

# The Role of Speech-Language Pathology in an Interdisciplinary Care Model for Persistent Symptomatology of Mild Traumatic Brain Injury

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## ABSTRACT

The Marcus Institute for Brain Health (MIBH) provides interdisciplinary care for adults struggling with persistent effects of mild traumatic brain injury and accompanying changes in behavioral health, with specific emphases on Veterans and retired elite athletes. The cognitive, physical, and behavioral symptoms associated with mild traumatic brain injury are interrelated, with neurobiopsychosocial modeling encompassing the factors related to recovery from a traumatic brain injury. The diffuse impacts of chronic concussive injuries require multiple clinical providers to address the breadth of symptoms, facilitating both interdisciplinary and transdisciplinary care models. By implementing integrated practice units, patients receive advanced medical care, imaging, speech-language pathology, physical therapy, behavioral health, neuropsychology, and clinical pharmacy for a cohesive diagnostic and intervention plan. Nationally, speech-language pathologists report challenges with best-practice options for concussion, particularly in the domain of assessment practices. At the MIBH, speech-language pathologists begin their assessment with a structured clinical interview that focuses on patients' needs and concerns. Evaluation modalities focus on hearing, communication, and functional cognition to guide therapeutic treatment planning. The intensive outpatient care program at MIBH incorporates both individual sessions targeting patient-centered goals and group care, where speech-language

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pathologists work transdisciplinarily to generalize care from all disciplines out into the community. Care practices for concussive injuries continue to evolve rapidly; speech-language pathology at the MIBH offers one such vision for excellence in clinical care.

**KEYWORDS:** speech pathology, speech therapy, concussion, mild traumatic brain injury, interdisciplinary

**Learning Outcomes:** As a result of this activity, the reader will be able to (1) define integrated practice units; (2) list three tools recommended for assessment in mTBI; and (3) summarize how the neurobiopsychosocial model applies to mTBI.

It is estimated that 62 million individuals sustain mild traumatic brain injury (mTBI) annually worldwide and perhaps as many as 6 to 8 million individuals in the United States per annum alone as evidence continues to emerge on incidence of injury.<sup>1-3</sup> While many individuals recover relatively quickly, for a significant subset, postconcussive symptomatology lasts for months to years<sup>4</sup> and the prevalence of mTBI remains unclear. This common condition affects young children, healthy youth, and the elderly. It impacts sports legends, military Veterans, and everyday citizens. Qualitatively, individuals describe marked changes in sense of self post-mTBI as well as decreased academic performance, social engagement, financial stability, and overall quality of life.<sup>5-7</sup> The significant increase in concussive events and potential long-term effects of injuries have led to a marked increase in need for well-trained rehabilitationists in both educational and medical settings.

The past decade has seen marked changes in mTBI/concussion research and care. While many injuries are sports-related concussions, speech-language pathologists (SLPs) are frequently providing assessment and intervention for individuals after falls, motor vehicle accidents, assaults, military, and work-related injuries. Multidisciplinary care is recommended to address the breadth of symptoms post-mTBI with a team including medicine, physical therapy, behavioral health, and cognitive therapy,<sup>8,9</sup> which in the United States is most commonly provided by speech-language pathologists.<sup>10</sup> In military medicine, SLPs are noted to be a key member of the interdisciplinary team particularly for cognitive supports and implementation

of functional rehabilitation.<sup>11,12</sup> Despite this recommendation, inclusion of SLPs in the clinical care team for mTBI has been mixed.<sup>13,14</sup> In a specialty physiatric clinic, for those patients with persistent symptoms, speech-language pathology had a utilization rate close to that of physical therapy (23 vs. 28%), but had the longest time delay to referral and most referrals came from internal providers.<sup>15</sup> Advocates in speech-language pathology note that SLPs are “overlooked” in schools and medical settings despite being qualified to provide care.<sup>14,15</sup>

