

Cognitive Rehabilitation for Service Members and Veterans Following Mild to Moderate Traumatic Brain Injury

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Introduction

The Traumatic Brain Injury Center of Excellence (TBICoE) manages the Traumatic Brain Injury (TBI) Pathway of Care within the Military Health System (MHS), and promotes state-of-the-science care from point-of-injury to reintegration for service members, veterans, and their families to prevent and mitigate consequences of mild to severe TBI.

TBICoE clinical recommendations (CRs) integrate evidence from research with a consensus of expert opinion to address clinical practice areas of importance to the MHS and Veterans Health Administration (VHA).

Overview

Cognitive rehabilitation practices in MHS and VHA hospitals and clinics vary considerably across providers and settings. The purpose of these TBICoE clinical recommendations on cognitive rehabilitation is to increase consistency in cognitive rehabilitation practices for service members and veterans following mild to moderate TBI in hospitals and clinics throughout the MHS and VHA.

Cognitive rehabilitation is defined as interventions that “achieve functional changes by (1) reinforcing, strengthening, or reestablishing previously learned patterns of behavior, or (2) establishing new patterns of cognitive activity or compensatory mechanisms for impaired neurological systems” (Harley et al., 1992).

These recommendations outline specific considerations for treating service members and veterans. Considerations include both strategies for intervention and approaches to the delivery of rehabilitation, including dosing and modality of treatment. Dosing and modality, in particular, are highly relevant to daily practice but lack prior guidance. Researchers, health care providers, and a diverse group of cognitive rehabilitation providers in the MHS and VHA informed the topics addressed to ensure close alignment with the needs of practicing clinicians.

The primary audiences for these CRs are speech-language pathologists, occupational therapists, neuropsychologists, and other providers of cognitive rehabilitation at military and VA hospitals and clinics. Secondary audiences include cognitive rehabilitation providers treating service members and veterans in civilian health care settings and other medical and rehabilitation providers in the MHS and VHA including physical medicine and rehabilitation physicians, neurologists, physical therapists, and behavioral health care specialists.

Background

Compared to their civilian counterparts, service members are at increased risk for sustaining a TBI based on their demographics, engagement in operational and training activities, and deployment to combat zones. More than 379,000 service members sustained a TBI between 2000 and 2017. Almost 85 percent of these TBIs were classified as mild TBI (mTBI), also known as concussion, and almost 14 percent as moderate TBI (TBICoE, 2017). A subgroup of these patients presents with persistent complaints of cognitive dysfunction interfering with work, activities of daily living, relationships, and quality of life following the acute recovery period (Carroll et al., 2004; Ruff, 2005; Sterr, Herron, Hayward, & Montaldi, 2006; Vanderploeg, Curtiss, Luis, & Salazar, 2007).

Post-concussive cognitive symptoms in service members and veterans frequently co-occur with pain and comorbid psychological health disorders, especially posttraumatic stress disorder (PTSD) and depression (Belanger, Kretzmer, Yoash-Gantz, Pickett, & Tupler, 2009; Seal et al., 2016). Veterans with mTBI and comorbid PTSD and/or pain experience more pronounced cognitive impairment and perform more poorly on measures of attention, speed of information processing and executive functioning than other veterans who served during Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) (Bogdanova & Verfaellie, 2012). This combination of symptoms (PTSD, TBI, pain) is known as the “polytrauma clinical triad” and increases risk of poorer outcomes both within and beyond the cognitive realm (Finley, Bollinger, Noël, Amuan, Copeland, Pugh, Dassori, Palmer, Bryan, & Pugh, 2015).

Table 1: Possible Indicators of Cognitive Dysfunction

Cognitive Function	Common Difficulties
Attention and Information Processing	<ul style="list-style-type: none"> ▪ Following conversations and maintaining one’s train of thought ▪ Recalling information that is read and the contents of conversations
Memory	<ul style="list-style-type: none"> ▪ Remembering to take medications and show up for appointments ▪ Remembering instructions, especially multi-component
Language	<ul style="list-style-type: none"> ▪ Easily accessing words when verbally expressing oneself ▪ Comprehending complex written and spoken information
Executive	<ul style="list-style-type: none"> ▪ Initiating, prioritizing, and completing tasks ▪ Managing time ▪ Organizing oneself to initiate and engage in productive use of time

Although distressed about their cognitive functioning on important tasks and roles, patients with mild to moderate TBI may perform broadly within normal limits on formalized neuropsychological assessments and may not demonstrate significant impairments in any specific neuropsychological domain. The cognitive dysfunction may be relatively subtle and only occur in effortful situations. Cognitive symptoms attributed to mTBI, such as difficulty with memory and attention, overlap with symptoms of PTSD and depression and can further complicate the evaluation of cognitive dysfunction (Maguen, Lau, Madden, & Seal, 2012). Cognitive symptomatology following mild to moderate TBI is often multi-factorial in etiology and affected by premorbid and co-occurring issues such as sleep disturbance, vision changes, balance disorders, depression, anxiety, medication effects, and substance use disorders, among others.

Rationale

Providers throughout the MHS and VHA treat service members and veterans with persisting cognitive dysfunction following mild to moderate TBI. Cognitive dysfunction is defined here as cognitive difficulties in daily life activities in the post-acute and chronic phases of recovery. These providers must have access to evidence-based clinical practices grounded in the latest science.

Several older resources describe best practices in TBI care across the spectrum of severity (Cicerone et al., 2011; Togher et al., 2014) but have a variety of limitations. The most recent guidance from the American Congress of Rehabilitation Medicine (ACRM) (Cicerone et al., 2011) reviews the literature from 2003 to 2008. Now a decade old, this guidance does not separately analyze cardiovascular accident and TBI or TBI by severity. Literature from the international group of researchers known as INCOG (Togher et al., 2014) provides guidance on evidence-based cognitive rehabilitation but focuses on moderate and severe TBI. This guidance also does not reflect the growing body of research on mTBI or the unique needs of military and veteran populations. Studies based on the civilian population may not fully inform the needs of military health care providers (Nakase-Richardson et al., 2017).

More recent literature on cognitive rehabilitation for individuals with mild to moderate TBI specifically incorporates service member or veteran populations, and evidence is rapidly accumulating. The clinical recommendations developed by TBICoE draw upon this recent literature and specifically target the needs of providers working with service members and veterans with mild to moderate TBI and cognitive dysfunction.

Scope and Structure

These clinical recommendations focus solely on intervention and are intended for providers of cognitive rehabilitation treating patients with mild to moderate TBI in the post-acute (7-12 weeks post injury) and chronic (>12 weeks post injury) stages of recovery.

These CRs address the spectrum of injury severity classified as mild and moderate according to the DoD and VA criterion. In this classification system, patients who meet the clinical criteria for mTBI but whose CT or MRI results are abnormal are classified as moderate TBI, a subgroup described in other classification systems as complicated mTBI.

Table 2: DoD TBI Severity Classification (VA/DoD Clinical Practice Guideline on Concussion/mild TBI, 2016)

Criteria	Mild	Moderate
Structural imaging	Normal	Normal or abnormal
Loss of consciousness (LOC)	0-30 minutes	>30 minutes and <24 hours
Alteration of consciousness/mental state (AOC)*	up to 24 hours	>24 hours, severity based on other criteria
Posttraumatic amnesia (PTA)	0-1 day	>1 and <7 days
Glasgow Coma Scale/Score (GCS) (best available score in first 24 hours)	13-15	9-12

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

Each set of recommendations is structured in the following manner:

- Topic area.
- Bulleted recommendations.
- Background and rationale.
- Evidence review references.

Additional clinical resources are available on the TBICoE website: Health.mil/TBICoE.

Appendices contain additional useful tools:

- **Appendix A (Glossary)** provides a glossary of terms. Reference it for terms commonly used throughout these recommendations.
- **Appendices B1, B2, and B3 (Resource Table, Resource Matrix, and Resource Matrix [SHORT])** consist of descriptions of and links to clinical resources for cognitive rehabilitation affiliated with the Department of Defense (DoD) and Department of Veterans Affairs (VA), as well as resource matrices highlighting which of the resources are relevant to specific sets of recommendations.
- **Appendix C (Methods)** summarizes the methodology used for the literature search that yielded the evidence review references.
- **Appendix D (Evidence Tables)** provides an evidence table for each of the 17 peer-reviewed studies that were part of the foundational evidence review.
- **Appendix E (Outcome Measures)** presents measures and tests that proved sensitive to change with intervention in the 17 peer-reviewed studies comprising the evidence review.
- **Appendix F (Clinical Questions)** outlines the key clinical questions that formed the basis for the clinical recommendations.
- **Appendix G (Expert Work Groups)** lists the subject matter experts supporting the development of the clinical recommendations.

