans. These strategies may be rehearsed in the context of computer or videogames, crafts, leisure activities, or work tasks. Homework assignments in which the Service member uses the strategy in personally-relevant activities are recommended as this may facilitate the generalization of newly-acquired skills and strategies ¹⁷¹.
- 2) If Service members with MTBI report or demonstrate problems with memory, occupational therapists incorporate compensatory memory training into their treatment plans. In general, Service members learn to routinely write notes about appointments and intended tasks in calendars or input the information into electronic devices such as PDAs rather than trying to remember the information. As above, homework assignments are provided so that Service members practice initiating notetaking or data entry and then use these prompts in the context of personal activities outside of the clinical setting.
- 3) If Service members with MTBI report or demonstrate difficulties with problem solving and organization, occupational therapists help them learn to use related compensatory strategies. Given the abstract nature of these strategies, therapists must provide ample opportunity for rehearsal and personal application (over a period of weeks).
- 4) Occupational therapists precede compensatory cognitive strategy training with an assessment of the Service member's central concerns and performance priorities as well as his or her preferences in terms of compensatory cognitive strategies (i.e., high tech versus low tech). Structured opportunities for self-reflection on performance (what went well, what to do differently next time) are woven into the training process.

Discussion: Occupational therapists within the DoD and VA system will best serve individuals with MTBI as they are familiar with an array of cognitive compensatory strategies and how to match those strategies to specific performance problems. DoD/VA clinicians might consider identifying a limited number of memory aids (notebook and electronic) that will be used with Service members for which formal training toolkits could then be developed.

Attention and Dual Task Performance Deficits

Assessment

Objective: To provide an assessment of how impairments of attention or cognitive deficits affect balance, walking or other mobility tasks in Service members with MTBI or concussion.

Practitioner: Physical therapist (Occupational therapists as appropriate)
ICF components: Activity and Participation
Strength of recommendation: Practice Option
Rationale: A specific assessment tool for assessment of dual-task costs or a decrement of physical task performance resulting from cognitive deficits in persons with MTBI is not available.
Recommendations of potential tools and formulas for calculating dual-task costs are found in ¹⁶.
Applicable level(s) of care: V-VIII (also part of a Combat Readiness Screen)

Background: Persons with concussion or MTBI frequently complain of imbalance, unsteady or slow walking, which may become even more pronounced when they attempt to do more than one task at a time. They may report a problem with speed and/or accuracy when they attempt simultaneous tasks. These complaints may begin immediately following a MTBI or concussion or may occur after a time delay.

Persons with traumatic brain injury and specifically with concussion have been shown to have a significantly slower gait speed and stability under dual task conditions ^{179,180}. For example, Parker et al. (2006) demonstrated significantly slower walking speeds and greater sway than controls, in subjects with concussion for up to 4 weeks post injury. Persons with brain injury, whether mild or moderate, have been anecdotally reported by physical therapists to show decrements in their balance function when their attention wanders during formal assessments of balance or gait such as with the *Berg Balance Scale* or the *Functional Gait Assessment*.

A comprehensive review of the issues related to the assessment and intervention for attention issues specifically in dual-task conditions has recently been published ¹⁶. Suggestions are provided in this thorough review for assessment tools that are considered feasible in a population with acquired brain injury such as the *Walking and Remembering Test* ¹⁸¹. The reader is referred to the McCulloch (2007) article for detailed information on available assessment tools and for formulas for calculating relative dual-task costs when combining mobility, cognitive and/or manual tasks.

There is a clear need for development of valid and reliable assessment tools to assess recovery and the effects of intervention of these common problems involving cognitive deficits affecting physical task performance after MTBI in order to establish definitive therapy assessment and treatment standards for both Service members and the civilian patient population.

Recommendations:

- 1) An assessment of dual-task performance is recommended. A specific and appropriate dual-task test that is clearly relevant for Service members with mild TBI cannot be recommended at this time. Some options are available. *The Functional Gait Assessment* is a clinical test of walking that contains items that require performance of more than one task such as walking while turning the head or walking around objects. Anecdotally, therapists report using a number of dual-task assessments such as the manual Timed Up and Go Test (TUG) which involves comparing time differences when a patient completes the TUG and the TUG while carrying a cup of water. *The Walking and Remembering Test* has been shown to be reliable and feasible in persons with acquired brain injury and can be considered for use.
- 2) Ideally, calculation of relative dual-task cost should be done. The therapist and the Service member should determine tasks that are relevant to the Service member. In order to determine dual-task costs, a baseline assessment (for example, walking time) is determined, and a cognitive task baseline is also obtained (for example serial 7 subtractions from 100 measured in time and number of errors). The relative dual-task cost is determined with a formula that takes into consideration the baseline performance (so that the patient's performance can be followed over time and can be compared to others) ¹⁶.
- 3) It is recommended that an effort be made to develop a dual-task assessment tool that is relevant to Service members, likely involving common soldiering tasks, and is feasible, valid, reliable and responsive to change so that it can be used to monitor natural recovery and response to therapeutic intervention.