As is common with other forms of TBI, the SLP diagnostic label typically most appropriate for mTBI is cognitive-communication disorder. Cognitive-communication disorder covers a broad range of impairments including deficits in expressiveness, receptiveness, and social communication accompanied by changes in attention, processing speed, memory, and executive functioning (EF),<sup>16</sup> all of which can be impaired in mTBI. While there have been characterizations of cognitive-communicative deficits after moderate to severe TBI, no such qualitative study or a broad consensus statement illustrating cognitive-communicative disorder following mTBI has yet been reported. Without an overarching characterization to describe possible SLP-related behaviors, clinicians may struggle with knowing what domains to assess and treat. In a review of the literature, word finding and verbal memory are frequently cited as symptoms as well as deficits in all areas of language. Emerging research also describes deficits in auditory comprehension, verbal expression, reading, writing, and social communication.<sup>17-21</sup> While these cognitive-

linguistic areas of need parallel deficits in more severe forms of TBI, clinicians struggle with best practices for assessment. A recent study indicated that SLPs report feeling most uncomfortable with assessment of TBI over all other TBI-related clinical tasks.<sup>10</sup> This is particularly significant in mTBI as it has the most limited published guidance for SLP clinical decision making paired with an expanded clinical need. At this point, with a lack of clear guidance in health care literature, practicing clinicians continue to rely on the emerging evidence base paired with clinical expertise to provide patient-centered care.

## CARE MODEL

The Marcus Institute for Brain Health (MIBH) is an interdisciplinary patient-centered care clinic at the University of Colorado Anschutz Medical Campus opened in July 2017. It was created based on the care model of the National Intrepid Center of Excellence at the Walter Reed National Military Medical Center in Bethesda, MD. The care at the MIBH focuses on individuals with at least 6-month post-mild-moderate TBI who have persistent symptoms and accompanying changes in psychological health, such as post-traumatic stress (PTS), depression, and anxiety. The majority of patients struggle with persistent symptomatology from concussive/subconcussive exposures and complex blast-plus mTBI injuries related to military service. The term “blast-plus” reflects that service members have commonly experienced both blast waves and an impact to the head, such as a fall or being hit by a blunt object. These combined effects of blast and biomechanical forces may result in more significant sequelae than an isolated blast injury. Approximately, 50% of patients seen reside in Colorado, while the remaining half from around the country. Most patients are Veterans or retired elite athletes, and there is a significant overlap in life experiences between these two groups. Both have often faced serial exposures to TBI as well as experienced significant life transitions, shifting from one career to another. The institute is predicated on a center of excellence model, with specialty care targeted to individuals who struggle with ongoing effects

of mTBI. There are two tracks of care: a week-long multidisciplinary assessment and a three-week intensive outpatient program (IOP).

A core tenet of the program is the use of an integrated practice unit (IPU). An IPU consists of groups of clinicians and non-clinicians together in a team to address the multifaceted needs of a patient with a complex medical condition. The Harvard Business Review describes an IPU as individuals working “together regularly as a team toward a common goal: maximizing the patient’s overall outcomes as efficiently as possible.”<sup>22</sup> Historically, IPUs were used in breast cancer and orthopaedic clinics, but today they are commonly found in both acute and chronic care settings.<sup>22</sup> IPUs are constructed with expert multidisciplinary providers co-located for ease of communication. Having providers in proximal spaces facilitates routine communication between the providers, hopefully increasing efficiencies in clinical care. In addition to the IPU, common outcome measures are used to assess patients’ outcomes as well as one metric gauging the success of the care model. In an IPU, care is largely interdisciplinary, where the providers work to “analyze, synthesize, and harmonize” their unique disciplines into a cohesive care model. At times, all clinical providers also work transdisciplinarily, incorporating and integrating care from multiple disciplines into their own discipline-specific clinical practices.<sup>23</sup> Care for persistent symptoms of concussion and related changes in psychological health is inherently complex; however, the implementation of an IPU is designed to improve patients’ outcomes and to decrease the overall cost of care.