A Tiered Approach to Cognitive Rehabilitation

Cognitive rehabilitation for patients who sustain mild to moderate TBI is appropriate for those experiencing persistent cognitive dysfunction beyond the acute stage. A tiered approach defines the focus of treatment based on time since injury (e.g., post-acute or chronic) as well as the presence of significant risk factors for chronicity.

Risk factors for persistent cognitive dysfunction include (Belanger, Spiegel & Vanderploeg, 2010; Ontario Neurotrauma Foundation, 2013; Ponsford et al., 2000):

- History of previous traumatic brain injury.
- History of previous neurological or psychiatric problems.
- Confounding effects of other health-related issues (e.g., pain medications, disabling effects of associated injuries, emotional distress).
- Presence of life stressors at the time of the injury.
- Higher levels of symptom reporting associated with mood symptoms and heightened self-awareness of failures.

Cognitive rehabilitation during the post-acute phase should be brief and focused on general management strategies for optimization of functional recovery. More intensive cognitive rehabilitation may be appropriate if cognitive dysfunction continues to impact daily functioning beyond the post-acute phase and can occur simultaneously with treatments for co-occurring conditions. In the chronic phase, the patient, provider and interdisciplinary team develop an individualized treatment plan and establish functional rehabilitation goals. Many patients at this phase benefit from a multidisciplinary team and an integrated cognitive rehabilitation treatment program, particularly if comorbid psychological health conditions are present.

Table 3: Treatment Phase, Timeframe, and Focus

Phase	Focus
Post-acute (7-12 weeks post injury)	<ul style="list-style-type: none"> ▪ Management of symptoms affecting cognitive function such as headaches, vestibular disturbance, sleep difficulties, mood disturbance, fatigue and pain ▪ Psychoeducation about cognitive symptoms of TBI ▪ Brief and focused assessment and guidance about strategies for management of cognitive symptoms
Chronic (>12 weeks post injury) and post-acute patients at high risk for chronic symptom persistence	<ul style="list-style-type: none"> ▪ Evaluation for cognitive rehabilitation ▪ Psychoeducation about cognitive rehabilitation ▪ Multidisciplinary team involvement ▪ Selection of functional rehabilitation targets and goals ▪ Integrated holistic treatment including management of comorbid conditions

Strong evidence supports the benefits of psychoeducation for reducing the severity and duration of post-concussive symptoms in the acute stage; however, few studies examine the impact of psychoeducation in the post-acute and chronic phases of concussion recovery (Mittenberg, Tremont, Zielinski, Fichera, & Raylis, 1996; Ponsford et al., 2002; Wade, King, Wenden, Crawford, & Caldwell, 1998). Comprehensive cognitive rehabilitation treatment programs with chronic patients typically include psychoeducation as one component of the intervention (Cooper et al., 2016; Huckans et al., 2010; Twamley, Jak, Delis, Bondi, & Lohr, 2014). In the post-acute phase, psychoeducation should promote positive expectations of recovery. If symptoms persist into the chronic phase, the focus of psychoeducation should shift toward self-management of symptoms with fading clinician support.

Cognitive Rehabilitation Treatment Goals

A thorough assessment including the context in which the cognitive difficulties occur is a prerequisite for effective cognitive rehabilitation. Although assessment is outside of the scope of this clinical recommendation, the VA/DoD Clinical Practice Guideline (CPG) for the Management of Concussion/mTBI offers applicable guidance regarding a comprehensive evaluation of cognitive symptoms and motivational interviewing (<https://www.healthquality.va.gov/guidelines/Rehab/mtbi/mTBICPGFullCPG50821816.pdf>). See also Clinical Resource Links web tool and, in particular, the Mild Traumatic Brain Injury Rehabilitation Toolkit (<https://medcoe.army.mil/borden-tb-tbi>) for additional guidance. Links and additional information on these and other resources are available in Appendix B1.

The patient's cognitive rehabilitation treatment goals are based on functional difficulties defined by self-reported complaints and concerns. Targets for cognitive rehabilitation are functional and individualized to the patient's life circumstances. Motivational interviewing can be used to gather concerns and identify targets. Goal attainment scaling (GAS) may facilitate setting individualized specific, measurable, attainable, relevant and timely goals. For additional guidance, see: <https://www.asha.org/siteassets/practice-portal/traumatic-brain-injury-adult/clinicians-guide-to-cognitive-rehabilitation-in-mild-traumatic-brain-injury.pdf>.

Notes

CLINICAL RECOMMENDATIONS

1. Cognitive Rehabilitation Modifications for Service Members and Veterans

1.1: Return to Productivity: Duty, Employment, Volunteering and School

Recommendations

- Emphasize the goal of return to full duty for service members or to employment or volunteer work for veterans by incorporating functional skills training, as well as tasks and aspects of the patient's actual work or duty responsibilities into treatment.
- Use activities such as notetaking and test taking that underlie successful return to school to address attentional, executive and prospective memory skills.

Background and Rationale

Cognitive rehabilitation incorporates military or civilian work, education, and personally relevant life activities such as volunteer work into treatment. It teaches strategies to optimize cognitive function in contexts relevant to the service member or veteran. Rehabilitation toward return to employment and school emphasizes not only specific cognitive skills necessary for success, but also accommodation needs and plans.

The cognitive rehabilitation plan may incorporate aspects of vocational rehabilitation. Treatment is structured to teach problem solving skills utilizing vocationally relevant and meaningful activities for successful job performance. For patients transitioning to supported employment, a structured cognitive rehabilitation program, such as the Cognitive Symptom Management and Rehabilitation Therapy (CogSMART) (Twamley, Jak, Delis, Bondi, & Lohr, 2014; Twamley et al., 2015), may be a valuable addition to the vocational rehabilitation plan.

A goal of return-to-school activities is to build confidence by simulating situations the patient may experience in a school environment. Activities often incorporate the use of assistive technology as a cognitive aid. Some patients may be connected with disability support services at their individual academic institution for an accommodations plan.

Evidence Review References

Two randomized controlled trials (RCTs) used cognitive rehabilitation interventions to improve cognitive functioning in vocational contexts with positive results.

1. Man et al. (2013): This RCT with civilians recruited from a regional hospital in Hong Kong with a history of mild to moderate TBI used a 12-session virtual reality problem solving program for training clerical work. The cognitive rehabilitation intervention improved executive functioning with significant differences at follow-up in vocational outcomes for the cognitive rehabilitation group compared to the control group.
2. Twamley et al. (2014, 2015): This RCT provided veterans with a history of mild to moderate TBI and PTSD (74 percent of patients) a 12-hour cognitive rehabilitation intervention in the context of supported employment. Patients who received cognitive rehabilitation showed decreased post-concussive symptoms and improved prospective memory after treatment, and gains were maintained at one year follow-up.

1.2 Considerations for Military Service Members

Recommendations

- Identify and incorporate service member's military specific occupation into treatment goals and interventions.
- Address factors that may impact the service member's ability or motivation to comply with treatment plans or put the service member at risk for a repeat TBI.
- Determine whether the TBI was sustained in a traumatic context, such as in a blast during combat operations or in a training mishap, to identify potential post-injury comorbidities such as posttraumatic stress disorder.

Recommendations

- Consider multiple concussions among the risk factors for persistence of cognitive dysfunction and consider a trial of cognitive rehabilitation.
- If family is not involved or available and the service member is willing, consider involving a friend from the patient's unit in treatment to serve in the supportive role usually taken by family members.
- With the service member's consent, collaborate with the service member's leadership to facilitate command support of cognitive rehabilitation treatment goals, translation of compensatory strategies to duty performance, alignment with DoD guidelines on return to duty and medical board processes, and continuity of cognitive rehabilitation treatment if needed at separation from service.