Discussion: Therapists are encouraged to assess dual-task costs in Service members with mild TBI with a tool that fits their practice environment and the Service member's deficits. Cognitive issues during difficult physical tasks could seriously affect the Service member's safety and ability to carry out his/her duties or life tasks.

Intervention

Objectives: To provide interventions that involve a progression of task difficulty and that include dual tasks involving motor, manual and cognitive tasks for those Service members who demonstrate a decrement in motor or cognitive function in dual task conditions; to assist the Service member in improving his/her ability to perform everyday tasks in complex environments.

Practitioner: Physical therapist (Occupational therapist as appropriate)
ICF components: Activity and Participation
Strength of recommendation: Practice Option
Rationale: A number of dual task training strategies have been employed with manipulation of the environment (closed versus open), task, and the instructional set for the subject. See McCulloch, 2007 for a comprehensive review of intervention approaches.
Applicable level(s) of care: V-VIII (also part of a Combat Readiness Screen)

Background: Balance during functional tasks is affected by attention. High-level mobility skills can be affected by shifting or dividing attention in persons with MTBI. A decrement in performance during tasks in complex environments that involve the interaction of attention and mobility would severely affect the safety of Service members in combat roles, driving, work and other environments.

In a case series involving older adults with balance deficits and issues with falling, Silsupadol et al.¹⁸² describe that the adults were able to improve their balance under both single and dual task conditions, with improvements tending to be condition specific. That is, those subjects who trained under dual-task conditions showed greater improvement in dual-task assessment. This report describes a number of intervention strategies and tasks that can be used to train dual task skills¹⁸². A Defense and Veterans Brain Injury Center paper has described the design of an ongoing clinical trial that looks at two ways of approaching rehabilitation for persons with TBI and cognitive impairment. These approaches termed “cognitive-didactic” and “functional experiential” provide and attempt to understand the most effective treatment methods for persons with TBI and cognitive issues¹⁸³. Again, McCulloch provides a comprehensive review of the issues related to intervention for attention issues specifically in dual-task conditions for persons with acquired brain injury¹⁶.

Recommendations:

- 1) If Service members with MTBI demonstrate deficits in dual-task conditions, interventions should include tasks in progressively more complex environments and progressively more difficult multi-tasking conditions. For example, the therapist may begin with simple interventions such as walking while carrying a cup of water in a quiet environment and progress to packing and carrying a rucksack through rough terrain while looking for specific items or signs.
- 2) Recreational sport activities often involve multiple task performance while maintaining a Service member's attention and motivation. Common military tasks required of Service members also often involve multiple task performance with accuracy and speed and would be relevant and motivating to the Service member. Incorporation of these types of dual tasks as therapeutic interventions is recommended.
- 3) There is a need for well-designed randomized controlled trials in the treatment of these common problems of cognitive deficits affecting physical task performance after MTBI in order to establish definitive physical therapy assessment and treatment standards for both Service members and the civilian patient population.

Discussion: Therapists are encouraged to design individualized intervention strategies for Service members with deficits in dual-task conditions that begin with simple interventions and move to more complex tasks as appropriate. Tasks that are relevant to the Service member are encouraged. Again, "cost" or decrement in skill level or time to complete a task when two or more tasks are done simultaneously, should be monitored in order to assess recovery and the effect of intervention.

Performance of Self-Management, Work, and Social Roles

Assessment

Objective: Identify the Service member's concerns about and specify any barriers to his or her performance of life roles.

Practitioner: Occupational therapist
ICF Component(s): Activity, Participation
Strength of recommendation: Practice Options
Rationale: Existing guidelines provide little guidance as to the optimal timing or composition of life role assessment after MTBI
Applicable level(s) of care: III (Combat Stress Unit), IV, V, VI, VII, VIII

Background: Trombly^{184,185} characterized three domains of personal roles that are essential to being in control of one's life: self-maintenance roles, self-advancement roles, and self-enhancement roles. Self-maintenance roles pertain to the maintenance of oneself and care of the family and home, comprising basic activities of daily living (BADL) (e.g. dressing, grooming, eating) and instrumental activities of daily living (IADL) (e.g., meal preparation, household tasks, bill paying)¹⁸⁶. Self-advancement roles have to do with education and work-related tasks while self-enhancement roles are associated with leisure and social participation¹⁸⁶.

Self-management roles after MTBI

While most people recover from concussion/MTBI within three months of injury⁴⁰, some experience symptoms that interfere with performance of life roles. For example, people who sustain a MTBI without other concomitant injuries or conditions typically do not experience disability related to performance of highly-automatic basic self-care tasks. That is, they retain their ability to independently put on their clothing, feed, and bathe themselves, albeit with greater concentration and effort⁴⁷. However, the efficiency of performance may suffer because of difficulties with attention/concentration, decision-making, and disruption in his or her daily routine. After MTBI people may experience errors and inefficiencies during IADL because these tasks tend to involve less automatization, more steps, and therefore, place greater demands on higher order thinking abilities (planning, prioritizing, self-monitoring)¹⁸⁷.