## NEUROBIOPSYCHOSOCIAL MODELING

Patients with persistent symptoms are treated at the MIBH for both TBI-related symptoms and changes in behavioral health, and the presence and expression of these symptoms can be understood through a neurobiopsychosocial model.<sup>24</sup> When considering persistent symptoms, there is a clear overlap of behaviors like impairment in sleep and memory in both concussion and psychological disorders. Sustaining an mTBI is tied to an increased risk of depression, sleep disorder, and memory dysfunction, just as

depression, anxiety, and PTS are linked to changes in sleep and memory.<sup>25</sup> The inter-relatedness of cognitive, physical, and emotional dysfunctions causes all the three domains to cycle up together in levels of impairment. Greater cognitive dysfunction often leads to increased depression and anxiety, while, concurrently, increased depression and anxiety directly inhibit cognitive success. While incorporating the neurological underpinnings, a neurobiopsychosocial model of persistent symptoms in concussion accounts for the unique variables that impact one's overall success postinjury. Moreover, both internal and external variables such as genetics, medical conditions, TBI and behavioral health history, life stressors, substance use, support systems, and perceptions of health and illness all impact recovery.<sup>8,26,27</sup> The neurobiopsychosocial model of mTBI provides a structure for interdisciplinary teams by reinforcing the value of all team members in clinical care. This is particularly salient for SLPs who have historically incorporated both internal and external factors in patient care planning for mTBI.

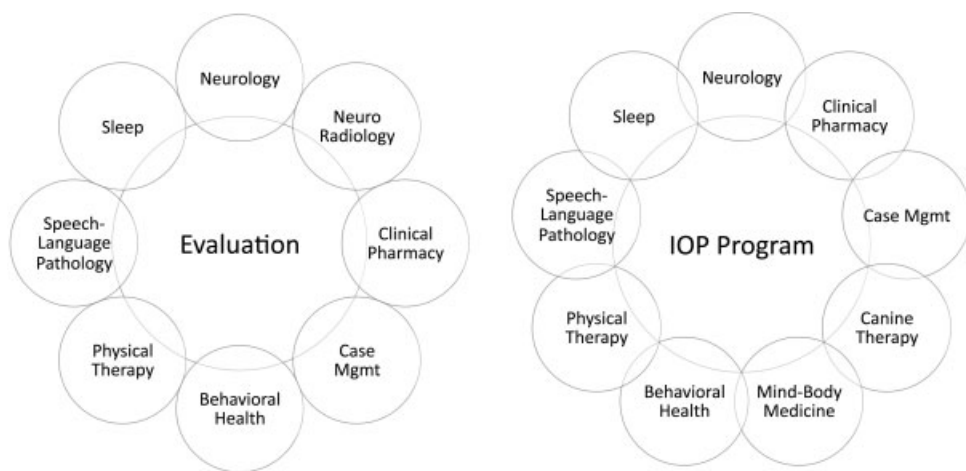
### MIBH EVALUATION MODEL

All individuals seen at the MIBH receive a comprehensive, multidisciplinary assessment with providers representing: neurology, sleep, clinical pharmacy, physical therapy (primarily visual-vestibular), speech-language pathology,

behavioral health (psychology/social work), and case management. After review of the records and team rounds for each patient, the evaluation week begins with an interdisciplinary clinical interview of the patient by six or more clinical staff members present in one room. The conversation focuses specifically on the patient's goals for the evaluation week. Potential patient goals range from comprehensive diagnostic evaluation and decreasing medications to improved sleep, care planning, and increased patient education. The clinical interview allows the patient to share past experiences and goals in a coordinated, cohesive manner rather than repeating this information across providers. Providers round immediately after to address any concerns raised during the interview, and then begin the individual assessments. Rounding occurs a second time after all discipline evaluations have been completed in order to create an integrated diagnosis and recommended plan of care, prior to a debrief with the patient (see Fig. 1).

