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Looking Beyond Test Results

Interprofessional Collaborative Management of Persistent Mild Traumatic Brain Injury Symptoms

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Patients with cognitive concerns following mild traumatic brain injury (mTBI), often referred to as concussion, present with complex constellations of strengths and limitations. Increasing evidence indicates that psychosocial factors, as opposed to the injury itself, predict persistent symptoms. As an alternative to the traditional medical model, a person-centered model empowers the patient to move forward past the injury in order to optimize function and maximize quality of life. Patient-centered assessment and treatment by speech–language pathologists, neuropsychologists, and rehabilitation psychologists can engender change, reduce perceived limitations, and increase participation in meaningful activities and roles. This article outlines several collaborative, process-oriented approaches to managing cognitive concerns subsequent to mTBI. The emphasis is on maximizing patient participation to guide clinical decision making and build self-efficacy. The authors are members of the *Joint Committee on Interprofessional Relations Between the American Psychological Association (APA) and the American Speech–Language–Hearing Association (ASHA)*. **Key words:** *cognitive rehabilitation*, *concussion*, *interprofessional collaboration*, *mild traumatic brain injury*

AN ESTIMATED 55.9 million individuals worldwide sustain a mild traumatic brain injury (mTBI) each year (Dewan et al., 2019). The true incidence is believed to be much higher (Carlson et al., 2011; Centers for Disease Control and Prevention (CDC), the National Institutes of Health (NIH), the Department of Defense (DoD), and the Department of Veterans Affairs (VA), 2013; Langburt, Cohen, Akhthar, O'Neill, & Lee, 2001), with

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increased risk for specific age groups (children up to 4 years of age; adolescents, aged 15–19 years; and adults older than 75 years) or professions (athletes, active duty military service members, veterans). Underestimation is attributed to the exclusion of cases in which treatment is sought in a military or government medical facility (e.g., Veterans Administration hospital), a nonhospital setting (e.g., medical clinic or physician's office), or for which no treatment is sought. Regardless, mTBI, often referred to as concussion, is a relatively prevalent experience with myriad clinical presentations and histories.

According to a recent review (Kristman et al., 2014), more than 50 definitions of mTBI are currently in use. Many of these definitions share common diagnostic criteria. Three widely used definitions (American Congress of Rehabilitation Medicine [ACRM], 1993; Centers for Disease Control and Prevention [CDC], 2003; World Health Organization [WHO], 2004) are summarized in Table 1 and define mTBI as an acute brain injury resulting from trauma that is associated with (1) a transient episode of confusion or disorientation; (2) loss of consciousness lasting no longer than 30 min; (3) an episode of posttraumatic amnesia around the time of the injury; and/or (4) other transient neurological abnormalities. Some definitions also include a Glasgow Coma Scale score between 13 and 15 (i.e., minimal or no behavioral abnormalities noted) shortly after injury. Further differences between these definitions have been discussed by Prince and Bruhns (2017).

CHALLENGES IN DIAGNOSING mTBI AND MANAGING mTBI SYMPTOMS

The plethora of definitions currently in use contributes to the challenge of diagnosing mTBI (Kristman et al., 2014), as does the lack of objective biomarkers (e.g., neuroimaging) that could make the presence or absence of a neurologically mediated condition clearer. In addition, the terms *mTBI* (referring to uncomplicated injuries without positive neuroimaging) and *concussion* are often used interchangeably; although technically accurate, this can lead to confusion. When selecting a set of diagnostic criteria, definitions supported in the scientific literature and by experts in the field are of utmost importance. Although there is no universal consensus on which mTBI definition should be used, the TBI Model Systems program sponsored by the National Institute on Disability, Independent Living, and Rehabilitation Research (widely considered as the gold standard in TBI care) uses the ACRM TBI classification system.

Beyond the lack of clarity in diagnostic criteria and lack of objective indicators for the presence of mTBI, symptom management is also challenging. In the first few weeks following injury, it is common for the individual to experience physical symptoms (e.g., headache, dizziness, fatigue, sensitivity to light), cognitive changes (e.g., slowed processing, mental fogginess, memory changes, and attention/executive difficulties), behavioral/emotional symptoms (e.g., depression, irritability, anxiety), and sleep symptoms (Gouvier, Uddo-Crane, & Brown, 1988; McCrea, 2008; Ryan & Warden, 2003). It has been well established since the mid-1990s that symptoms related directly to a single mild brain trauma resolve quickly—in 7–10 days for many and by 3 months at the most for those with neurological vulnerabilities (Dikmen, Machamer, Fann, & Temkin, 2010; Dikmen, Machamer, & Temkin, 2001; Dikmen, Machamer, Winn, & Temkin, 1995; Schretlen & Shapiro, 2003). This finding has been replicated by multiple investigators with use of sophisticated statistical methodology (Rohling et al., 2011; Rohling, Larrabee, & Millis, 2012). However, in some individuals, symptom complaints persist for months and sometimes even longer. Postconcussion syndrome (PCS) has been used as a diagnostic label for these longer term symptoms following mTBI.

Postconcussion syndrome

There is little agreement in the literature about the prevalence, evolution, duration, or resolution of PCS symptoms. Growing

Table 1. Common definitions of mild traumatic brain injury (mTBI)