Similarly, some Service members report difficulties resuming personal roles after deployment, especially those with polytrauma¹⁸⁸. In Resnik and Allen's qualitative study, researchers conducted semi-structured interviews with 14 injured veterans. The veterans (some polytrauma that included MTBI and others had orthopedic injuries) described difficulty initiating self-care tasks (even though they were able to perform the tasks) along with challenges in health maintenance. For example, they reported challenges taking medications as prescribed, not keeping medical appointments, changes in health habits including weight gain.

Work and social roles after MTBI

As discussed in the previous sections, some people with MTBI are not able to resume life roles that are important to their independence and full participation in social and community roles. In their long term follow-up study of Vietnam veterans, Vanderploeg and colleagues found that compared to uninjured controls, those with self-reported MTBI had increased likelihood of depression and poorer psychosocial outcomes including under-employment and marital problems¹⁸⁹. Therefore, occupational and physical therapists aim to identify possible concerns regarding work, social relationships, transportation, and leisure during early stages of recovery and at any time in life long care in order to provide therapy intervention and optimize Service members' functioning in these realms.

Successful return to work and school is often a priority and concern of Service members who are returning from OEF/OIF and have sustained a MTBI. Although little research has been conducted in the area of MTBI and post-secondary education, challenges have been observed. These include difficulty with

information processing, memory, problem solving, and visual-spatial ability¹⁹⁰, all skills necessary for success in the classroom and at work. These issues may not emerge until Service members face the novel challenges and multi-tasking demands of the work or education environments. Difficulty may indicate the need for a comprehensive occupational therapy evaluation as well as specialized vocational and educational assessments.

The ability to return to many of life roles and occupations (including work or school) depends on access to transportation and for most people that means driving. Driving is one of the predictors of life satisfaction with individuals with brain injury⁵⁸ and it is an area of concern for many returning Service members. Service members returning from OEF/OIF have been driving in combat zone conditions which require aggressive, fast driving often on sidewalks and down small alleys; these skills do not translate to safe driving on the roads of Chicago, or rural Texas. Returning veterans have reported panic attacks and hypervigilance that cause them to be overly aggressive during driving¹⁸⁸. In fact, driving behaviors of Service members at home on leave, or home after multiple deployments, is dangerous when compared with those that did not serve in a combat zone (E. Stern, personal communication on December 11, 2007). In addition, MTBI-related symptoms can impact driving performance including visual disturbances, attention, decreased frustration tolerance, memory and executive functioning deficits, vertigo, seizures, and fatigue. Therefore, driving evaluations, pre-screens, simulator, as well as on-the-road evaluation may be indicated for returning Service members with MTBI.

Family functioning is often a primary concern after MTBI. Testa et al. (2006) reported issues of somatic complaints, memory and attention deficits, communication difficulties, and episodes of aggression being issues for family life one year after injury. High stimulations levels associated with busy households and the demands for multi-tasking make it difficult for some Service members to easily resume parenting responsibilities¹⁸⁸. For some Service members, problems with anger, irritability, depression, and/or anxiety creates a climate in the household that prevents family members from doing things together¹⁸⁸. Furthermore, post-deployment roles of family members change as those on the home front become responsible for household tasks that were typically delegated to the spouse. Family wellbeing, happiness of couples, and relationships can be impacted by MTBI¹⁹¹⁻¹⁹³, PTSD, and/or post-deployment readjustment to home life. As with problems in other life roles, once identified, occupational therapy intervention may be beneficial.

Performance of life roles are assessed through structured observation and self-report. While some researchers question the validity of self-report measures, formal and informal inquiries as to those issues that most concern the patient will most certainly optimize his or her engagement in the therapy process and adherence to therapy recommendations¹⁹⁴.

- The *Canadian Occupational Performance Measure* (COPM) is a semi-structured interview that provides the therapist with information about the tasks that the patient most wants and needs to do^{195,196}. Patients rate their skill level and their degree of satisfaction with their performance of tasks that are important to them. The COPM has construct and criterion validity¹⁹⁷ as well as good to strong inter-rater reliability¹⁹⁸. It was used to organize

treatment and for outcomes measurement in two studies involving outpatients with mild to moderate TBI who received occupational therapy^{199,200}. However, the COPM may not be useful in planning care for individuals with severe TBI who tend to be less aware of deficits¹⁹⁹. The COPM is a Practice Standard for overall assessment of role performance and satisfaction.

Here are other assessment options specific to the performance of various life roles.