### Speech–Language Assessment

The speech-language pathology evaluation comprises record review, clinical interview, standard (core) assessment tools as well as additional measures individualized after the clinical interview. The assessment is typically two hours in length including a hearing screening. The Institute of Medicine report on sports-related concussions in youth makes an



**Figure 1** Standard Marcus Institute for Brain Health (MIBH) clinical care providers. If recommended, neuropsychological assessment can occur at either time point.

important point that neuropsychological testing should be used to “characterize functions” rather than be used as a diagnostic criterion.<sup>28</sup> This is particularly salient for SLPs who are called on not to diagnose mTBI but rather to set a plan for rehabilitation. It is with this lens that the role of assessment for SLPs working in mTBI is considered. At the MIBH, SLP-based cognitive-linguistic assessment is a core service and is performed for all patients. The SLP assessment battery was designed to consider a breadth of mTBI cognitive-linguistic behaviors with minimal overlap of traditional neuropsychological measures. The typical SLP evalua-

tion is more heavily loaded to auditory processing, language, and functional cognition, all of which may impact daily functioning (see Table 1). Additionally, while psychological evaluation is a behavioral health standard, neuropsychological assessment is a discretionary service, utilized only when deemed necessary by the clinical team.

## Auditory Functioning

Changes within the auditory system occur post-mTBI even in the absence of injury to the ear or temporal lobe. Hypersensitivity to noise

**Table 1 Common SLP mTBI Assessment Measures at the MIBH**

Communicative domain	MIBH core measures	MIBH common supplemental measures
Auditory functioning	Pure tone hearing screening <i>Functional Hearing Questionnaire</i> <sup>37</sup> <i>QuickSIN Speech in Noise Test</i> <sup>38</sup>	WJIV Oral Language: Oral Comprehension <sup>42</sup>
Word finding	WJIV Oral Language: Retrieval Fluency <sup>42</sup>	WJIV Oral Language: Rapid Picture Naming <sup>42</sup> <i>Controlled One Word Association Test – FAS Test</i> <sup>43</sup>
Discourse/conversational success	LCQ Self-report <sup>52,53</sup> Informal language sample	LCQ Informant report <sup>52,53</sup>
Reading		FAVRES subtest 4: Building a Case (informal) <sup>58</sup> WJIV Achievement: Sentence Fluency <sup>42</sup>
Writing		FAVRES subtest 4: Building a Case (informal) <sup>58</sup>
Social communication	LCQ Self-report <sup>52,53</sup>	LCQ Informant-report
Cognitive domain	MIBH core measures	MIBH common supplemental measures
mTBI signs and symptoms	<i>Neurobehavioral Symptom Inventory</i> <sup>69</sup>	NA. An alternate symptom checklist could be used
Attention/processing speed	FAVRES subtest timing scores <sup>58</sup>	WJIV Cognitive: Processing Speed cluster <sup>42</sup> <i>Conner's Continuous Performance Test</i> <sup>70</sup>
Working memory	BRIEF-A Self-report <sup>57</sup>	WJIV Cognitive: Numbers Reversed <sup>42</sup> WJIV Cognitive: Auditory Attention <sup>42</sup> <i>Wechsler Memory Scale-IV</i> Logical Memory I and II <sup>71</sup>
Verbal memory and learning		WJIV Cognitive: Story Retell <sup>42</sup>
Executive functioning	FAVRES subtest 2: Scheduling <sup>58</sup> BRIEF-A Self-report <sup>57</sup>	FAVRES subtest 4: Building a Case <sup>58</sup> BRIEF-A: Informant report <sup>57</sup>

Abbreviations: BRIEF-A, Behavioral Rating Inventory of Executive Functioning-Adult; FAVRES, Functional Assessment of Verbal Reasoning and Executive Strategies; LCQ, La Trobe Communication Questionnaire; MIBH, Marcus Institute for Brain Health; mTBI, mild traumatic brain injury; WJIV, Woodcock-Johnson IV Tests.