American Congress of Rehabilitation Medicine (ACRM) Mild Traumatic Brain Injury Committee, 1993	National Center for Injury Prevention and Control (US) of the Centers for Disease Control and Prevention (CDC), 2003	World Health Organization Collaborating Centre Task Force on Mild Traumatic Brain Injury (WHO MTBI, C, 2004
"A patient with mTBI is a person who has had a traumatically induced physiological disruption of brain function, as manifested by at least one of the following: (1) any period of loss of consciousness; (2) any loss of memory for events immediately before or after the accident; (3) any alteration in mental state at the time of the accident (e.g., feeling dazed, disoriented, or confused); and (4) focal neurological deficit(s) that may or may not be transient; but where the severity of the injury does not exceed the following: • loss of consciousness of approximately 30 minutes or less; • after 30 minutes, an initial Glasgow Coma Scale (GCS) of 13–15; and • posttraumatic amnesia (PTA) not greater than 24 hours."	"The conceptual definition of mTBI is an injury to the head as a result of blunt trauma or acceleration or deceleration forces that result in one or more of the following conditions: Any period of observed or self-reported: • Transient confusion, disorientation, or impaired consciousness; • Dysfunction of memory around the time of injury; • Loss of consciousness lasting less than 30 minutes. Observed signs of neurological or neuropsychological dysfunction, such as: • Seizures acutely following injury to the head; • Among infants and very young children: irritability, lethargy, or vomiting following head injury; • Symptoms among older children and adults such as headache, dizziness, irritability, fatigue or poor concentration, when identified soon after injury, can be used to support the diagnosis of mild TBI, but cannot be used to make the diagnosis in the absence of loss of consciousness or altered consciousness. Research may provide additional guidance in this area."	"mTBI is an acute brain injury resulting from mechanical energy to the head from external physical forces. Operational criteria for clinical identification include: (i) 1 or more of the following: confusion or disorientation, loss of consciousness for 30 minutes or less, post-traumatic amnesia for less than 24 hours, and/or other transient neurological abnormalities such as focal signs, seizure, and intracranial lesion not requiring surgery; (ii) Glasgow Coma Scale score of 13–15 after 30 minutes post-injury or later upon presentation for healthcare. These manifestations of MTBI must not be due to drugs, alcohol, medications, caused by other injuries or treatment for other injuries (e.g. systemic injuries, facial injuries or intubation), caused by other problems (e.g. psychological trauma, language barrier or coexisting medical conditions) or caused by penetrating craniocerebral injury."

Note. mTBI = mild traumatic brain injury.

evidence indicates noninjury factors, as opposed to the injury itself, predict incomplete recovery or prolonged PCS symptoms in individuals with mTBI (Rohling et al., 2011; Wäljas et al., 2015). Symptoms may be attributable to a comorbidity such as a psychological diagnosis (e.g., posttraumatic stress disorder or PTSD) or tendency (e.g., health anxiety; Vasterling, Bryant, & Keane, 2012), or in some cases may be conceptualized as a somatoform presentation (Williams, Potter, & Ryland, 2010). Vanderploeg, Belanger, Curtiss, Bowles, and Cooper (2019) examined multiple longitudinal studies and concluded that many or all symptoms in the chronic PCS stage were not related to mTBI but rather associated with factors such as pain, insomnia, stress, depression, or PTSD. Avoidance of activity due to fear has also been strongly associated with prolonged recovery (Silverberg, Panenka, & Iverson, 2018).

Another notable factor is a history of prior concussions. Additional research is needed to understand the potentially chronic and cumulative effects of multiple concussions over time (Carson, 2017; Godbolt et al., 2014; Iverson, Echemendia, LaMarre, Brookes, & Gaetz, 2012; Ponsford et al., 2012; Scopaz & Hatzenbuehler, 2013; Silverberg et al., 2013). Donnell, Kim, Silver, and Vanderploeg (2012) compared percentages of individuals meeting symptom-based *International Classification of Diseases, Tenth Revision* (*ICD-10*) criteria for PCS in a sample composed of subgroups diagnosed with either a history of mTBI or a psychiatric condition (PTSD, Generalized Anxiety Disorder [GAD], depression, or somatization). Although 27% of those with a history of mTBI met criteria for PCS based on subjective report of symptoms, 39% of those with PTSD met criteria, 41% with GAD, 55% of those with depression, and 91% of those with somatization met criteria for PCS, despite having no history of mTBI. These findings support the nonspecificity of PCS symptoms.

Consistent with the notion that psychiatric symptoms may be the cause rather than the consequence of concussion symptoms, Zahniser et al. (2019) demonstrated using structural equation modeling that depression and anxiety symptoms predicted functional impairment, but the reverse (that functional impairments predicted depression and anxiety) was not supported by the data. Thus, it stands to reason that subjective report of PCS symptoms does not indicate a direct relationship between mTBI and symptom experience. This leaves the clinician walking a fine line where the patient's experience of PCS symptoms should not be invalidated and also should not be directly linked to history of mTBI.

The concept of cognitive reserve has been applied to account for individual differences in the degree of brain injury and its clinical manifestations or the brain's ability to compensate for damage (Stern, 2009). It has been suggested that individuals with low cognitive reserve may be at greater risk for persistent cognitive symptoms (Oldenburg, Lundin, Edman, Nygren-de Boussard, & Bartfai, 2016), or that cognitive reserve may serve a protective effect on the impact of injury (Donders & Stout, 2019).

Another issue that has made PCS a complicated clinical construct is the lack of observable deficits on objective neurocognitive measures of assessment (Ponsford et al., 2000; Rohling et al., 2011; Schretlen & Shapiro, 2003). Studies using self-report measures of symptoms and distress, however, have found that some individuals with mTBI continue to subjectively report symptoms 1 year or more after injury (Hou et al., 2012; Ingebrigtsen, Waterloo, Marup-Jensen, Attner, & Romner, 1998; McMahon et al., 2014). In a prospective study over a 12-month period, McMahon et al. (2014) found that 77% of 375 patients with mTBI reported at least one symptom of PCS 3 months postinjury, with a significant increase in symptom report from 3 months to 1 year. This does not align with the known physiological recovery trajectory following TBI in which there is an acute insult, followed by a period of healing, not worsening, of the brain injury. From a psychological perspective, however, this is not unexpected as people are known to have poor accuracy when estimating their own cognitive abilities as compared with others and are prone to "hindsight bias." In the context of what is often referred to as "diagnosis threat" (Pavawalla, Salazar, Cimino, Belanger, & Vanderploeg, 2013), a tendency toward heightened awareness of cognitive lapses and to some extent, a manifestation of a self-fulfilling prophecy of impairment creates a presentation as impaired, which contributes to distress long after the neurological underpinnings of mTBI have resolved.