Background and Rationale

Service members can sustain repeated concussions from exposure to explosives, high velocity weapons, parachuting, and rugged work or training environments. This exposure occurs during the high-risk operational and training tasks associated with certain military occupational specialties. Some service members may not readily report cognitive difficulties due to a perceived stigma or fear of impacting promotional opportunities and operational readiness or a compensatory mechanism to maintain self-esteem or self-actualization associated with being a member of the U.S. military. Providers may want to explore these factors to gain greater insight into the impact of the cognitive difficulty on the service member and to optimize cognitive rehabilitation. Other factors unique to the military population affecting cognitive rehabilitation relate to the frequent presence of severe comorbid conditions and the possibility that they may not have ready access to cognitive rehabilitation due to remote duty location, deployment, and occupational specialty responsibilities.

Command support is crucial to ensure the service member has opportunities to implement compensatory strategies. Active-duty service members may receive support from their chain of command to participate in therapy, assistance with entering service-specific "wounded, ill and injured units" or support in organizing their treatment assignments to facilitate attendance at medical appointments. This provider-command collaboration also includes exploration of possible limited duty status and reinforces the need for progressive return to duty and other physical fitness restrictions or accommodations, such as rest breaks, physical fitness waivers or modified duty hours.

Service members transitioning through the medical evaluation board process, end of active service, or retirement, may lose a sense of leadership support and must exercise more independent decision making. Providers may need to assess and monitor the service member's status during this transition to support continued use of compensatory strategies and continuity of care, if indicated.

Evidence Review References

Of the 17 studies comprising the evidence, 11 studies specifically included service member and/or veteran populations in the sample (Cooper et al., 2016; Huckans et al., 2010; Nelson, L. A., MacDonald, M., Stall, C., & Pazdan, R., 2013; Pagulayan et al., 2017; Riegler, L. J., Neils-Strunjas, J., Boyce, S., Wade, S. L., & Scheifele, P. M., 2013; Storzbach et al., 2017; Sullivan, K. W., Quinn, J. E., Pramuka, M., Sharkey, A., & French, L. M., 2012; Twamley, Jak, Delis, Bondi, & Lohr, 2014; Twamley et al., 2015; Vanderploeg et al., 2018; Vas et al., 2016; Waid-Ebbs et al., 2014). Many of these interventions are tailored specifically for OEF/OIF veterans and support the need for the provider to be aware of the history and context of the injury, the range of risk factors and comorbidities contributing to cognitive difficulties, and the unique challenges of the service member engaged in cognitive rehabilitation.

2. Interventions and Strategies to Address Cognitive Dysfunction

2.1: Attentional Difficulties

Recommendations

- Provide psychoeducation about attentional difficulties and positive expectations for cognitive recovery in the post-acute phase and as a brief initial intervention in the chronic phase of recovery.
- Address attentional challenges as a component of a comprehensive treatment plan for executive dysfunction.
- Ensure that the use of restorative interventions that directly train attention are therapist directed and used in conjunction with or as a supplement to compensatory strategy training; may consider as optional an attentional training component such as attention process training (APT) or interactive metronome (IM) training.
- Consider adding an attentional training component if using a manualized cognitive rehabilitation intervention that does not specifically address attentional function (e.g., Strategic Memory and Reasoning Training, and Goal Management Training).

Background and Rationale

Attentional difficulties underlie many of the self-reported cognitive difficulties after mild to moderate TBI with patients frequently complaining of distractibility and difficulty attending to more than one thing at a time (Cicerone, 1996). In fact, Vanderploeg and colleagues (2005) found that mTBI in a veteran population resulted in negative long-term psychological outcomes on subtle aspects of complex attention. Psychoeducation on the relationship between attention and other cognitive domains, including executive functions and memory, must be provided whenever the patient engages in cognitive rehabilitation. Dual task demands tax cognitive efficiency and may reflect dysfunction of the central executive component of working attention. Attention is inherently interrelated with the executive function domain and acts as a mediator of executive function (Diamond, 2013).

The CogSMART curriculum (Twamley, Jak, Delis, Bondi, & Lohr, 2014) includes various self-management strategies addressing attentional difficulties: self-talk during tasks to maintain focus, reducing distractions; eye contact, paraphrasing, and asking questions; appropriate use of pacing and routines; and lifestyle strategies. In the psychoeducational component of the SCORE study (Cooper et al, 2016), management strategies suggested for poor concentration include taking breaks to relax, shortening the work day, and limiting the number of distractions.

Due to the interrelation of attention and executive functions, strategies targeting executive control may improve attentional control. Compensatory strategy training enables patients to more effectively allocate their attentional resources (Cicerone, 2002). Treatment of attentional difficulties is often included in multi-component evidence-based therapies for executive dysfunction such as those used in the SCORE trial (Cooper et. al., 2016; integrated and traditional treatment arms) and Short Term Executive Plus Intervention (STEP) (Cantor et al., 2014).

Computerized technology has been used to directly train attention. For example, interactive metronome (IM) training is based on a computerized behavioral feedback operant conditioning paradigm to improve attentional function. The patient engages in motor responses to the beat of a computer under cognitively demanding circumstances while a computer provides performance feedback (Nelson et al., 2013).

Attention process training (APT) has also been used to directly train attention. Attention process training is a process oriented therapy that uses repeated stimulation of attentional systems to strengthen the underlying neural processes (Sohlberg, McLaughlin, Pavese, Heidrich & Posner, 2000).

Evidence Review References

Five of the studies in the reviewed literature, all of which have been published since 2013, are pertinent to the rehabilitation of attentional complaints following mild to moderate TBI. In several, attentional training was one component of a comprehensive approach to cognitive rehabilitation. One of these studies (Van Vleet, Chen, Vernon, Novakovic-Agopian, & D'Esposito, 2015) specifically focused on the rehabilitation of attentional function.

1. Cantor et al. (2014): The STEP protocol includes therapist-delivered APT-II along with problem-solving and emotional regulation training. Although STEP reduced executive dysfunction and improved problem solving, there were no significant improvements in attention.
2. Cooper et al. (2016): Therapist-directed cognitive rehabilitation (both traditional cognitive rehabilitation and integrated treatment, consisting of therapist-directed cognitive rehabilitation, individual psychotherapy, and group psychotherapy) that included therapist-directed APT-III, achieved superior outcomes on a measure of functional cognitive abilities compared to treatment arms without therapist directed cognitive rehabilitation. The difference in outcomes was evident both at the end of treatment and at follow-up.
3. Nelson et al. (2013): IM was superior to standard rehabilitation care in improving attention and memory on standardized tests in this randomized controlled trial.
4. Vanderploeg et al. (2018): A further analysis of the SCORE data found that self-administered computerized cognitive rehabilitation was not beneficial and negatively associated with cognitive and neurobehavioral improvement.
5. Van Vleet et al. (2015): Tonic and phasic alertness training (TAPAT), a non-therapist directed computerized attentional training program, was compared to a delayed/waiting list control; the very small sample size precluded statistical significance testing in this case control study.

2.2: Memory and New Learning Difficulties

Recommendations

- Emphasize self-management and internal and external compensatory memory strategies coupled with psychoeducation. If indicated, address within the context of a comprehensive approach.
- Consider including external cognitive aids and assistive technologies (AT) as compensation for prospective memory difficulties.

Background and Rationale

Aspects of memory interrelate with attentional and executive function. A comprehensive treatment plan for memory should address attentional challenges as a component. Difficulties often occur in the strategic and organizational aspects of memory. Working memory, which refers to holding information in mind while manipulating it, is similar in many ways to selective focused attention and distinct from short-term memory (Diamond, 2013). In many individuals with mTBI, the reported memory difficulties are attentional control problems that occur as the result of inattention and a lack of active processing of information.

Prospective memory, the ability to remember future intentions, is a common cognitive dysfunction following mild to moderate TBI. Prospective memory may be a sensitive marker of cognitive dysfunction in blast-related mTBI even years post injury (Pagulayan et al., 2017). Compensatory Cognitive Training (CCT) addresses prospective memory difficulties and associated compensatory strategies (Storzbach et al., 2017).

Compensatory memory strategies are categorized as external or internal. External memory strategies involve aids to the patient, such as a memory notebook (Sohlberg, 2005). External aids (e.g., checklists, notebooks, post-it notes, hand-written lists, etc.), including technology (smartphones and tablets), are employed to improve function on tasks involving prospective memory. It is important to keep up-to-date with recently developed AT and applications.