- The *Occupational Self Assessment Version 2.2* (OSA) is somewhat more structured approach to identifying the patient's primary concerns and priorities²⁰¹. Rather than asking the patient to generate a list of his or her concerns within broad categories of self-care, productivity, and leisure, the OSA is comprised of 21 statements regarding functioning ("concentrating on tasks", "taking care of myself", "expressing myself to others", "having a satisfying routine"). First, the patient rates his or her competency specific to each statement and then rates how important the area is. Finally, the patient chooses up to 4 areas/statements that he or she would like to change, which inform the treatment plan. Kielhofner and colleagues²⁰² found that the OSA can be used as a valid, sensitive, and reliable measure of occupational competence and preferences.
- Asking a patient to provide an hour-by-hour detailing of his or her typical day is another way to identify problem areas that may be helped by therapy, especially for outpatients²⁰³. It also catalyzes patient-therapist conversations about how the individual spends his or her time and satisfaction levels with daily activities. Patients who describe no semblance of routine may benefit from habit re-instatement (re-establishing patterns of everyday activities so they become increasingly automatic, accurate and effortless).
- The *Epworth Sleepiness Scale* (ESS)²⁰⁴ is a self-administered, 8-item questionnaire to measure daytime sleepiness in adults. The total ESS score provides an estimate of a person's sleepiness in daily life but does not specify what factors contribute to sleepiness or diagnose specific conditions.
- The *Fatigue Severity Scale* (FSS)²⁰⁵ is designed to measure the impact of fatigue on a person and may be useful when Service members indicate that fatigue is a barrier to their performance of everyday tasks. The FSS has good psychometric properties and detects change over time²⁰⁶.
- The *Assessment of Communication and Interaction Skills*²⁰⁷ is a structured observation rating scale that explores the interaction of an individual during occupational engagement or in a group setting. It may be a helpful inclusion in occupational therapy evaluation when the patient or others indicate that communication and social functioning interfere with task performance.
- The *Activity Co-engagement Self-Assessment* (ACeS)²⁰⁸ is a self-report tool designed to help the occupational therapist better understand the patient's engagement in activities with loved ones including types of activities performed together, potential barriers to activity engagement; perceived self-characteristics as related to engaging in activities with others.

Respondents may specify the relationship at issue (with children, spouse/significant other, or friends/siblings).

- The *Dyadic Adjustment Scale*(DAS) ²⁰⁹ is a standardized 32-question self-report questionnaire exploring adjustments in partner relationships. It is administered via paper-pencil or interview to married or partnered couples to gain understanding of activity engagement and social roles.
- Return to duty/work performance may occur via structure observation of task performance.
- *Drivers screening and testing* - In preliminary studies of driver evaluation outcomes, one of the best predictors of safe driving is the report of general driving performance from family members (D. Warden personal communication, April, 2003). However, there are currently no standardized pre-driving screens or driving screening for individuals post MTBI at this time. The pre-driving screenings typically contain components of motor skills, reaction time, visual screening and cognition. Driver simulators are used to evaluate safe return to the road as well as reaction time, visual attention, and general driving skill even before patients demonstrate competence for on-the-road driving. Evaluation of skills needed for driving should be completed by occupational therapists because of their expertise in understanding impact of impairment on activity performance. On-the-road assessments are also completed by a therapist with specialized knowledge and training. The VA has a comprehensive initiative for returning our veterans to the road and detailed information can be found at the following URL:
http://www1.va.gov/vhapublications/ViewPublication.asp?pub_ID=435

Finally, in order to proceed to plan intervention, the findings from above-mentioned assessment should be further informed by other assessment data specific to the Service member's cognitive, physical, and emotional status.

Recommendations:

- 1) Occupational therapists use a combination of interview and observational methods to assess competence in self-maintenance roles.
- 2) Occupational therapists directly observe the Service member's performance in key ADL and IADL, if at all possible, noting level of independence/competence as well as qualitative aspects of performance (i.e., number of reminders or redirections required; response to visual or auditory distractions; ability to self-monitor; speed and efficiency of performance; ability to multi-task; response to feedback; initiation of compensatory techniques; evidence of planning and/or strategy use versus trial and error approach) as per the earlier discussion of a dynamic assessment.
- 3) If it is not possible to directly observe the Service member's performance on a given self-maintenance activity, the therapist solicits input from the Service member's family regarding their observations.

- 4) Occupational therapists ask Service members with MTBI who are outpatients to describe their “typical day” and also ask specific questions about sleep-wake hygiene (i.e., presence and nature of wind down routine), especially if the Service member is having problems with sleep and rest.

Discussion: Because there are few standardized methods for assessing competence/independence in self-maintenance tasks after MTBI, observation of functional performance, particularly the qualitative aspects of performance, become of central importance. Worksheets/tools with operational definitions of various qualitative aspects of performance would likely help therapists use a consistent rubric for objectifying and interpreting observations of functional performance. Tools of this nature could improve the sophistication of observational skills for clinicians who are relatively unfamiliar with the functional manifestations of cognitive impairments and inefficiencies that often accompany MTBI.

Intervention

Objective: Provide intervention that optimizes the Service member’s competence, efficiency, and self-confidence in performing life roles after MTBI.

Practitioner: Occupational therapist
ICF component(s): Activity and Participation
Strength of recommendation: Practice Option
Rationale: Existing guidelines provide little guidance as to the optimal timing or composition of intervention specific to life roles after MTBI
Applicable level(s) of care: III (Combat Stress Unit), IV, V, VI, VII, VIII

Background: There is little empirical literature that specifies intervention to enable the patient with MTBI to quickly and fully return to his or her self-maintenance roles. In general, patients with MTBI who are seen in the Emergency Department are told to return to their everyday activities (non-jarring, non-contact) as they feel able to do so ²¹⁰. One could correctly assume that this includes resuming activities associated with life roles.