In sum, the "miserable minority" of persons who do not recover fully or quickly from concussion has been well described in the literature (Ruff, 2011) but has been statistically disproven to reflect the effects of neurological injury (Rohling et al., 2012). Research has consistently demonstrated that predictors of persistent PCS symptoms include psychiatric comorbidities and litigation status in relation to the injury (Hanks et al., 2019; Tsanadis et al., 2008). The results of numerous meta-analyses suggest that symptoms commonly referred to as PCS have little to do with the brain injury itself, as their persistence is in direct opposition to the known, fairly linear, recovery course of mTBI (Dikmen et al., 2001; Donnell et al., 2012; Rohling et al., 2011; Schretlen & Shapiro, 2003). As such, objective measures designed to capture the effects of brain injury are unlikely to capture the symptoms and distress reported by patients who have prolonged recovery following mTBI, and subjective measures are likely to reflect global distress and overinterpretation of relatively normal and benign physical, cognitive, and emotional experiences.

The nonspecificity of PCS symptoms complicates assessment and management of reported symptoms following mTBI. The label itself can result in symptom misattribution, as it implies that the symptoms are direct results of concussion, despite considerable evidence that nonneurological factors best predict persistent symptom report. Because of varying clinician expertise and awareness of this scientific literature, it may be difficult for persons reporting persistent symptoms following mTBI to receive consistent clinical care and for professionals to decide on the best course of assessment and management (Turgoose & Murphy, 2018).

Posttraumatic stress disorder

Posttraumatic stress disorder with dysfunctional regulation of fear conditioning may develop early after injury or may have a delayed onset. A prospective study of accident victims found that 14% met criteria for PTSD at 6 months postinjury (Gil, Caspi, Ben-Ari, Koren, & Klein, 2005). These rates are higher in the military population with risk of exposure to extreme psychological stress or life-threatening contexts in which mTBI may be sustained (Hoge et al., 2008; Vasterling et al., 2012). A systematic review of military injuries found that PTSD co-occurred in 33%–39% of those with mTBI (Carlson et al., 2011).

One important issue that has been examined in the literature is whether co-occurrence of mTBI and PTSD leads to deficits over and above their individual effects. Brenner et al. (2009) found no differences in neurocognitive performance between Veterans with PTSD only, compared with those with both mTBI and PTSD. However, Combs et al. (2015) found that those with comorbid mTBI and PTSD performed worse on several neuropsychological measures than did Veterans in the mTBI only and PTSD only groups. It is worth noting that no measures of engagement or performance validity were utilized in the study by Combs et al. (2015), thus making it difficult to determine how much of the effect on test performance was due to effort versus true cognitive ability.

There is evidence from neuroimaging studies of similar connectivity disruptions in persons with mTBI or PTSD (Kaplan et al., 2018). However, such findings are common in numerous psychological and neurological disorders and thus lack specificity to either PTSD or TBI (Asken, DeKosky, Clugston, Jaffe, & Bauer, 2018). As such, it is as yet unclear how comorbid PTSD and mTBI, in the context of many other factors, may uniquely contribute to a patient's experience of distress and functional impairment.

> Studies suggest that comorbid psychological diagnoses such as PTSD may impact performance on cognitive testing above and beyond the mTBI in ways that as yet are not entirely clear, as research findings are mixed and findings of abnormalities often lack specificity to any one cause.

Other comorbidities

As stated previously, a variety of other demographic and/or health issues can confound the clinical presentation following mTBI or concussion including general mental health status, personality traits, and/or stress-related disorders; education; substance abuse; precipitation of preexisting medical conditions that are exacerbated by mTBI; psychogenic and/or iatrogenic disorders; somatization, which can frequently account for PCS symptoms when other comorbidities are ruled out; conversion disorder; and suggestibility effects (Delis & Wetter, 2007; Dikmen et al., 2001; Dikmen et al., 2010; Iverson & Lange, 2003; Larrabee, 2003; Larabee, 2007; Waldron-Perrine et al., 2012). Low psychological resilience is also a significant predictor of reported PCS symptomatology, independent of mTBI history (Sullivan, Edmed, Allan, Smith, & Karlsson, 2015).

In the context of mTBI, it is often the case that the patient's interpretations of symptoms as inconsistent with a stable sense of self, or are seen as barriers to successful functioning in life that create more problems than the symptoms themselves. That is, it is not the experienced symptom but rather the belief about how the symptom negatively impacts the patient's life that actually affects the patient's functional status. In the rehabilitation and neuropsychological literature, this presentation is conceptualized and treated as part of a somatoform condition if it cannot be objectively verified as having a physiological etiology and is inconsistent with medical investigations (Cassidy et al., 2014; Larrabee, Binder, Rohling, & Ploetz, 2013). A specific variant of this presentation has been termed "cogniform" in the case of perceived cognitive deficits in the absence of objective neurological indicators of impairment (Delis & Wetter, 2007). Delis and Wetter (2007) further contend that it is important to differentiate somatoform/cogniform symptoms from the brain injury itself to avoid iatrogenesis (the harmful effect of mistreating a psychological difficulty as a physical impairment), consequent to misdiagnosis of brain dysfunction by health practitioners in the absence of adequate medical or psychometric evidence for such a diagnosis.

INTERPROFESSIONAL COLLABORATIVE MANAGEMENT OF COGNITIVE SYMPTOMS FOLLOWING mTBI

For the reasons described previously, assessment and treatment of individuals who report persistent symptoms following mTBI can be challenging. These symptoms can be classified as (1) somatic or physical/sensory (e.g., headache, sleep disturbance, fatigue, dizziness, photophobia); (2) affective or emotional (e.g., anxiety, increased irritability, depression); or (3) cognitive (e.g., attention and memory problems, increased distractibility, losing one's train of thought, feeling foggy, difficulty multitasking, and slow speed of processing). Many of these symptoms interact with and exacerbate each other to negatively affect function (Prince & Bruhns, 2017).

Given that many psychosocial determinants appear to be the primary driving factors for report of persistent PCS, such as anxiety, depression, PTSD, avoidance, and low psychological resilience (Meares et al., 2011; Rohling et al., 2011; Silverberg et al., 2018; van der Naalt et al., 2017; Wäljas et al., 2015), a patient-centered, collaborative model for assessment and treatment, rather than a traditional medical model, would likely yield the best outcomes. Using a patient-centered model presents an opportunity for increasing resilience in patients who present with these challenges through collaboration among patient, psychologists, and speech-language pathologists (SLPs; Neils-Strunjas et al., 2017; Waldron-Perrine et al., 2016).