Internal memory strategies involve mental manipulation to improve memory, and include semantic association, semantic elaboration and chaining, and imagery. Patients with mild and moderate TBI may attain more benefit from internal memory strategies than those with severe injuries (O’Neil-Pirozzi et al., 2010). Internal compensatory strategies include rehearsal, repetition and practice for habit formation. Semantic association (categorizing and clustering) is the primary strategy taught in an internal memory strategies (I-MEMS) study with a secondary focus on semantic elaboration/chaining and imagery (O’Neil-Pirozzi et al., 2010). Specific methods included error-free learning and metacognitive strategy training (O’Neil-Pirozzi et al., 2010). CogSMART (Twamley, Jak, Delis, Bondi, & Lohr, 2014) and CST (Huckans et al., 2010) curriculums emphasize memory compensation training and include a session on internal memory strategies.

Evidence Review References

The evidence in the area of memory rehabilitation is limited. No RCTs specifically focused on memory rehabilitation and only one study (O’Neil-Pirozzi et al., 2010) examined the treatment effectiveness of specific memory strategies.

1. Huckans et al. (2010): This pilot study of cognitive strategy training (CST), which included practice with a variety of compensatory strategies and external aids, showed that participants increased their use of memory compensation strategies including external aids after participating in CST.
2. O’Neil-Pirozzi et al. (2010): Compared to patients who do not receive internal memory strategy (I- MEMS), this intensive therapist-led training improved patients’ self-identified functional memory on tests of everyday memory functioning and verbal learning. Greater improvement was found in those with mild to moderate TBI compared to those with severe TBI.
3. Twamley et al. (2014): This RCT of a manualized intervention (CogSMART) that emphasizes habit learning and compensatory strategies showed improved prospective memory performance on testing. CogSMART in the context of supported employment was associated with improved functional memory and return to competitive employment.

2.3: Executive Dysfunction and Comprehensive Integrated Treatment

Recommendations

- Individualized compensatory strategy training is the key approach for the management of executive dysfunction complaints. The provider advises and coaches the patient to develop and use compensatory strategies for goal setting, planning, self-monitoring, and time management.
- Approaches that teach and rehearse key compensatory strategies to minimize executive dysfunction often focus on problem solving, goal setting, reasoning, and emotional regulation.
 - Consider using one of the following manualized skills based therapies for treatment of executive dysfunction: Short-Term Executive Plus (STEP), Strategic Memory and Reasoning Training (SMART), Goal Management Training (GMT), or Compensatory Cognitive Training (CCT)/CogSMART.
- A therapeutic milieu, which provides integrated cognitive rehabilitation, including emotional self-regulation training, is often indicated for patients with cognitive dysfunction and comorbid psychological health disorders.
 - Consider adapting group content and curriculum pertinent to the individual patient(s) from the integrated treatment arm of the Study of Cognitive Rehabilitation Effectiveness (SCORE) (Cooper et al., 2016) (Link: [Health.mil/SCORE](https://www.health.mil/SCORE)).

Background and Rationale

Executive function (EF) is an umbrella term that includes metacognition and a variety of effortful higher order abilities enabling an individual to successfully and independently engage in goal-oriented behavior (Kennedy et al., 2008). Self-awareness of one's strengths and weaknesses is the foundation for self-management (O'Keefe, Dockree, Moloney, Carton, & Robertson, 2007). Executive dysfunction can disrupt cognitive performance in related domains, such as attention and working memory, and attentional complaints should be addressed as part of a comprehensive treatment plan for executive functions.

There are three core EFs: inhibitory control (interference control and response inhibition), working memory, and cognitive flexibility. Reasoning, problem solving, and planning are constructed from these higher order EFs. EF skills are essential for mental and physical health; success in school and in life; and cognitive, social, and psychological development (Diamond, 2013). EF plays an important role in job performance, social relationships, and activities of daily living such as driving, and financial management (Lezak, Howieson, Bigler & Tranel, 2012; Rabinowitz & Levin, 2014).

Executive functioning difficulties are common following TBI even among those with mild injuries (Hartikainen, 2010). Executive dysfunction in patients with mild to moderate TBI may manifest as difficulties with problem solving, goal setting, reasoning, and emotional regulation. Situational context, comorbid conditions, and psychosocial factors all may impact executive function performance. Therefore, treatment for these difficulties is optimally delivered in a therapeutic milieu focused on self-management, and whenever possible, in both individual and group treatment sessions.

Compensatory strategy development is a key component of compensatory strategy training for executive functions in the mild to moderate TBI population. Compensatory Cognitive Training (CCT), a revised version of CogSMART (Twamley, Jak, Delis, Bondi, & Lohr, 2014), is a ten-session group-based intervention developed for veterans that improves cognitive functioning and reduces post-concussive symptoms. Each CCT session consists of didactic presentation, discussion, and activities involving a variety of cognitive strategies and external aids for attentional, learning and memory, and executive functioning difficulties. Strategies taught in CCT that address executive function include time management, goal setting, and self-monitoring (Storzbach, Twamley, Roost, Golshan, Williams, O'Neil, & Huckans, 2017).

Treatment in the SCORE study (Cooper et al., 2016) is based on an intensive six-week treatment program with one of three types of cognitive rehabilitation: computer-based cognitive rehabilitation, traditional cognitive rehabilitation (therapist-directed individual, group, and computerized attention training), and integrated cognitive rehabilitation (therapist-directed cognitive rehabilitation and individual and group psychotherapy). Strategies addressing executive function include goal setting, planning, and organization (including time management) and were addressed in both the traditional and integrated interventions. The executive function targets were part of a larger, comprehensive treatment approach.

Executive function interventions for metacognitive processes include planning, inhibition, and self-monitoring (Cicerone, Levin, Malec, Stuss, & Whyte, 2006). Goal Management Training (GMT) focuses on metacognitive training in goal formulation, maintenance, and execution. GMT teaches patients to self-regulate by identifying errors in processing and implementing strategies to reduce these slips. The key self-regulation strategies are "stop, define the goal, learn the steps, and check the plan" (Waid-Ebbs et al., 2014).

The overall goal of Strategic Memory Advanced Reasoning Training (SMART) is also to teach metacognitive strategies to improve cognitive control functions. SMART emphasizes strategic attention, integrated reasoning, and cognitive flexibility ("innovation") applied to daily functioning. Integrated reasoning involves three core skills: synthesis of big ideas, interpretation of meaning, and implementation/application (Vas et al., 2016).

Problem solving interventions focus on the executive cognitive functions of planning and self-monitoring. The cognitive rehabilitation component of STEP (Cantor et al., 2014) is a five-step problem solving intervention termed SWAPS. The SWAPS approach addresses active self-management by: (1) directing patient to "Stop"; (2) ask "What is the problem?"; (3) identify "Alternatives"; (4) direct patient to "Pick one and plan"; and (5) ask "Satisfied?" The individual cognitive rehabilitation sessions in STEP include direct attentional training (APT-II) and advising regarding compensatory strategy use.

In addition to the problem solving group treatment and individualized compensatory strategy training, the STEP intervention also includes group training in emotional regulation. This psychotherapy group focuses on skill development to address emotional dysregulation and behavioral dyscontrol. Likewise, the integrated arm of SCORE is multi-modal and includes psychotherapy in addition to cognitive rehabilitation. Patients in the integrated treatment approach participate in psychotherapy (both individual and group) and homework related to CBT and mindfulness based training (Cooper et al., 2016).

Integrated approaches within the setting of a therapeutic milieu offer advantages for comprehensive treatment for many patients with chronic cognitive and affective symptoms. In this comprehensive rehabilitation model (also called holistic or integrated cognitive rehabilitation), a team of providers and rehabilitation specialists works collaboratively to ensure that each patient receives the most appropriate cognitive rehabilitation content and efficient delivery methods (Institute of Medicine, 2011). Treatment is individualized, guided by a consideration of the individual's goals, and addresses both the cognitive and behavioral aspects of executive functioning. Integrated cognitive rehabilitation has also employed mindfulness-based stress reduction and emotional regulation training to target post-concussive symptoms (Cantor et al., 2014; Cooper et al., 2016).

Evidence Review References

Five RCTs provide quality evidence for the effectiveness of executive dysfunction treatment for patients with mild to moderate TBI. The effective ingredients in these high intensity, multi-component interventions have not been analyzed.