As previously mentioned in the assessment discussion, unless the individual experiences other concomitant injuries or conditions, MTBI in and of itself typically does not impact a person’s ability to perform self-care activities. MTBI-symptoms (such as dizziness, headache, or vision changes) may distract the patient during these typically mundane activities, making the individual less efficient and more error-prone. Intervention, then, focuses on helping the individual understand the impact of potentially-transient MTBI sequelae on performance so that he or she does not erroneously misattribute performance inefficiencies to brain damage and thereby suffer further assaults to self-confidence and helping the patient figure out ways to perform everyday activities despite these issues.

Intervention associated with self-management roles

Patients may also benefit from help to reboot various aspects of her or her daily self-care habits and routines. Patients with MTBI are vulnerable to habit disruption because related symptoms may at least temporarily prevent them from carrying out previously routinized everyday activities in the manner most familiar to them. As a result, patients find themselves having to think through and organize each step of many self-maintenance tasks, increasing the energy demands and decreasing the performance efficiency on relatively mundane tasks ²¹¹.

Patients may realize improvements in their efficiency and accuracy as they re-establish a consistent sequence of task performance which, with enough repetition, will once again become automatic ²¹². Giles ²¹³ recommended performing a task analysis on a potentially disrupted habit sequence and then with the patient, deciding on an optimal chain of steps ²¹⁴. These steps are recorded on a checklist so that the individual does not have to rely on memory/recall in order to correctly adhere to the sequence each time the task is performed. Therapists reinforce the everyday use of the checklist past the point of competence to that of overlearning ²¹⁵ so that over time, performance of one step prompts the patient to initiate the next step on an automatic basis ²¹⁶. In the meantime, patients find themselves more successfully able to carry-out everyday tasks despite the presence of distracting MTBI symptoms. Checklists to re-establish automatic routines may prove beneficial for a variety of self-maintenance activities that are typically performed with a consistent sequence of steps including: morning self-care activities (grooming, bathing, dressing sequence); pre-sleep wind-down (to promote improved sleep-wake hygiene); leaving the house/office/barracks (to ensure that the individual has what he or she needs to take with, has turned off lights and locked the doors).

IADLs that comprise self-maintenance roles tend to involve more problem solving than routinization. Therefore, therapists help patients design and employ compensatory cognitive strategies that lessen the demands of IADLs (see the discussion of Cognitive Interventions).

For example, prompts to initiate various household or work tasks might be incorporated into a weekly planning procedure involving a memory aid. For unstructured multi-step home repair projects, the patient can be taught to use a project planning technique such as the IDEAL Problem Solver to break the task into a sequence of steps before beginning work. Intervention may also involve teaching patients new strategies to improve financial management including the following:

- Service members learn/re-learn basic math skills necessary for personal finance tasks;
- Service members establish routines for bill paying, bank account management and organizational systems to maintain personal paperwork;
- Service members and spouses learn to set-up cooperative systems for money management.

Intervention associated with work, social, leisure roles

As with resumption of personal roles, there is relatively little empirical literature that specifies intervention and outcomes associated with occupational therapy and community re-entry after MTBI. However, Trombly et al. (2002) reported that individualized outpatient OT contributed to goal achievement for persons with mild to moderate TBI; many of those goals pertained to resumption of work, social, leisure, and parenting roles. Occupational therapy to improve study and job skills for persons with mental health concerns²¹⁷ may be similarly beneficial to those with MTBI.

In general, occupational therapists use assessment data (related to specific community re-entry concerns and current cognitive, physical, and emotional status) to inform the intervention plan. The following examples typify occupational therapy intervention specific to community re-entry and lifelong care. Note that intervention may occur in one-on-one or group formats and take place in the clinical or community settings.

Occupational therapy for return to work or school:

- Service members learn to use compensatory cognitive strategies to improve task follow-through, task planning, recall of verbal or written information, how to optimize performance by minimizing distracting variables. See the Cognition section of the *Guidance*.
- Service members establish habits and routines for frequently-performed work tasks to improve efficiency (such as the series of tasks that take place at the beginning or end of each day.) See discussion of habit formation in the Performance of Self-Maintenance Roles section of the *Guidance*.
- Service members establish personal habits and routines that maximize their accuracy and efficiency in getting to work and/or school on time. See discussion of habit formation in the Performance of Self-Maintenance Roles section of the *Guidance*.
- Service members learn how to request and employ feedback from superiors and co-workers.

Occupational therapy for driving and transportation

- Occupational therapists may intervene to improve driving if there are no other concerns that would prevent legal driving in the Service member's home state. Some of these medical issues may include presence of a seizure disorder, significant visual impairment, vertigo, and anger management issues.
- Intervention involves remediation of deficits such as activities specifically designed to improve reaction time, visual scanning, attention, range of motion, as well as adaptive strategies. The latter include adaptations to the vehicle for easy reaching, only driving during the day, driving with another in the car, or restricted highway driving.