Biopsychosocial models, such as the World Health Organization's (WHO), International Classification of Functioning, Disability and Health (ICF; WHO, 2001), provide a common language and theoretical framework for comprehensive health care management that encompasses both traditional and patient-centered approaches. Optimal implementation of such models for individuals with persistent mTBI depends on ongoing interprofessional collaboration among rehabilitation professionals including psychologists and SLPs (Paul-Brown & Ricker, 2003; Ylvisaker, Hanks, & Johnson-Greene, 2002). Interprofessional care also provides improved access (i.e., referrals from one provider to another to address symptoms causing functional impairment) and health care cost savings (i.e., coordinated care decreases redundancies in services and use of inappropriate services; Zwarenstein, Goldman, & Reeves, 2009).

The Joint Committee on Interprofessional Relations Between the American Psychological Association (APA) and the American Speech–Language–Hearing Association (ASHA), a group comprising of clinical neuropsychologists/rehabilitation psychologists and SLPs, has consistently worked toward the common goal of improved and increased interprofessional relationships for the benefit of both disciplines. Since its inception in 1989 and joint position statement recognizing that the "mutual respect and cooperation between disciplines and professions is an ongoing necessity" (Joint Committee on Interprofessional Relations Between ASHA and Division 40 of the APA, 1990), the committee has worked to provide information and guidance for SLPs and psychologists in the cooperative and collaborative assessment and treatment of persons with brain injury (see www.asha.org/apa/). The Joint Committee also advocates for interprofessional education at the preservice and in-service levels to enhance collaboration and communication among rehabilitation team members (Sander, Raymer, Wertheimer, & Paul, 2009; WHO, 2010).

Collaboration during evaluation/intervention planning maximizes opportunities to streamline assessment in a time-efficient manner and integrate professional expertise across disciplines (Wertheimer et al., 2008). This is especially important in patient-centered approaches that often require specialized training and extended evaluation/intervention sessions. Because psychologists and SLPs often use complementary assessment tools, collaboration limits redundancy of assessment procedures and/or reduces practice effects resulting from administration of identical or similar instruments. It also increases the likelihood that interpretation of test results is based on all available information, including data from both standardized testing and patient-centered qualitative evaluations (Joint Committee on Interprofessional Relations Between ASHA and Division 40 of the APA, 1989).

A patient-centered management model, in which assessment and treatment are driven by the collaborative efforts of the patient, psychologist, and SLP, presents a tremendous opportunity for increasing patient resilience and supporting optimal therapeutic outcomes (Neils-Strunjas et al., 2017; Waldron-Perrine et al., 2016). Given the close association between psychosocial factors and report of persistent PCS, (Meares et al., 2011; Rohling et al., 2011; Silverberg et al., 2018; van der Naalt et al., 2017; Wäljas et al., 2015), this model seems particularly well-suited for the management of mTBI.

What to treat? When test results fail to corroborate patient's report of symptoms

Patients with cognitive concerns following mTBI present with complex constellations of strengths and limitations. High functioning individuals, in particular, may notice very subtle changes in their thinking that dramatically affect their perceived ability to function in specific ways. Such nuanced changes do not lend themselves to detection on standardized testing. Performance within normal limits on standardized testing often does not correspond with the patients' subjective experience of cognitive decline following their neurological event (Carone, 2017). This discrepancy must be addressed in the context of feedback and processing of findings, or it may interfere with alliance building in the context of therapy. Attempts to reconcile the difference between subjective experience and objective data using personalized education can be an important step in helping the patient identify the role of interpretation in the experience of distress. Self-efficacy can then be restored through a series of goal-oriented behavioral successes. Education on potentially controllable nonneurological factors contributing to an individual's prolonged symptom report can help combat iatrogenesis and reification of the disability identity.

It is important for the clinician to empathize with the patient's experience as well as reflect on performance on standardized tests and, as needed, to explain and resolve any discrepancies. An emphasis on reestablishing self-efficacy and addressing controllable contributory factors is essential for optimal symptom management.

Setting a general expectation for functional recovery is imperative for optimal rehabilitation outcomes (Working Group to Develop a Clinician's Guide to Cognitive Rehabilitation in mTBI, 2017), and this expectation setting must occur across disciplines. Given the common presence of diffuse and multiple symptom loads, it is important to take the perspective that the treatment goal and ability to attain that goal do not depend solely on the etiology of the difficulty (i.e., neurological or otherwise). Rather, the person-centered goal is to "... reduce suffering and improve functioning and quality of life" (Iverson, 2010, p. 318). This can occur regardless of ability, provided that the environment and approach are modified to support the individual's attainment of the goal, or the goal is modified to be reasonable within the present environment and at an appropriate level of difficulty on the goal hierarchy (i.e., stepwise progression of goals leading to "big picture" functional goals).

As an example, military service members and Veterans are at risk for conditions including physical impairments, cognitive challenges, and psychological stressors that can impede postdeployment functioning and reintegration. The approach taken by the Department of Defense and the Veterans Health Administration is to aggressively treat what is treatable, with the assumption that systematically treating complaints (e.g., light sensitivity, sleep disturbance, anxiety) can have concomitant benefits (e.g., reduce headaches, improve cognition). Addressing their multiple needs simultaneously with interprofessional interventions for TBI sequelae supports their readjustment to civilian life and achievement of academic and vocational potential (Pogoda et al., 2016). It is important to note that evidence-based rehabilitation emphasizes time-limited therapy in the context of expectations for patient progression toward independence or supported independence.

In sum, this approach to symptom management (1) emphasizes a focus on symptoms and problems rather than the diagnostic conundrum, (2) captures the essence of a person-centered or process-oriented approach to managing mTBI, and (3) is well supported by both the literature and expert consensus (Iverson, 2010; Working Group to Develop a Clinician's Guide to Cognitive Rehabilitation in mTBI, 2017). This emphasis, and a shift away from a formal etiology-based therapeutic milieu, are essential for maximum functional progress and development of self-confidence.