1. Cantor et al. (2014): This RCT showed that patients receiving STEP improved on several executive function measures compared to the comparison group. The STEP intervention integrated group cognitive rehabilitation, group psychotherapy, and individual cognitive rehabilitation.
2. Cooper et al. (2016): This RCT showed that both traditional and integrated cognitive rehabilitation treatments had superior outcomes to computer-based cognitive rehabilitation. Gains in cognitive functioning were maintained at six weeks post treatment. Integrated cognitive rehabilitation was most effective in reducing psychological distress and emotional symptoms.
3. Storzbach et al. (2017): This RCT showed that patients who participated in CCT, a curriculum based group intervention, experienced decreased cognitive difficulties. Post-treatment gains in cognitive functioning were maintained at a follow-up five weeks post-treatment.
4. Vas et al. (2016): This RCT showed that SMART improved reasoning, cognitive flexibility, and awareness while decreasing depression significantly more than an educational intervention. These treatment gains were maintained at a three-month follow-up.
5. Waid-Ebbs et al. (2014): This RCT showed that GMT conducted in a group setting improved planning and problem solving compared to no treatment.

2.4: Cognitive-Communication Difficulties

Recommendations

- Tailor cognitive-communication interventions to everyday communication needs based on the patient's functional complaints and an analysis of the individual's communication performance in different contexts.
- Include interventions such as psychoeducation, environmental modifications (e.g., reducing distractions), external aids (e.g., notetaking and recording), and internal compensatory strategies (e.g., active listening, restating, slowing down).
- Consider guidance in the INCOG Recommendation for Management of Cognition Following TBI, Part IV; Cognitive Communication (Togher et al., 2014) for moderate to severe TBI, which may be relevant to mTBI including:
 - Consider the person's premorbid native language, literacy, and language proficiency; cognitive abilities; and communication style, including communication standards and expectations in that individual's culture.
 - Provide the opportunity to rehearse communication skills in situations appropriate to the context in which the individual will live, work, study, and socialize.
 - Measure outcomes at the level of participation in everyday life (see Appendix E for the outcome measures used in studies included in the evidence review).

Background and Rationale

Cognitive-communication difficulties have an underlying basis in cognitive impairments. In mild to moderate TBI, these cognitive impairments typically are in attention and working memory. Communicative competence encompasses listening, speaking, reading, writing, conversing, and socially interacting (College of Audiologists and Speech Language Pathologists of Ontario, 2002). Consider a referral to audiology for evaluation and collaboration for patients experiencing cognitive-communication difficulty.

Communication challenges may appear most prominently in complex, cognitively demanding situations, such as conversations, listening in a classroom, or performing under time pressure. Symptoms can include word-finding problems and difficulty keeping track of the most critical content. Components of verbal fluency as measured by clustering (generating words from the same phonemic or semantic category) and switching (change to a new subcategory) may also be affected (Zakzanis, McDonald, & Troyer, 2011).

Specific compensatory strategies to treat difficulty with word-finding include: the use of synonyms and related words, "WH" questions (who, what, where, why, how), alphabet and phonetic cues, circumlocution, context clues, conversation fillers, stop and slow down, and restatement and rephrasing. Specific strategies to support comprehension of content include: active listening, asking questions, notetaking, conversation recording and playback, eliminating distractions, paraphrasing, and key point emphasis.

The patient's communication partners, environments, and role demands need to be carefully considered as well as the individual's educational background and premorbid communication style. Communication standards and expectations in the individual's culture are important (Togher et al., 2014). Some competencies may vary from service members to veterans. For service members, communicating appropriately with authority figures is critical; for veterans, adopting an appropriate communication style with an academic advisor or work supervisor is important.

Evidence Review References

This set of recommendations was developed exclusively via subject matter expert consensus. Of the 17 articles that met the inclusion and exclusion criteria outlined in Appendix C, none directly related to this set of recommendations.

2.5: Use of Technology

Recommendations

- Select assistive technology (AT), preferably multi-functional devices, to address the specific cognitive support needs of the patient.
- Instruct the patient's use of the specific AT and collaborate to apply the AT to situations in which cognitive dysfunction occurs.
- Educate the key people (employers, instructors, command) in the environment(s) in which the patient will use the AT and elicit support for the patient's use of AT.

Background and Rationale

AT in clinical populations supports cognitive function relating to attention, executive function (planning and time management) and memory, and the impact of cognitive impairment (Gillespie, Best, & O'Neil, 2012). AT as a cognitive aid has a variety of functions, for example as an organizational tool for planning, tracking activity, and setting goals; as a delivery vehicle for prompts and motivational messages; as an alarm to help refocus attention; and as a notetaking device to capture key takeaways from medical appointments. Technologies that work for the general population to improve daily functioning also help those with mild to moderate TBI. These technologies may include smart phones, tablets, computers, and noise cancelling headphones, among others. AT devices that offer multiple features should be prioritized, as they maximize ease of use and functionality (Veterans Health Administration, 2010).

AT may be incorporated into the cognitive rehabilitation plan to address a patient's specific functional needs such as maintaining a schedule or storing information. Sohlberg and Turkstra (2011) outline seven steps to select and train the use of an external aid, summarized as follows: 1) Complete a needs assessment; 2) Design an individualized training plan; 3) Administer an initial assessment; 4) For clients needing instruction to learn the steps for using the aid, begin each session with a probe to determine retention and where to begin in therapy; 5) Conduct systematic training; 6) Cycle through Steps 4 and 5 until mastery is reached; 7) Initiate the plan for follow-up and maintenance. To adopt AT, the patient must receive competency training. If the technology is familiar, patients still benefit from training on how to maximize use in specific circumstances. Learning when and how to use AT for cognitive function support can be a useful therapeutic exercise under the direction of a provider and becomes a springboard for future symptom self-management. Support by key persons in the contexts where it will be used can also support its adoption.

Evidence Review References

This set of recommendations was developed exclusively via subject matter expert consensus. Of the 17 articles that met the inclusion and exclusion criteria outlined in Appendix C, none directly related to this set of recommendations.

2.6: Telehealth and Virtual Reality

Recommendations

- Consider telehealth as a mode for cognitive rehabilitation delivery when the patient cannot otherwise access cognitive rehabilitation or difficulty of access interferes with appointment compliance or follow-up.
- If possible, provide an initial in-person visit with the therapist or local team member (such as a case manager) to introduce telehealth, ensure that the patient has access to the hardware and software required for the telehealth interface and knows how to use it, and develop a therapeutic alliance with the patient.

Background and Rationale

Technologies such as virtual reality and telehealth can be used to overcome practical limitations of delivering cognitive rehabilitation in an office setting. Technological platforms may motivate more intensive skill practice with game-like features embedded in functional real-world virtual environments. Although evidence to date is limited, skill practice in multiple virtual “environments” may facilitate skill acquisition in the patient’s real-life work, study, living, and social environments. In one study, virtual reality offered a medium for improving problem solving skills within a vocational context that may be a superior method for skills development compared to studying a manual (Man, Poon, & Lam, 2013).

Telehealth delivery allows treatment interactions between the patient, family, and a provider without travel. When possible, patients apply, internalize, and practice skills and tasks within their home during the sessions and receive real-time feedback from providers. Telehealth may be as effective as face-to-face intervention for training problem solving (Riegler, Neils-Strunjas, Boyce, Wade, & Scheifele, 2013). However, not all cognitive rehabilitation interventions are appropriate for telehealth delivery, and providers must consider the patient’s comfort level with any telehealth platform.

Table 4: Considerations for Using Telehealth to Deliver Cognitive Rehabilitation

Consideration	Action
Universal design	Use universal design principles (e.g., user-friendly interface) and reduce user demands as much as possible.
Screen sharing	Use platforms allowing screen-sharing to view the patient’s screen in real time.
Vision	Make accommodations and adaptations (such as glare control and magnification) for vision impairments and light sensitivity.
Hearing	Make accommodations and adaptations for hearing impairments.
Hardware, software, training	Ensure that the patient and provider have appropriately encrypted hardware, software, tools, and training to support the telehealth platform.
Appropriate environment	Ensure that the patient and provider have a quiet space free from distractions during sessions, unless working under distracting conditions is the therapeutic goal of the session.
Backup plan	Coordinate a backup plan with the patient for failed technology or emergencies.