- Driving simulation may be used to desensitize Service members to anxiety-provoking elements of driving situations as well as to promote self-awareness of driving safety issues.

Occupational therapy for leisure

- Service members learn new leisure outlets to replace those they are no longer able to perform.
- Service members learn cognitive, communication, coping, and pacing strategies that enable them to engage in leisure activities with family members.
- Service members learn planning strategies that enables them to consistently schedule time for leisure by themselves or with others and to budget resources for these stress-relieving activities.

Occupational therapy for family and social relationships

- Service members learn pacing/fatigue management, communication, and/or planning strategies to enable them to routinely engage in activities with family or friends.
- Service members acquire new household or parenting skills to optimize their engagement in family roles.
- Service members and spouses learn and employ information management systems (calendars, bulletin boards, etc.) to improve communication and planning.

Occupational therapy for health and wellness

- Service members learn to identify and modify situational factors that are linked to alcohol use or abuse and smoking.
- Service members learn to compensatory cognitive strategies to routinely perform daily exercise to prevent weight gain and other consequences of a sedentary lifestyle.

Recommendations:

- 1) Service members' input regarding tasks of personal importance and self-report of performance status should be important drivers of the intervention plan, especially when the Service member is an outpatient who has had exposure to real-life challenges after MTBI.
- 2) Occupational therapists should facilitate the early resumption of ADLs by helping the Service member to identify the conditions under which he or she is most successfully able to perform the tasks and/or by setting up a checklist to promote the reinstatement of related habit sequences.

- 3) To that end, occupational therapists help Service members with MTBI learn to use individualized compensatory cognitive strategies that will enable them to successfully resume self-maintenance roles.
- 4) The therapist may also consider working with the employer to suggest modifications for environment, length of day, and changes to duties. Education to both the employee and the employer reduce attrition levels ²¹⁸. The occupational therapist should work closely with the vocational counselors to insure adopted strategies and modifications facilitate successful employment.
- 5) Interventions aimed at helping the Service member or veteran return to school should emphasize cognitive skills training, pacing, insight, stress reduction strategies, and load reduction. Acquisition of cognitive compensatory strategies (discussed earlier in the *Guidance*) may also be important for return to school success. Educators and University administrators must be educated on the significance of MTBI on the performance of their students.
- 6) If Service members or veterans describe difficulties resuming roles within their families, OT intervention should include activity-based family group work like cooking or use of games. Videotaping and discussion post-activity can provide insight into elements of the task that were problematic. These types of activities can be done with spouses and veteran, with child and veteran or with the family. Activities should take place in multiple contexts to offer opportunity for generalization of skills. It is further recommended that group work be done with groups of families. Feedback from peers, especially in the military culture, may carry greater weight than from a therapist.
- 7) Activities such as role playing, skills training, and education regarding communication may also be beneficial in the area of family roles and associated occupations.
- 8) Intervention regarding driving should be client-specific involving remediation of driving-related subskills and/or provision of adaptive strategies. Recommendations should be made in conjunction with a driving rehabilitation specialist, if such a resource is available within the setting.
- 9) If the Service member is concerned about leisure or finances, incorporate skill-building specific to these areas into the OT intervention plan.
- 10) Health and wellness should be addressed through education seminars, individual coaching, leisure coaching, and nutritional supports.
- 11) Use of a buddy system and incorporation of physical fitness program will assist with many of the issues associated with health and wellness.

Discussion: Service members with MTBI run the risk of trivializing the importance of resuming self-maintenance activities. Therefore, it is important that occupational therapists frame the resumption of self-maintenance activities (ADL and IADL) as work hardening activities that are important prerequisites for return to duty, work, or education.

The concept of habit formation and reinstatement may have expanded importance for soldiers receiving rehabilitation as outpatients in the Warrior Transition Units. With larger blocks of unstructured time, Service members with MTBI would likely benefit from occupational therapy intervention aimed at structuring daily routines around balanced and therapeutic use of self-care, work, and leisure activities in ways that are both satisfying and advance recovery. Research about the effectiveness of such interventions is needed.

Participation in Exercise

Assessment

Objective: To identify the frequency and duration of the Service member's participation in aerobic and strengthening exercise; to determine the Service member's ability to monitor his/her response to exercise using heart rate or Rate of Perceived Exertion Scale, or for the Service member to determine the intensity of exercise using a metabolic equivalent (MET) table.

Practitioner: Physical therapist (or Occupational therapist if PT not available)

ICF component: Activity and Participation

Strength of recommendation: Practice Option

Rationale: No specific information has been located that specifies the type of self-monitoring during exercise that is the easiest to use for persons with MTBI. The American Heart Association website includes information for determining target heart rate (www.americanheart.org).