Positive prognosis for recovery from mTBI should be emphasized to offset potential misinformation suggesting a long and unpredictable course with the possibility of permanent damage. Evidence supports an emphasis on progression toward maximal independence with time-limited therapy and gradual fading of supports as appropriate.

Interprofessional perspectives in assessment

In the absence of objective baseline test data, it is difficult to determine to what extent an individual's subjective perception of decline reflects objective decline rather than the influence of cognitive bias. That is, when a diagnosis of mTBI is conferred, an adjustment reaction may manifest as anxiety, and an individual's symptom perceptions may be magnified, resulting in overinterpretation of relatively benign and common cognitive lapses and, subsequently, poor cognitive self-efficacy, or feeling that one is incapable of being successful in his or her thinking (i.e., problem solving, remembering). Concern about the symptoms often results in anxiety manifesting as greater attention to physical or cognitive symptoms, resulting in perceived exacerbation, a cyclical pattern that is difficult to disrupt. It is important that clinicians interacting with patients prone to this experience of health anxiety do not engage in iatrogenic care (e.g., reification of the patients' worries that their experience of impairment or distress will be permanent) and instead emphasize an expected trajectory of recovery with personalized education and engagement in consistent use of compensatory strategies to aid in incremental resumption of functional activities.

Assessment also provides an opportunity for the measurement of patient engagement via performance validity tests (PVTs), the results of which may inform the case conceptualization and treatment plan. Neuropsychological abilities as measured by standardized tests are known to be impacted more by effort toward cognitive tasks than by TBI of any severity (Green, Rohling, Lees-Haley, & Allen, 2001). Without consideration of patient engagement or effort, erroneous conclusions may be made about the patient's rehabilitation potential and the underpinning of functional difficulties. To maximize patient engagement and rehabilitation outcome if effort is a salient factor, collaboration between SLPs and psychologists is critical during the assessment process. The psychologist should consult with the SLP and other therapists before providing feedback to establish what behavior patterns exist and to integrate the assessment information from all disciplines in such a manner as to establish a cohesive treatment plan and maximize patient engagement.

Patient-centered assessment is essential to formulation of patient-centered treatment plans and may take several forms. A few for which there is an evidence base are described in the following sections.

Collaborative individualized assessment

The purpose of Collaborative Individualized Assessment (Fischer, 2000) is patient empowerment through inclusion in the evaluation process to yield a rich characterization of the patient's strengths and weaknesses. In this approach, the clinician and the patient collaborate to individualize the assessment, including the use of both standardized and functional assessment tools. Life events are considered the primary data source, and diverse tools can be utilized to collect data, whereas standardized test scores and functional assessment tools are secondary sources. Assessment results are interpreted within the context of the patient's life.

Dynamic assessment

Given the emphasis on functional symptoms, traditional assessment tools often lack precision with regard to identification of functional challenges and goals that may be related to cumulative, often nonneurological symptom impact. Dynamic assessment can inform the development of effective intervention by describing performance in the context of real-world settings and activities, where and when challenges are likely to manifest. Dynamic assessment allows the clinician to explore the effects of both objectively measured and subjectively perceived changes in functional ability with specific situational demands and supports (Coelho, Ylvisaker, & Turkstra, 2005; Turkstra, Coelho, & Ylvisaker, 2005). This allows for the development of functional goals relevant to the individual's life and values, resulting in opportunities for him or her to experience success in performing functional cognitive tasks, an experience that is necessary to manage anxiety and develop confidence.

Although again a departure from the traditional medical model of care, dynamic assessment is consistent with the WHO ICF in that it (1) unifies and standardizes language for functioning, disability, and health to facilitate interprofessional care, (2) determines the patient's needs according to functioning status rather than etiological diagnosis (Laxe, Cieza, & Castaño-Monsalve, 2015), and (3) provides tools in TBI rehabilitation to understand and appreciate the "full burden of TBI."

Patient-centered feedback and personalized education after assessment

Feedback following assessment, including personalized education, is essential to fulfilling the purpose of testing. Establishing positive rapport and empathy for the patient is essential throughout the therapeutic process, and especially critical as the clinician reviews and communicates the purpose of the assessment and the findings, in plain, simple language. The clinician should integrate the assessment findings with information from other providers to emphasize generalizability of the findings. The results should be summarized in terms of cognitive strengths and weaknesses, with the word "impairment" used with extreme caution to minimize "diagnosis threat" (Pavawalla et al., 2013).

During the feedback session, it is helpful to emphasize how the findings relate to everyday life concerns that the patient reported at the outset of the evaluation, consider assessment findings of other interdisciplinary team members and how the findings fit with theirs, and describe the test findings in terms of domains of daily functioning and behavior. If engagement in the testing process is found to be suboptimal via performance validity measures, these data can be utilized to demonstrate for the patient how reduced engagement, including in life activities, can adversely impact successful performance. Feedback also provides the opportunity to provide salient education with regard to not only likely etiology of symptoms (i.e., neurologically based, caused by the general impact of stress and trauma, or influenced by general health and social practices) but also the importance of general self-care practices including sleep hygiene, minimizing substance use, exercise, hydration, healthy dietary habits, and behavioral modifications for pain management (i.e., pacing). The feedback session should end with reassurance that interventions exist that can address the patient's experience of cognitive challenges, and this should be expressed with empathy by the clinician from the patient's perspective. Reflection of themes of resilience is also recommended to positively influence self-efficacy and maximize the likelihood of continued therapeutic engagement.

> Because it is likely that formal neuropsychological testing results for the patient with mTBI will indicate few, if any, impairments or even inefficiencies, the clinician should reaffirm understanding of the patient's struggles, while reinforcing areas of resilience that the patient exhibited to support self-esteem and self-efficacy.

Transitioning from patient-centered assessment to patient-centered treatment

Collaboration throughout the intervention process increases knowledge; facilitates the use of shared terminology, and hence clear and consistent communication to both the patient and the other medical professionals; supports the development of complementary, valid, and meaningful treatment plans that maximize personal relevance; and ultimately contributes to successful patient outcomes

(Sander & Constantinidou, 2008). The importance of holistic rehabilitation is highlighted, with emphasis on the entire person and building the efficacy of that individual.