Evidence Review References

The evidence for using telehealth and virtual reality is limited to one small sample case control study and an RCT at a single site that compared vocational problem solving training delivered via telehealth to a psychoeducational approach.

1. Man et al. (2013): This RCT showed that a virtual reality based problem solving skills intervention for vocational training was superior to a conventional psychoeducational approach in improving some aspects of executive functioning; however, training gains did not transfer into improved vocational outcomes.
2. Riegler et al. (2013): This case control study showed that therapist-directed problem solving training delivered by telehealth technology with videophones allowed two thirds of participants who had not previously completed clinic treatment to complete the intervention and improve on a measure of memory and learning to a degree similar to that attained by participants in face-to-face intervention.

2.7: Use of Computerized Cognitive Rehabilitation

Recommendations

- Use therapist-guided computerized interventions to improve attentional function as an adjunct component of an integrated cognitive rehabilitation treatment plan.
- Avoid self-administered or independent use of computerized cognitive rehabilitation.

Background and Rationale

Effective treatment of cognitive dysfunction is possible without computerized intervention. No specific computerized intervention has been rigorously evaluated or shown to be superior to other computerized programs. Although studied extensively in patients with moderate-severe injuries, attention process training (APT-III) has recently been used as a component of integrated cognitive rehabilitation interventions for patients with mild to moderate brain injuries (Cantor et al., 2014, Cooper et al., 2016). Computerized attentional training programs, such as APT-III, are appropriate when therapist directed. Without therapist intervention to teach compensatory strategies and promote generalization through application to real-life situations, any improvement in cognitive function or skills is often limited to the trained tasks and does not often transfer to other tasks.

Evidence Review References

Evidence on the effectiveness of computerized cognitive rehabilitation programs is methodologically poor. In contrast, research shows that self-administered or independent use of computerized cognitive rehabilitation activities may be harmful by resulting in attrition or poorer outcomes.

1. Cantor et al. (2014): In this RCT, multi-component executive function treatment included several sessions of therapist-directed computerized attention training (APT-III); however, the effective ingredients of this multicomponent intervention were not analyzed.
2. Cooper et al. (2016): In this RCT, therapist-directed cognitive rehabilitation resulted in reliable Key Behavior Change Inventory (KCBI) improvements in 23 percent of those who received the traditional and 19 percent of those who received the integrated cognitive rehabilitation treatments, compared with none in the psychoeducation arm, and seven percent in the computerized arm.
3. Lebowitz et al. (2012): This small sample (n=10), pre-post repeated measures study demonstrated the feasibility of in-home use of brain plasticity based cognitive training software (Cortex Insight, Posit Corp.) but lacked sufficient methodological rigor to draw any conclusions about effectiveness.
4. Sullivan et al. (2012): A retrospective study of the medical records of patients who used commercially available computerized cognitive rehabilitation programs as a standalone service or as an adjunct to traditional rehabilitation care was unable to draw conclusions about the effectiveness of brain fitness training.
5. Vanderploeg et al. (2018): Secondary analysis of the SCORE data (Cooper et al., 2016) showed that computerized cognitive rehabilitation in isolation results in poorer outcomes and higher patient attrition rates than other cognitive rehabilitation interventions.

3. Delivery of Rehabilitation for Patients with Cognitive Challenges

Taxonomy of Cognitive Rehabilitation

A taxonomy for rehabilitation interventions developed by Dijkers et al. (2014) will be used to describe considerations for the effective delivery of cognitive rehabilitation. This taxonomy is particularly relevant to dose and modality of treatment. The Rehabilitation Treatment Taxonomy Project (Dijkers et al., 2014) is a three-part treatment model that divides rehabilitation treatments into ingredients (what the provider does), targets (the aspects of functioning those ingredients are known or hypothesized to change), and mechanism of action (how the ingredients work). This taxonomy provides a conceptual structure and terminology to facilitate provider training and education, as well as dissemination of information about evidence-based interventions.

Most cognitive rehabilitation treatments have multiple ingredients such as information, opportunities to practice, teaching, and motivational enhancements. Cognitive rehabilitation is a volitional treatment in which the patient must apply effort to perform specific actions. The targets of volitional activities include: skills and habits (ingredient example: providing repeated practice using a mnemonic device to remember names) and representations (ingredient example: providing information about sleep hygiene). Representations refer to providing or discussing information that modifies thoughts, beliefs, or motivations.

3.1: Treatment Plans

Recommendations

- Incorporate improved self-efficacy and independent management of systems as central components of the treatment plan.
- Consider referral for comorbid conditions that may impact cognitive function prior to or concurrent with cognitive rehabilitation. Concerns include mental health issues, sleep disturbance, pain management, headache, poor nutrition, substance use, physical inactivity, hearing loss, family and financial stress, and visual and vestibular disturbances.
- Collaborate with the patient and any other team members at the outset of treatment to establish patient-centered goals aimed at specific activity or participation outcomes.
- Identify specific activities or tasks that are problematic; the component knowledge, skills, and abilities necessary for successful completion; and target areas in which the patient has decreased efficacy.

Background and Rationale

Consideration of the whole patient is important when developing a tailored, holistic cognitive rehabilitation treatment plan. Communication and collaboration among members of the team (if applicable) with varied perspectives and areas of expertise enhance treatment effectiveness. Improved self-efficacy is a key goal of treatment. Treatment plans are developed to build toward independent self-management of symptoms.

Many patients with mild to moderate TBI are considered “high-functioning” and may accomplish the daily tasks they did prior to injury; however, task performance may require a higher level of effort and leave a patient feeling exhausted. In this case, treatment should incorporate strategies for managing fatigue and allocating energy resources.

When considering how to develop and structure a treatment plan, examine the knowledge, skills and abilities required to successfully engage in work and life activities. A list of specific qualifications and personal attributes needed for a particular job or other targeted task can be helpful, along with a review of responsibilities, in which steps and skills required for a specific area where the patient is reporting or experiencing difficulties are broken down. For example, returning to work or duty may include writing down the steps for prioritizing emails, identifying the steps necessary to inspect a cockpit panel, determining how to place a work order for a vehicle repair, or organizing briefings. The context in which the task will be completed, the physical functions required to complete the steps, the necessary communication and cognitive skills, and any known time constraints are useful considerations.

Evidence Review References

This set of recommendations was developed exclusively via subject matter expert consensus. Of the 17 articles that met the inclusion and exclusion criteria outlined in Appendix C, none directly related to this set of recommendations.

3.2: Frequency, Intensity, Length, Duration and Timing of Interventions

Recommendations

- **Frequency, intensity, length of sessions:** Provide sufficient treatment intensity and practice for the targeted skills to become habitual or automatic and incorporated into the patient's daily activities. For representation targets, provide lengthy and frequent enough sessions for patient to understand and self-manage the condition(s).
- **Duration of treatment:** Adjust the duration of treatment based on the patient's progress toward treatment goals. If a patient is not progressing, determine the underlying cause and adjust the frequency, or intensity of treatment. A time-limited trial of cognitive rehabilitation for patients with complex environmental or personal circumstances may help to further assess their ability to engage effectively in cognitive rehabilitation.
- **Timing:** Conduct a motivational interview to indicate the patient's readiness to participate. Patient-identified functional goals for treatment indicate readiness for initiation of cognitive rehabilitation.

Background and Rationale

Determination of the length, frequency, and duration of specific interventions depends on the rehabilitation target. A single session usually cannot accommodate the high-dose practice necessary for skills acquisition. Treatment of representation targets should continue until the patient has incorporated the skill or habit into daily activities. Practice involves problem solving to fit the skill into function and modify as needed. Patients can demonstrate understanding by explaining or teaching material back to providers or peers in their own words.

Patient characteristics, including readiness to change, comfort with the level of expected effort, and comorbidities also play a role in determining appropriate length, frequency, and duration of treatment. If a patient is not demonstrating progress, the provider and patient should partner to determine the underlying cause and adjust duration or frequency. Possible underlying causes include but are not limited to: patient is not ready to engage in treatment; the time commitments of treatment are too great; treatment goals are not aligned with functional needs; and teaching method and modality are not a good fit. Reconsider the diagnosis and appropriateness of cognitive rehabilitation and consult with the referring provider regarding the possibility of an unaddressed confounding diagnosis. Finally, in order to ensure that patients apply the skills consistently, patients should be evaluated in the context in which they use the skill.