Applicable level(s) of care: VII, VIII (also V, VI at therapist's discretion)

Background: The American College of Sports Medicine and the American Heart Association have published updated guidelines on the frequency and duration of exercise for all healthy adults²¹⁹. There are a number of ways to determine the intensity of exercise. These include such measures as heart rate, rate of perceived exertion, and metabolic equivalents. Target heart rate zones may be calculated in many ways. One means to monitor exercise intensity is to use the guideline of 50-85% of age-predicted maximum heart rate as the target zone for exercise (see the American Heart Association's website information on target heart rates). Other means to measure exercise intensity may be more accurate for various individuals and the reader is referred to sports medicine literature for further information on recommendations for this.

The *Rate of Perceived Exertion Scale* (RPE) uses a subjective numeric rating (range 6-19) of exercise intensity based on how a subject feels in relation to level of fatigue. For example, RPE of 13 or 14 (exercise that feels "somewhat hard") coincides with an exercise heart rate of about 70% maximum. The Haskell et al. guideline²¹⁹ provides a table using metabolic equivalent (MET) level to classify common physical activities as light, moderate or vigorous in intensity.

Graded exercise testing of persons after moderate to severe traumatic brain injury has been shown to be reliable for both submaximal and peak exercise testing²²⁰. Information on this level of exercise testing was not found for persons with MTBI. At this point formal exercise testing does not appear to be necessary for Service members who are otherwise able to monitor their exercise intensity and response.

Recommendations:

- 1) Therapists use an oral or written question format that asks the Service member's current participation in aerobic and strengthening exercises, including specifically the frequency and duration of their participation. This can be a simple question and answer or take the form of a survey or questionnaire using a Likert-type scale.
- 2) Therapists determine if Service members can accurately take their own resting heart rate and also determine their heart rate following an exercise bout.

or

- 3) Therapists determine if Service members can accurately use the Rate of Perceived Exertion Scale to determine their perception of exercise intensity.

Discussion: Physical therapists within the DOD and VA systems should choose the type of exercise monitoring system that fits their practice setting and knowledge base as well as the easiest system for the particular Service member to learn and provide instruction in that monitoring system.

Intervention

Objective: To provide the Service member with recommendations and support for lifetime participation in fitness activities to enhance their well-being and to potentially improve cognitive status.

Practitioner: Physical therapist (or Occupational therapist if PT not available)

ICF components: Activity and Participation

Strength of recommendation: Practice Standard

Rationale: All healthy adults aged 18 to 65 yr need moderate-intensity aerobic physical activity for a minimum of 30 minutes on 5 days each week and activities to increase muscular strength and endurance for a minimum of two days each week. (Haskell et al., 2007;ACSM and AHA Guidelines). Exercise may improve mood and aspects of health status in individuals with TBI²².

Applicable level(s) of care: VII, VIII (also V, VI at therapist's

Background: As discussed above, the American College of Sports Medicine and the American Heart Association have published updated guidelines on the frequency and duration of exercise for all healthy adults²¹⁹. These guidelines are specifically that: "All healthy adults ages 18 to 65 years need moderate-intensity aerobic physical activity for at least 30 minutes on 5 days each week or vigorous-intensity aerobic physical activity for at least 20 minutes on 3 days each week" (p. 1423). Additionally, recommendations are made for healthy adults to participate in activities that increase muscular strength and endurance in order to promote and maintain good health and physical independence. A thorough review of the guidelines and the various combinations of exercises that meet these recommendations are found in the special report by Haskell et al. (2007).

Physical activity has been shown to improve quality of life and other factors in older adults²²¹ and persons with traumatic brain injury²². In a retrospective review, Gordon et al. (1998) examined the benefits of exercise in a community-based sample of persons with traumatic brain injury compared to persons without disabilities. The findings of this review indicated that the persons with TBI who were exercisers reported less depression, fewer symptoms and a better self-reported health status than the non-exercising individuals with TBI. Gordon's group has developed a "TBI Consumer Report" that is available on their website (www.mssm.edu/tbinet/resources/publications/tbi_consumer_reports.shtml#issue2) which can be used to provide education about exercise following TBI. Persons with traumatic brain injury have been shown to improve their cardio-respiratory fitness after a 12-week circuit-training program although they did not show any significant reductions in percent body fat²²².

Physical activity that resulted in increased cardiovascular fitness may improve cognitive status, including attentional control in older adults²²³ as well as learning and memory²²⁴. In animal studies, voluntary exercise after traumatic brain injury resulted in an upregulation of brain-derived neurotrophic factor (BDNF) when it was implemented at an appropriate time⁶⁷. This BDNF can improve cortical plasticity, neuronal survival and growth, all factors that are important in cognitive enhancement. Studies are beginning that are investigating the effect of aerobic exercise on cognition and brain activity following traumatic brain injury in humans (J. Lojovich, personal communication, 12/18/07 dissertation proposal University of Minnesota). Given the enhancement in cognitive performance in the animal model and older adults, it would be expected that participation in a consistent aerobic exercise program could enhance the cognitive status of Service members with MTBI cognitive symptoms that haven't resolved.