The concept of person-centered therapy originated in the 1950s with Carl Rogers (Rogers, 1951), who believed that patients should be encouraged to focus on their subjective understanding of their experiences, rather than on the interpretation of others regarding their situation. He defined a person-centered approach as an individualized, biopsychosocial approach that includes assessing current physical, cognitive, and emotional states and relevant historical factors. Rogers believed that clinicians must follow three core principles to effectively connect with patients: (1) genuineness, (2) unconditional positive regard, and (3) empathic understanding. These principles along with an individualized approach are used to identify a person's values, goals for treatment, and challenges that impact the person's daily living. Through this process, the clinician acknowledges the patient as a unique individual and an expert about himself or herself and not as an impairment or disease. This approach encourages collaboration between clinician and patient and increases the patient's sense of empowerment and self-efficacy.

Although the practice of incorporating multiple factors of a patient's life into treatment plans and goals is common today, prior to Rogers, the medical aspects (i.e., presumed diagnosis) of the patient were the driving force in determining treatment options formulated by clinicians with little input from the patient or the family. The commitment to a patient-centered approach requires time, which can be challenging with large caseloads and shorter lengths of treatment. Collaborative, interprofessional teams, therefore, are critical to successfully engaging in person-centered interventions.

Treatment outcome measures

Although the rationale for use of dynamic assessment and person-centered interventions is clear, it should also be emphasized that measurement of progress is key to continued patient motivation and informed guidance of the treatment plan. Tracking progress toward treatment goals optimizes patient engagement with goal-directed behavior and promotes self-efficacy. What is less clear is how best to measure progress with regard to symptom burden and functional recovery. Given the multifaceted nature of functional goals, it is unlikely that one measurement tool will successfully capture the nature and extent of positive change experienced over the course of rehabilitation. The literature supports the idea that flexible and ecological measures can be effective in capturing change in person-centered outcomes (Ylvisaker et al., 2002).

Some tools for measuring treatment progress are referenced in Table 2. Goal Attainment Scaling (GAS) is particularly useful in addressing patient-identified goals (Malec, 1999). The patient–clinician team (including the SLP and the psychologist) develops objectively anchored, functional goals that are relevant and realistic. Levels of goal achievement are established in incremental steps of functional progression that are appropriate to patient expectations (Turner-Stokes, Williams, & Johnson, 2009; Working Group to Develop a Clinician's Guide to Cognitive Rehabilitation in mTBI, 2017). The universality of the metric of GAS facilitates comparison of progress across contexts, allowing for additional tracking of information relevant to maximizing functional progress.

> A list of measurement tools for mTBI is referenced in Table 2, with Web sites that contain references for interpretation and patient education. Goal Attainment Scaling is a metric that can be individually tailored and applied across patient contexts.

Optimizing treatment effectiveness and patient engagement

Management of symptoms requires a balanced approach that simultaneously (1) validates patient experience of decreased

Table 2. Measurement tools for mTBI[a]

- Functional measures for mTBI
  - Goal Attainment Scaling (GAS): Set of patient-specific goals developed collaboratively with clinician; progress toward attaining goals is tracked over the course of treatment—can be used as an outcome assessment measure (http://www.cckm.ca/CPSLPR/pdf/Schlosser2004.pdf)
  - Patient Reported Outcomes (PRO): Wide range of PRO measures for different outcome purposes (http://www.nihpromis.org)
  - The Center for Outcome Measurement in Brain Injury (COMBI) Web site (http://www.tbims.org/combi/list.html) provides access to many commonly used outcome measures, including the following:
    - Mayo-Portland Adaptability Inventory (MPAI): It includes three subscales—Ability, Adjustment, and Participation (http://www.tbims.org/combi/mpai/)
    - Patient Competence Rating Scale: Self and collateral report of functional independence (also COMBI Web site)
    - Health-related Quality of Life (HRQOL) measures: Variety of HRQOL outcome assessments for concussion/mTBI; some are available via NIH Toolbox (http://www.nihtoolbox.org/Pages/default.aspx)
- Postconcussive symptom measures for mTBI
  - Key Behaviors Change Inventory (KBCI): Another HRQOL measure that has been used in mTBI outcome assessment (https://www.researchgate.net/publication/10886669_Development_of_the_Key_Behaviors_Change_Inventory_a_traumatic_brain_injury_behavioral_outcome_assessment_instrument)
  - Neurobehavioral Functioning Inventory (NFI): Similar to the KBCI (http://www.tbims.org/combi/nfi/index.html)
  - Neurobehavioral Symptom Inventory (NSI): A postconcussive symptom self-report measure commonly used with Military Service Members and Veterans
  - Satisfaction surveys: Often site-specific—particularly useful in assessing outcomes at provider or program level

Note. mTBI = mild traumatic brain injury; NIH = National Institutes of Health.
[a]Working Group to Develop a Clinician's Guide to Cognitive Rehabilitation in mTBI (2017).

functioning without suggesting or reinforcing that this experience is a direct result of neuropathology, and (2) offers a positive pathway for improved function based on building patient self-esteem and resilience. In changing the interpretation of symptom experience from one of "brain injury victim" to one of active "spotlight shifting" (i.e., decreasing patient focus, the "spotlight," on the symptom by guiding the patient to reengage in meaningful, values-based activities), the clinician is empowering the patient to move toward improved functioning while not providing or reifying misinformation that may lead to iatrogenesis. This allows the patient to feel understood while maintaining an evidence-based approach for setting expectations.

Treatment involving predominantly evidence-based compensatory strategy training can address both self-efficacy and functional symptoms in accordance with basic learning principles: (1) incremental goal setting with opportunities for the experience of mastery at regular intervals; (2) alignment with patient on goals and approaches; (3) guided practice of strategies in context; and (4) teaching to mastery. A more thorough review of recommended guidelines for engagement in cognitive rehabilitation is available elsewhere (i.e., INCOG Guidelines; Bayley et al., 2014).