(hyperacusis) is a common occurrence after all types of mTBI. It has been found that 27% of patients seen in an emergency department reported hyperacusis early on, and that noise sensitivity was a significant predictor of ongoing symptomatology at 3 months postinjury.<sup>29,30</sup> Both hypersensitivity to noise and tinnitus impact the overall functioning and quality of life for individuals post-mTBI. Their presence likely increases levels of discomfort, fatigue, and cognitive overwhelm, thereby impacting on the audiological function. Vander Werff, in an excellent review article reported audiological consequences of mTBI that included impairments in communication such as understanding speech in noise, conversation, and complex interpersonal interactions.<sup>31</sup> A significant amount of daily interaction can occur in noisy environments such as restaurants, stores, workplaces, athletic facilities, and schools. Decreased functioning in noisy environments has been found post-mTBI in adults exposed to blast and non-military causes.<sup>32,33</sup> Auditory processing disorder (APD), a condition in which the integration and interpretation of sound becomes disordered, is estimated to be as high as 85 to 89% in certain populations post-mTBI, including sports and motor vehicle injuries.<sup>34-36</sup>

Patients receive a hearing screening and complete the *Functional Hearing Questionnaire*<sup>37</sup> offering the patient's perspectives on their auditory information. If a patient has normal or near-normal hearing, the *QuickSIN Speech in Noise Test*<sup>38</sup> is also administered to screen auditory success in background noise. When individuals fail this screening tests and report deficits in daily life, rather than referring for full APD evaluation, they are referred for functional interventions. In conjunction with colleagues in audiology, SLPs typically recommend treating the functional symptoms as a first line of treatment, rather than asking the patient to undergo additional auditory assessment. This was decided, together with audiology, as additional assessment would likely not change the interventional recommendations.

### Word Finding

The ability to produce a targeted single word is an inherently complex task and slowed word

finding is a common communication disorder after mTBI.<sup>39,40</sup> Adults with persistent symptoms from motor vehicle accidents had significantly reduced production of words in both semantic and phonological speeded naming tasks<sup>18</sup> and decreased categorical fluency has also been found in those with injuries resulting from exposure to blast.<sup>41</sup> In the SLP evaluation, word finding is assessed under speeded conditions, often with both generative and confrontational conditions. While categorical naming is a standard task (foods, names, and animals), phonological naming, such as the FAS test, where individuals name as many words beginning with a targeted letter in one minute, is also utilized.<sup>42,43</sup> A benefit of combining speeded generative naming and confrontational naming allows the SLP to gauge some of the effects of a more visually dependent task.

### Social Communication

One of the newest areas of research considers changes in social communication after mTBI. Concussion in young children has been tied to decreases in theory of mind, mutual engagement, conversational flow, and reading emotional cues that persisted up to 24 months post-injury.<sup>21,44-46</sup> A recent study described group pragmatic intervention for adults with mTBI,<sup>47</sup> and there are numerous articles that cite changes in social participation, social success, and increased isolation.<sup>5,8,48-51</sup> These changes have traditionally been attributed to psychological health needs such as increased depression or anxiety, which do impact social participation, though further exploration of social communication behaviors in terms of cognitive-linguistic function is warranted.<sup>51</sup> At the MIBH, patients and informants (when available) complete the *LaTrobe Communication Questionnaire* (LCQ) using the Struchen norms.<sup>52,53</sup> The LCQ is a free tool that has items targeting initiation/conversational flow, disinhibition, conversational effectiveness, and partner burden.

### Executive Functioning

Chronic changes in executive function have been found in adults and children after

mTBI.<sup>54</sup> Specific deficits noted included: planning, organization, emotional regulation, and decision making, though self-awareness is often considered to be a strength of individuals post-mTBI. For multiple injuries, EF seems to be particularly impacted by serial or cumulative injuries.<sup>55</sup> It is clear that while there are numerous bottom-up factors associated with successful cognitive function after mTBI, top-down variables cannot be ignored. Individuals with mTBI routinely report failure at vocational and avocational activities due to the heavy cognitive load associated with these real-life demands that are heavy on EF. The accompanying cognitive fatigue often results from the engagement of multiple brain areas necessary for performing the complex cognitive tasks.<sup>56</sup>

Assessment for EF can be challenging as many types of measures are highly decontextualized and limited in association with patients' reports of dysfunction. At the MIBH, there are two core measures utilized: *Behavioral Rating Inventory of Executive Functioning-Adult* (BRIEF-A)<sup>57</sup> and *Functional Assessment of Verbal Reasoning and Executive Strategies* (FAVRES).<sup>58</sup> The BRIEF-A affords the patient perspective on numerous domains including behavioral components, working memory, and metacognitive functioning. There is both a self and informant report that affords an interesting juxtaposition of perspectives on complex functioning. For the FAVRES, subtests 2 (scheduling) and 4 (building a case) are used for their applicability specifically in TBI.<sup>59</sup> Due to its level of complexity, scheduling is used most frequently, though subtest 4 offers an opportunity to evaluate written output, including organization and cohesion.