Certainly, a screening of health risk factors prior to beginning or resuming an exercise or fitness routine is important in the general public and in Service members with MTBI²²⁵. As appropriate to other populations, Service members with risk factors should be referred for medical clearance before beginning an exercise program. It is noted that the ACSM and the AHA have made a companion recommendation to the one for adults, specifically applied to adults age 65 and older, and adults age 50-64 with chronic conditions or physical functional limitations that affect movement ability or physical fitness²²⁶. The American Physical Therapy Association (APTA) has developed a web-based resource called the APTA's Physical Fitness for Special Populations (PFSP) web resource that provides information on

participation in fitness activities for persons with disabilities. As yet this resource does not provide specific information for persons with traumatic brain injury although it does have recommendations for persons post stroke and other disabilities.

Recommendations:

- 1) Physical therapists provide instruction to the Service member on the frequency and duration of aerobic and strengthening exercise based on the updated physical activity guidelines recently released by the American College of Sports Medicine (ACSM) and the American Heart Association while recognizing any person-specific limitations or residual MTBI-related symptoms.
- 2) Therapists provide instruction on the rationale for lifetime exercise to the Service member including information on wellness, alleviation of co-morbidities, etc.
- 3) Therapists provide suggestions and/or specific means for Service member to monitor their own exercise frequency, duration and exercise response including a log or calendar.
- 4) Therapists provide training in self-monitoring techniques such as heart rate and/or exertion. They consider teaching Service members to use the Rate of Perceived Exertion Scale to allow the Service members to determine their exercise intensity and tolerance or provide information on MET levels of specific types of exercise.

Discussion: Exercise is important for all adults to maintain health status and well-being. It may be additionally important for Service members with deficits following MTBI to reduce co-morbidities and potentially enhance cognitive status. Therapists should screen for factors that may affect exercise prescription for the Service member. Tolerance to activity and symptoms such as increased dizziness should be monitored and appropriate adjustments made to an exercise program per individual Service member's needs and presentation. Structured exercise programs may be important elements to build into the regimen of Warrior Transition Units.

Outcome Assessment-Participation

Objective: To identify long term outcomes and participation or restriction of participation issues in Service members and veterans who have sustained a MTBI during active service in the OEF/OIF campaigns.

Practitioner: Physical Therapist or Occupational Therapist ICF component: Participation Strength of recommendation: Practice Option Rationale: Long-term outcomes measuring participation provide information on individual patient and program evaluation outcomes. No recommendation for a specific evaluation of participation is made at this time. Applicable level(s) of care: Level VIII

Background: As paraphrased by Resnik and Allen ¹⁸⁸, participation (from an ICF perspective) has to do with the extent to which an individual takes part in the life areas or situations of his or her own choosing and do so in a manner that is expected of a person without restrictions. Both occupational and physical therapy view participation as an overarching outcome of intervention.

A number of outcome measures designed to assess outcome or participation in persons following brain injury are available. These include both generic and disease-specific type outcomes. The Center for Outcome Measurement in Brain Injury (<http://www.tbims.org/combi>, accessed December 30, 2007) describes measurement tools for all levels of the International Classification of Functioning (ICF) Model for persons with moderate to severe traumatic brain injury. For example, *The Mayo-Portland Adaptability Inventory* (MPAI) was primarily designed to "...assist in the clinical evaluation of people during the postacute (post-hospital) period following acquired brain injury (ABI), and to assist in the evaluation of rehabilitation programs designed to serve these people" (COMBI website). The *Participation Objective, Participation Subjective* (POPS) was developed in 2004 at Mount Sinai School of Medicine, New York NY. This instrument consists of a list of 26 elements of participation (e.g., going to the movies, housework, opportunities to meet new people). Another instrument used to assess participation is the *Community Integration Questionnaire* which looks at long- term community participation outcomes in persons with brain injury ²²⁷. However, use of these instruments to measure participation after MTBI has not been established.

As an example of a generic outcome measure, the *SF-36 Health Survey* was developed for the Medical Outcomes Study and its psychometric properties extensively evaluated. This short-form was constructed to survey health status and was designed for use in clinical practice, research, health policy evaluations and general population surveys ²²⁸. A version of the SF-36 is available to assess health outcomes for veterans ^{229,230}. Given the need to consider their health status over the prior 4 weeks, memory impairment in a Service member with concussion/mTBI may hinder their ability to answer the questions appropriately. There is a 1-week acute version of the SF-36 with requires recall of health status over the preceding 1 week only.

Recommendations:

- 1) A participation level outcome measure should be given to Service members and veterans to monitor their individual situations and to allow evaluation of programs designed to serve these individuals.
- 2) Further work needs to be done to identify appropriate participation level outcome measures for this DOD-VA population with mild traumatic brain injury.

Discussion: Extensive information on outcome measures in persons with brain injury can be obtained from *The Center for Outcome Measurement in Brain Injury*. <http://www.tbims.org/combi> (accessed December 30, 2007). A group should be tasked to identify the optimal measurement strategy for program evaluation and long term management of Service members with MTBI.

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Appendix A.1: Summit Expert Panel and Guidance Advisers and Reviewers

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