> Regardless of etiology, SLPs and psychologists need to address functional difficulties with day-to-day attention, working memory, speed of processing, organization, and time management by teaching compensatory strategies and building confidence to

decrease anxiety associated with perceived cognitive lapses.

A number of approaches from the psychological literature are relevant across disciplines to optimize treatment effectiveness when working with patients. Whereas research with regard to a collaborative patient-centered approach applied specifically to the mTBI population remains in its infancy, approaches that are considered patient-centered have been empirically supported in other rehabilitation populations. A few approaches are described in the following sections in the context of their potential application to mTBI to provide clinicians with a basic understanding of strategies to incorporate into their clinical practice.

Motivational interviewing

Motivational interviewing (MI) is a directive but patient-centered therapeutic style that enhances readiness for change by helping patients explore and resolve ambivalence (Rollnick & Miller, 1995). The clinician asks permission to provide information to the patient ("Can I tell you what the data tells us about how you're doing?"), and if the patient agrees, feedback is provided. The clinician elicits the patient's reaction to the feedback ("So how are you taking that in?") and responds with open-ended questions ("Tell me more about what you're thinking"), affirmations ("That sounds like a step in the right direction"), reflective statements ("I'm hearing you say you know you need this, but it's hard to stick to your plan"), and summarizations (a recap of pros and cons of changing behavior). If the patient disagrees, becomes angry, or questions the accuracy of the feedback, the clinician, rather than justifying or becoming defensive, "rolls with resistance" through empathy with the patient's perspective ("This is really hard, I can imagine"). Reflective listening is used to clarify the nature of the resistance with open-ended and evocative questions. A recent meta-analysis revealed a large initial effect and moderate long-term effect, particularly for ethnic minorities and when practiced without a manual to guide MI delivery (Hettema, Steele, & Miller, 2005).

The theoretical foundation of MI is grounded in psychological constructs. Motivational interviewing has particular relevance to interprofessional management of mTBI because of the dynamic interplay of neurological, psychosocial, and cognitive influences on functioning. Issues that can be addressed collaboratively to optimize engagement in the rehabilitation process include (1) cultivating readiness for change; (2) overcoming resistance or resolving ambivalence; (3) building intrinsic motivation and commitment to using therapeutic strategies; (4) fostering resilience and psychosocial adjustment with coping strategies; and (5) promoting self-efficacy by increasing insight of limitations and reinforcing belief in capabilities to self-monitor and self-regulate behavior (Medley & Powell, 2010).

A shared MI communication style strengthens therapeutic alliance and reinforces consistent messaging from the psychologist and the SLP with empathic listening and collaborative decision making. As an example, a patient expresses resistance in using a written planner to track appointments because it involves "extra steps that weren't necessary" prior to injury. The patient prefers the planner over other options because it does not involve technology or the assistance of others. The SLP employs principles of MI to help identify the benefits of engaging in strategy use to compensate for memory lapses that result in missed appointments. The psychologist reinforces use of the planner to increase compliance in documenting events that trigger anxiety in the patient's daily routine.

With roots in a Rogerian person-centered approach, MI stimulates change talk, motivation, and commitment from the patient. The goal of MI is to set the stage and allow the patient to resolve ambivalence about making any specific behavior change (such as using a memory strategy or improving sleep hygiene), while reflecting and amplifying change talk.

Dynamic coaching

Dynamic coaching is a collaborative, problem-solving process that includes active engagement and interaction between the clinician and the patient (Kennedy, 2017; Kennedy & Krause, 2011). This approach is based on evidence from instructional practices (Ehlhardt et al., 2008; Kennedy et al., 2008) and incorporates strategies from MI (Kennedy, 2017). Ylvisaker and Feeney (1998) developed a collaborative approach to rehabilitation in which the clinician partners with the patient to formulate and systematically address patient-specific hypotheses. This rehabilitative process, described as problem-solving and reciprocal-adjusting to achieve positive outcomes, evolved into a self-coaching approach (Ylvisaker, 2006) within a context-specific framework. In dynamic coaching, the patient is empowered by the clinician to assume a self-regulating, problem-solving mind-set to achieve personalized goals. The clinician serves as a coach, modeling and instructing the patient in compensatory strategies. The patient is regarded as an expert with self-awareness and insight to identify his or her needs, develop meaningful goals, implement strategies that support the goals, monitor performance, and evaluate goal attainment (Kennedy, 2017; Working Group to Develop a Clinician's Guide to Cognitive Rehabilitation in mTBI, 2017).

Dynamic coaching is most effective when (1) functional, patient-centered goals are developed collaboratively; (2) strategies are selected by the patient and aligned with self-appraisal of his or her skills and abilities; (3) metacognitive awareness and direct instruction are used to train strategies; and 4) practice supports meaningful activity and takes place in real-world contexts. (Working Group to Develop a Clinician's Guide to Cognitive Rehabilitation in mTBI, 2017)

Acceptance and Commitment Therapy

Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 2016) is a therapeutic intervention that has its roots in behavioral therapy, more specifically Relational Frame Theory (RFT), and mindfulness (Powers, Zum Vorde Sive Vording, & Emmelkamp, 2009). It was developed by clinical psychologist Steven Hayes as one of the "third wave" cognitive behavior therapies (CBT). A key component of ACT, and one that sets it apart from other behavior therapies, is its emphasis on values-guided, mindful action. In fact, the goal of ACT is to lead the patient to a values-based, mindful existence. For example, when a patient is thinking about who he or she wants to be and what changes that he or she wants to make, the clinician asks questions such as: "What do you want to stand for in life?" or "What really matters to you?" The patient then works with the clinician to determine whether he or she is acting in accordance with personal values, "making room" for unwanted thoughts and feelings that are difficult to extinguish. If the patient is not engaging in value-consistent behavior, the clinician assists the patient in moving toward alignment through values-guided action with ACT-based skills and principles, in order to achieve an enriched and fulfilling life (Harris, 2009).