### Other Assessment Considerations

During the clinical interview, SLPs consider additional areas of dysfunction as well as the impacts on daily life for additional objective assessment. When neuropsychological evaluation has not been recently conducted, tool selection may incorporate increased cognitive elements. In general, clinicians work to interpret both face-level test factors as well as

underlying skills, such as speed and visual function, to better interpret linguistic, cognitive, and perceptual functioning. Considering tools broadly is particularly important when considering patient fatigue and overwhelm, so common in mTBI.

- *Attention/processing speed:* With attention, processing speed, and cognitive overwhelm directly impacting daily life, specific assessment in this area may be performed.
- Reading and/or writing assessments for patients engaged in collegiate pursuits or those with similar vocational/avocational needs. This is also important for individuals with histories of learning disabilities or attention deficit/hyperactivity disorder.
- Visual dysfunction directly impacts reading skills. Consequently, SLP and physical therapist consultations are required regarding treatment planning for individuals with reading deficits.
- Verbal memory is frequently impaired after mTBI, often more so than visual memory skills. In our protocols, verbal memory is most frequently assessed using story retells and/or list-learning type tasks, with both immediate and delayed conditions. Verbal working memory may also be measured, using tasks like reversed digit recall.
- Assessment follows patient concerns and presentation. While cognitive-linguistic skills of these patients are somewhat homogenous, we have assessed individuals for aphasia, dementias, dysarthrias, fluency, and voice disorders. None of these disorders commonly occur after mTBI, but as generalists, targeted assessment follows whatever needs of the patient arise. Additionally, as SLPs continue to struggle with adequate assessment tools for mild disorders,<sup>60,61</sup> the role of patient perspective is critical.

After the assessment, a plan of care is created for each patient that includes discipline specific recommendations and patients may be recommended for intensive care at the MIBH. When individuals have a primary driver for their challenges, such as severe depression, specific unidisciplinary care with outside providers is recommended.

## ASSESSMENT IN PRACTICE

Raymond is a fictitious 38-year-old Colorado Veteran, whose primary complaints are changes in work status and avoiding loud spaces, and has come for an assessment. He completed two tours in Afghanistan for the U.S. Army and is receiving partial disability benefits but would like to return to work. He is married with two boys aged 12 and 15. Raymond's clinical team met prior to his clinical interview to discuss key findings from the medical records and observations from the clinical administration team, who had spoken with Raymond on the phone. Shortly after this, Raymond arrived for his clinical interview, during which Raymond indicated that he would like to "be a better father" and "get back to work." The team met as a group immediately after to discuss Raymond's goals and if there were any additional areas of diagnostic need to consider. Raymond's SLP appointment was the following day. While Raymond passed the hearing screening, he failed the auditory processing screening assessment. He and his wife both reported that Raymond struggles with memory, completing projects, engaging with others, and thinking of words. Raymond was diagnosed with a cognitive-communication disorder. At the subsequent team rounds, the team discussed that Raymond was also diagnosed with PTSD and visual-vestibular deficits. With so many of these diagnoses impacting his daily functioning, the team agreed that if Raymond was interested he would benefit from intensive interdisciplinary intervention.

## MIBH INTERVENTION MODEL

The MIBH also has an IOP for patients that need interdisciplinary care to address changes in physical, cognitive, and behavioral health. For patients with persistent symptoms that load on each other, interdisciplinary care may be a more robust care model. The IOP is 3 weeks in length. Overarching goals are functional in nature and cross-disciplines. For example, when a patient's goal is to "work better," physical therapy may target visual-vestibular functioning to improve headaches and work tolerance, behavioral health may incorporate strategies for emotional regulation decreasing disruptive behavior at work, and

speech therapy may implement metacognitive strategy instruction for planning and organization at the workplace. The patient participates in goal setting, and the goals are unified across providers.