The optimal timing for cognitive rehabilitation is when a patient can engage with the provider in therapeutic goal setting. A provider may use a time-limited trial to assess the patient's motivation for change and, if necessary, temporarily pause cognitive rehabilitation until the patient is more ready to engage. Patients are ready to re-engage in therapy when they can verbalize task-specific goals with some assistance from the provider and regularly attend sessions.

Evidence Review References

The multi-component interventions reviewed involved many sessions of treatment. For example, the SCORE interventions were administered in over 60 sessions. Although doses of interventions varied widely across studies, cognitive rehabilitation intervention duration was often six to 12 weeks with multiple sessions per week. No study evaluated different doses of the same treatment.

Table 5: Multi-component Interventions

Citation	Intervention	Frequency	Intensity	Duration
Cantor et al. 2014	STEP	3 days/week	Two groups (45 minutes each) + 1 hour (60 minutes) individual session/week	12 weeks, 108 sessions
Cooper et al. 2016	SCORE	10 hours/week	<p>Traditional</p> <p>Two cog rehab groups + five individual cog rehab sessions + three computerized sessions; all 1 hour</p> <p>Integrated</p> <p>Two group psychotherapy + 1 individual psychotherapy + two cog rehab groups + three individual cog rehab sessions + two computerized sessions; all one hour</p>	6 weeks, 60 total sessions
Huckans et al. 2010	CST	1 day/week	One group (120 minutes)	6-8 weeks
Twamley et al. 2014 & 2015	CogSMART	1 day/week	One group (60 minutes)	12 weeks
Storzbach et al. 2017	CCT	1 day/week	One group (120 minutes)	10 weeks
Vas et al. 2016	SMART	1 day/week		8 weeks, 12 sessions

3.3: Modality of Treatment: Comparing Individual and Group Therapy

Recommendations

- Consider individual therapy when the rehabilitation targets are skills and habits, such as routine use of strategies and AT, or are highly task or needs specific.
- Consider group therapy when the rehabilitation targets are representations, with a focus on peer support, education and conscious practice of skills in an interactive format.

Background and Rationale

The patient's goals provide a useful framework when considering the role of group and individual treatment modalities. Individual therapy takes place with a one-to-one patient/provider ratio, while a group is defined here as two or more persons with one (or more) providers. Decision making for individual and group therapy begins with consideration of the setting and patient characteristics and includes a problem focused assessment to determine appropriate treatment targets.

Table 6 lists factors to consider when deliberating the appropriateness of individual and group therapy.

Table 6: Considerations Relevant to Individual and Group Therapy

INDIVIDUAL	GROUP
Determination of specific compensatory strategies most applicable to the individual	Psychoeducation about recovery from mild to moderate TBI and about compensatory strategies
Personal and targeted goal setting	Strategy application and practice of cognitive and psychological targets (e.g., emotional regulation, irritability management, social communication, group interaction)
Initial individualized skill training (e.g., auditory attention, reading comprehension, in-depth AT/tools)	Psychological and social support, affirmation, and feedback from peers
High frequency repetition	Peer-based brainstorming and problem solving
	Ecologically valid setting requiring participation and working together as a group

Background and Rationale

Providers should base decisions on specific targets and patient characteristics. If the patient needs a confidential or highly controlled environment, individual therapy can also address representation targets. Group therapy may be helpful for specific skill building if the group structure supports repetitive practice.

Group and individual therapy can occur concurrently, sequentially or selectively depending on rehabilitation targets, patient goals, and clinical judgment. Group therapy acts as a multiplier of individual sessions by providing patients with the opportunity to suggest solutions for each other, discuss the feasibility of strategies, and learn from peers. Providers should consider patient characteristics to match patients based on injury severity, demographics, timing of treatment and schedules to ensure that the dyads or group will work well together and benefit all patients within the group.

Evidence Review References

This set of recommendations was developed exclusively via subject matter expert consensus. Of the 17 articles that met the inclusion and exclusion criteria outlined in Appendix C, none directly related to this set of recommendations.

3.4: Manualized Treatments

Recommendations

- Use manuals as a resource but not as a stand-alone treatment or substitute for clinical judgement.

Background and Rationale

Manualized treatments have a variety of benefits and potential limitations.

Table 7: Clinical Benefits and Limitations of Manualized Treatment

Benefits	Limitations
Provides curriculum and materials	May limit individualization of treatment
Facilitates consistent delivery of the active ingredients of treatment	May limit independent clinical thinking and decision making
Identifies key topic and skill areas to address	May require provider training to minimum proficiency in specific manualized treatment interventions
Promotes generalization through use of similar techniques by different disciplines and members of integrated team	May inhibit generalization due to limited ecological validity and variability
Encourages use of effective treatment approaches	
Supports research by allowing for aggregation of clinical care outcomes across providers and settings	

Manuals provide guidance on which key clinical areas to address and specific therapeutic interventions to address them. Providers can implement a manualized treatment into practice rapidly, promoting the use of systematic, evidence-based techniques. However, manualized treatments are not inherently superior to therapy delivered without the use of a manual.

Manualized treatment requires carefully considering the applicability of the manualized treatment to the specific patient and may need to be modified given the patient’s characteristics and goals. Manualized treatments are multi-component, and the patient may only require some portions. However, when modifying a manualized treatment, providers should carefully consider the targets of the ingredients in question, since some ingredients may be necessary for treatment benefit.

Table 8: Selection of a Manualized Treatment

Fit for patient characteristics	Consider the patient characteristics, the relevance of the manual to the clinical population, and the stage of treatment for which the manualized treatment may be appropriate.
Intervention and delivery detail	Select a manual that provides a complete description of the intervention delivery, including as many of these characteristics as possible: frequency, intensity, time (duration), and type (intervention description).
Evidence base	Select evidence-based manualized treatments from studies published in peer-reviewed journals.

Evidence Review References

Manualized treatment protocols were used in several studies in the reviewed literature including: STEP (Cantor et al., 2014); SCORE (Cooper et al., 2016); CST (Huckans et al., 2010); CCT (Storzbach et al., 2017); (Twamley, Jak, Delis, Bondi, & Lohr, 2014; Twamley et al., 2015); SMART (Vas et al., 2016); GMT (Waid-Ebbs et al., 2014). Please refer to Appendix D for links to manuals under “Treatment materials/manuals available for clinical use.”

3.5: Interdisciplinary Rehabilitation of Cognitive Dysfunction

Recommendations

- Consider an interdisciplinary team approach for patients experiencing persisting cognitive difficulties and emotional distress that interfere with activity participation.
- Referral considerations include:
 - Significant complaints of inefficiency or difficulty participating in important activities that the patient needs, wants, or is expected to perform.
 - Concern by key persons in the patient's life about a change in the patient's performance of complex instrumental activities of daily life including home, community, work, school and leisure, as well as interpersonal difficulties caused by or resulting in affective distress.

Background and Rationale

Referrals for interdisciplinary rehabilitation of chronic cognitive dysfunction should be based on clinical evaluation, treatment history, patient self-report, and information provided by command or family. The referral threshold for interdisciplinary cognitive rehabilitation is relatively low for persons who experience chronic cognitive symptoms related to a TBI event or multiple events. Relevant patient and injury characteristics include premorbid or comorbid psychological health disorders, a history of repeated concussions, and symptoms in several domains affecting function.

If available, given the setting and resources, an interdisciplinary team should collaborate to develop and deliver an integrated cognitive rehabilitation treatment plan. This approach is generally beneficial to the patient. An integrated team includes providers of cognitive rehabilitation, such as a speech-language pathologist, occupational therapist, and neuropsychologist. Collaboration among rehabilitation specialists and behavioral health care providers is often most efficient for addressing the patient's symptom constellation. Additionally, cognitive rehabilitation providers rely on collaboration with other key persons, such as the referral source (e.g., primary care provider), family members, academic advisors, and command or work supervisors.

Evidence Review References

This set of recommendations was developed exclusively via subject matter expert consensus. Of the 17 articles that met the inclusion and exclusion criteria outlined in Appendix C, none directly related to this set of recommendations.