A second way in which ACT differs from other therapeutic approaches (which also makes it particularly appropriate for persistent symptoms following mTBI) is that it does not focus directly on symptom reduction. Rather, ACT purports that people can live fulfilling and enriched lives by using the ACT principles, regardless of the symptom experience. Acceptance and Commitment Therapy assumes first, that quality of life is primarily dependent upon mindful, values-guided action, and second, that this is possible regardless of how many symptoms one has, provided that one responds to symptoms with mindfulness (Harris, 2009). Although the goal of ACT is not to reduce symptoms, symptom reduction has occurred as a "side effect" in randomized controlled trials using this therapy approach, often over and above traditional CBT (Jiménez, 2012). Paradoxically, if one is focusing on reducing symptoms, then one is, by definition, focusing on the symptoms (i.e., "spotlighting"), which can exacerbate the symptom experience. Conversely, when the "spotlight" is shifted away from the symptoms and toward values-based action, symptom perception is often reduced.

In collaborative interventions, the psychologist can initiate therapeutic strategies based upon principles of ACT and consult with the SLP to infuse the use of values and acceptance language to reinforce concepts of ACT. For example, the SLP might say, "Is asking your supervisor for additional time to complete assignments in line with your goals and values or can you see how it might be related?" or "It's normal to feel apprehensive about doing this. See if you can explore or reflect on this feeling, then do what you know is important."

Acceptance and Commitment Therapy is a therapeutic intervention that has its roots in behavioral therapy, more specifically RFT, and mindfulness. The goal of ACT is to lead the patient to a values-based, mindful existence and live a fulfilling and enriched life by using ACT principles, regardless of his or her symptom experience.

Cultivating resilience to promote positive outcomes

Resilience has been described as a multidimensional construct which captures the personal qualities and skills of an individual that enables positive adaptation to adversity, hardship, or trauma (Neils-Strunjas et al., 2017; Waldron-Perrine et al., 2016). The concept of resilience has been applied to improved recovery trajectories following a TBI (Holland & Schmidt, 2015). Neils-Strunjas et al. (2017) identified five personal factors that can promote resilience in adults with acquired brain injury: (1) identify skills, beliefs, or values successfully used in the past to adapt to adversity; (2) highlight benefit-of-life experiences or trauma to assist in adjustment; (3) explore supportive relationships; (4) redevelop self-control and self-reliance in daily activities; and (5) focus on interests, beliefs, spirituality, and values that make life meaningful.

Strategies for improving resilience often include reengaging in avoided activities (e.g., work, driving, exercise, etc.), while learning adaptive strategies for managing reported symptoms (e.g., pacing, using schedules, and deep breathing). This helps the patient move the spotlight from the symptom experience to the meaningful activity at hand, facilitating a sense of mastery through persistence and endurance. Incorporating incremental concrete goals to increase behavioral activation and gradual exposure to avoided activities while incorporating symptom management strategies is further supported by the work by Silverberg et al. (2018). Specifically, this research found that avoidance of feared or anxiety-provoking experiences was the best predictor of prolonged symptom report following concussion, whereas endurance was the best predictor of positive recovery.

Collaboration between the SLP and the psychologist supports a deeper understanding of behaviors exhibited by patients. As an example, consider a patient does not complete assignments that support generalization of strategy use in nonclinical settings. Rather than assuming reasons for noncompliance, the SLP consults with the psychologist. Both agree that the patient is hesitant to engage in recommended therapy tasks because the fear of making a mistake seems to keep him from trying. Discussion in a joint therapy session with the SLP, psychologist, and the patient focuses on his expressed values, treatment goals, the role of avoidance, his response to feedback, and the role of the SLP and the psychologist to support achievement of incremental steps toward his overall goals. As a result, the therapeutic alliance is strengthened and the patient agrees to follow through with generalization tasks with the support of dynamic coaching in therapy sessions that transitions to self-coaching strategies in nonclinical contexts. The SLP and the psychologist will meet with the patient in 2 weeks to discuss the outcome of their collaborative plan.

SUMMARY

Neuropsychological assessment often fails to detect change from normal in the mTBI population; however, many individuals continue to subjectively experience subtle but impairing cognitive difficulties. Unfortunately, the literature does not address this from a scientific perspective because (1) standardized tests are insensitive to high-level nuances, and (2) perception of impairment is so highly influenced by belief systems and affective states that self-report of both history and present state is not always consistent with objective reality. Thus, treating holistically and functionally, regardless of etiology or level of impairment, and expressing empathy with the perception and the distress it causes, can result in positive outcomes.

Collaborative, patient-centered assessments and interventions by SLPs, neuropsychologists, and rehabilitation psychologists can optimize cognitive functioning and psychological well-being for patients with subjective symptom complaints following mTBI. A person-centered, process-oriented approach facilitates meaningful changes in the patient's life by optimizing the therapeutic milieu and building self-efficacy to support positive outcomes. Collaborative, patient-centered approaches and strategies promote a strong therapeutic alliance that empowers patient change to ultimately reduce limitations and increase participation in meaningful activities and roles, enabling the patient to move forward past the injury and maximize overall quality of life.

CLINICAL IMPLICATIONS

Managing postconcussion cognitive symptoms is not a simple task. Clinicians are equipped with a limited evidence base with findings that are often inconclusive or lacking the robustness to guide clinical decision making. However, emerging evidence offers promising potential for (1) making more definitive diagnoses (e.g., neuroimaging, biomarkers); (2) affirming risk factors for persistent symptoms (e.g., multifactorial conditions, history of multiple concussions, individual vulnerabilities, preinjury psychiatric history, premorbid personality traits); and (3) identifying factors that may serve as protective features to promote timely recovery (e.g., resilience, cognitive reserve, age, intellectual abilities/education, family functioning/social support, nutrition, exercise; Holland & Schmidt, 2015; Oldenburg et al., 2016; Prince & Bruhns, 2017). Rather than being mired in the quagmire of skepticism, proactive collaborative interventions can help patients overcome cognitive challenges and reduce the risk of persistent symptoms or negative psychosocial consequences. Implementing individualized cognitive rehabilitation provides opportunities for clinician–researchers to increase understanding and advance knowledge that can lead to innovations and inform future clinical decision making.

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