3.6: Addressing Comorbidities

Recommendations

- Address common comorbid conditions that affect cognition either prior to or concurrent with the initiation of cognitive rehabilitation. These conditions include psychological health disorders, sleep disturbances, headaches, and chronic pain.
- Refer patients with active substance abuse disorder or active psychotic disorder to a behavioral health care provider prior to initiation of cognitive rehabilitation. Provide cognitive rehabilitation concurrently if adequate resources are available and inter-disciplinary collaboration is possible. If not, defer cognitive rehabilitation until the disorder is adequately managed.
- Refer patients presenting with decreased alertness and severely diminished attention to the appropriate specialist for assessment and treatment prior to initiating cognitive rehabilitation. Defer cognitive rehabilitation until the patient can sustain adequate attention to benefit from treatment sessions.

Background and Rationale

Patients with comorbid medical and psychological health disorders may benefit from rehabilitation of cognitive dysfunction. While the cognitive rehabilitation team is not primarily responsible for addressing comorbid conditions, cognitive rehabilitation can provide the patient tools and compensatory strategies for self-management of aspects of comorbid conditions that can improve the patient's daily functioning. While patients are participating in cognitive rehabilitation, they should also be referred to providers for specialized care for issues such as sleep disorders, headaches, and chronic pain in order to optimize the functional outcomes of cognitive rehabilitation.

Although uncommon, patients who are decompensated due to active psychosis or whose attention is severely compromised from severe symptomatology of other comorbid health conditions are not appropriate for cognitive rehabilitation. Substance dependent patients should participate concurrently in substance abuse treatment. Polytrauma patients with decreased arousal and alertness from high dose narcotics may need to have these medications tapered prior to initiation of cognitive rehabilitation.

Evidence Review References

Pagulayan et al. (2017): This secondary analysis of an RCT of cognitive compensatory strategy training (CCT) found CCT to be efficacious for improving cognitive function for veterans with a history of mild TBI regardless of the severity of comorbid psychological health disorders. Patients with a history of psychotic disorder, substance use disorders with less than 30 days abstinence, or severe auditory or visual impairments were excluded from participation in CCT.

3.7: Interventions for Patients with Difficulty Engaging in Cognitive Rehabilitation

Recommendations

Consider factors related to:

- **The patient** — assess for potential psychosocial barriers to treatment effectiveness and address personal crises that may need management.
- **The team** — ensure the team is involved, engaged, and sensitive to the psychosocial needs of the patient, and aim for shared strategy use across providers.
- **Treatment delivery** — modify treatment intensity and/or incorporate treatment pauses; set clear expectations for attendance and functional homework completion; change provider if necessary.
- **The intervention** — focus treatment on patient-centered, functional goals to maximize motivation; engage in frequent and ongoing conversation with the patient regarding treatment goals; modify intervention approach; set clear and specific expectations for appointment attendance and boundaries for no-shows. If the initial intervention approach is not resulting in patient engagement, consider selecting an alternative approach.

Background and Rationale

The team of providers can implement a number of strategies when working with patients with difficulty engaging in cognitive rehabilitation. Team cohesion and engagement are crucial. Shared strategy use across providers and other members of the integrated team — including command, work supervisors, family, and friends — provides consistency and can increase engagement. Some members of the treatment team may be more familiar with the patient and can provide useful context or information to support the patient's engagement with other providers on the team. The team may also refer the patient to other appropriate services as needed and may consider alternative therapies to improve cognitive functioning such as mindfulness.

Evidence Review References

This set of recommendations was developed exclusively via subject matter expert consensus. Of the 17 articles that met the inclusion and exclusion criteria outlined in Appendix C, none directly related to this set of recommendations.

3.8: Generalizing and Maintaining Treatment Effects

Recommendations

- Support generalization and maintenance of treatment effects:
 - Engage the patient's network including family, friends, command, academic advisors, and work supervisors.
 - Promote self-management of cognitive challenges.
 - Promote metacognitive approaches that encourage self-monitoring.
 - Encourage skills practice in a variety of environments.
 - Assign functional homework.
 - Promote AT for self-monitoring.

- Consider training the patient in anticipatory awareness.

Background and Rationale

Initiating treatment with “quick wins” to highlight the benefits of treatment can build momentum and motivation, thereby building a foundation to generalize and maintain new learning. Patient-centered goals and a strong therapeutic alliance between the patient and provider help patients sustain the motivation to use skills or habits learned in treatment. Specific and carefully structured homework assignments provide the repetition and reinforcement needed to generalize and maintain new learning. Group therapy can promote generalization of skills by providing opportunities for patients to practice with peers.

The tools used during treatment sessions should resemble those used in real life. For example, if a patient's goal is to use a smartphone calendar, the session should incorporate the specific smartphone calendar the patient wants to use so that the patient can practice with it. The patient can then continue using the same smartphone calendar after the session, incorporating it into daily activities and promoting maintenance of treatment.

There are three primary levels of awareness: intellectual, emergent, and anticipatory (Crosson et al., 1989). Without intellectual awareness, the patient may have general awareness of a problem but is unable to identify it. With emergent awareness, patients recognize when impairment affects their ability to perform a task as they are attempting to perform that task. With anticipatory awareness, patients anticipate when impairment will affect performance and implement strategies to maximize success. Anticipatory awareness training increases self-monitoring and self-management of symptoms by teaching patients to identify when they need to use a specific strategy.

Patients with self-regulation difficulties or psychological comorbidities may benefit from additional sessions of cognitive rehabilitation to adopt skills or habits and establish long-term maintenance.

Evidence Review References

This set of recommendations was developed exclusively via subject matter expert consensus. Of the 17 articles that met the inclusion and exclusion criteria outlined in Appendix C, none directly related to this set of recommendations.

3.9: Booster Sessions and Follow-up Options

Recommendations

- Consider a tapered discharge plan in which sessions are spaced out at increasing intervals prior to discharge of the patient from treatment.
- Consider a booster session after discharge to address specific functional needs.

Background and Rationale

A tapered discharge plan provides opportunities for the provider to evaluate how well the skills, habits, and representations learned in treatment are being applied in the patient's daily life. After completing the final tapered session, the patient is considered discharged. If the patient returns for treatment following discharge with reports of new or lingering functional challenges, the provider should consider what underlying factors may be contributing to the cognitive complaints. Based on the evaluation, the provider may offer short-term and goal-directed interventions with a focus on compensation and self-management.

Evidence Review References

This set of recommendations was developed exclusively via subject matter expert consensus. Of the 17 articles that met the inclusion and exclusion criteria outlined in Appendix C, none directly related to this set of recommendations.

SUMMARY

These TBICoE clinical recommendations and associated products support state-of-the-science clinical care in the MHS. They address a gap in available guidance for treating MHS and VHA patients with mild to moderate TBI and persisting cognitive dysfunction. By integrating emerging research literature with expert consensus, they expand existing guidance for cognitive rehabilitation developed by the DoD and VA, including the 2016 VA/DoD Clinical Practice Guidelines on Concussion/Mild Traumatic Brain Injury. As a comprehensive resource for providers, they offer detailed, evidence-informed clinical guidance and links to an array of DoD and VA cognitive rehabilitation resources and tools.

The recommendations focus on three topics:

- Modifications of cognitive rehabilitation for service members and veterans.
- Specific interventions and strategies.
- Best practices in the delivery of cognitive rehabilitation.

The first section of the clinical recommendations addresses specific modifications for service members and veterans by focusing on return to productivity: duty for service members and employment, volunteering, or school for veterans. In this regard, treatment both incorporates tasks reflecting the service member's specific occupation and also targets issues affecting the service member's motivation and compliance. This section incorporates motivational factors, considers the traumatic context in which the TBI may have been sustained, and emphasizes the importance of collaboration with command support to generalize the use of cognitive rehabilitation strategies to duty performance.

The second section draws upon high quality evidence that has emerged in the past five years supporting integrated, interdisciplinary team-based cognitive rehabilitation targeting the interrelated areas of attention, memory, and executive functioning. Patients are likely to benefit from an approach emphasizing functional goals, self-management of symptoms, metacognition, and emotional regulation in which comorbid psychological and medical conditions are also addressed. Self-administered or independent use of computerized cognitive rehabilitation is not recommended.

The final section directly addresses effective delivery of rehabilitation for patients with cognitive challenges. This section provides detailed guidance on developing treatment plans, treatment modality, and dosage considerations, including frequency, intensity, length, duration, and timing of interventions to support clinical decision making throughout the course of treatment. A conceptual structure guides what the provider does, the targets of treatment, and how the ingredients work.

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