Patients arrive in small cohorts and engage in individual and group therapies for both traditional modalities and integrative therapies (complementary and alternative medicine). Individual therapies include speech-language-cognitive therapy, physical therapy, counseling, medicine, clinical pharmacy, mind-body medicine, and case management. Group therapies include behavioral health, mind-body movement, meditation, creative arts, and implementation groups that facilitate generalization outside the clinic setting. There is some individualized scheduling based on specific patient needs, but the overall structure is the same for all patients, with the content of the therapy sessions targeted to individual patient needs. The most intense work often occurs in individual appointments and is targeted in the morning, while the remainder of the day helps to process the morning work and settle the system prior to returning home for the evening.

## Intervention with Speech-Language Pathology

In addition to broad institute-wide goal setting, goal attainment scaling is used to facilitate functional goal setting in conjunction with motivational interviewing.<sup>62,63</sup> Motivational interviewing is a technique used throughout health care disciplines to facilitate internal motivation to make health-related behavior changes. Rather than informing a patient why specific changes are required, the patient works together with a clinician to identify barriers and options for change. For example, consider that Raymond reported that he did not want to use a calendar for appointments because preinjury he had "never needed to." Rather than repeatedly telling Raymond that his kids become angry whenever he forgets their lacrosse games and therefore needs a calendar app on his phone, motivational interviewing utilizes a conversational counseling style that affords Raymond the space to describe how using the calendar reinforces his self-perception that he is



“broken.” The clinician can help normalize the use of calendars and, if desired, target a system that Raymond likes and can use independently. Goal attainment scaling is used to create functional outcomes as well as to ensure that the patient agrees on the plan of care. Working together, a reasonable level of improvement over therapy is defined by the patient and clinician. This is the goal. With both parties knowing what level of improvement is expected after 3 weeks, the clinician and patient share the responsibility for clinical success. Depending on the circumstances, the patient may not reach the target or s/he may exceed it, and the outcomes from goal attainment scaling also account for this degree of variability. Goal setting in an IOP can be difficult as the overall duration for care is short and with multiple disciplines of care, clinicians need to consider the amount of patient resources that will be allocated to speech as well to other disciplines. Clinicians must be mindful about not overwhelming a patient with theoretical strategy use, but rather recommended targeted interventions, even at the expense of addressing all areas of need. Additionally, many complex patients continue to need additional follow-up care after the program, and we work with SLPs local to the patient to facilitate continued care near the patient’s home.

### Individual Therapy Sessions

In individual speech therapy, interventional activities are highly variable depending on functional patient needs though a key component for all focuses on education over the interrelated nature of cognitive-linguistic functioning with physical and emotional factors. Patients work toward independence defining those relationships within their own lives to predict and prepare for more successful daily functioning. This hybrid of psychoeducation and metacognitive strategy instruction promotes awareness and facilitates change as patients prepare to return home. Based on the work of Kennedy and Krause, a dynamic coaching model is the basis for the clinical intervention, with focuses on self-regulation, respect, and autonomy.<sup>64</sup> The finite nature of an IOP can make long-term implementation more challen-

ging for both patient and clinician, and the focus on self-regulation facilitates greater independence after returning home, across a wide range of environments. Dynamic coaching is inherently flexible in nature, with patient-clinician collaboration to identify and modify strategies for implementable functional changes. It is anticipated that strategies will shift throughout the therapeutic relationship, refining them based on patient experience and practice. Coaching works especially well in mTBI where the patient’s awareness of strengths and deficits is often relatively high, and the clinician can offer professional perspective to improve functional outcomes.

In addition to psychoeducation, individual sessions target needs based on evaluation and cooperative goal-setting. Clinicians provide evidence-informed therapies looking to the literature for mild to moderate TBI including the INCOG guidelines, the ACRM (American Congress of Rehabilitation Medicine) Manual, and the DoD/VA (Department of Defense/Veterans Affairs) Clinical Practice Guidelines.<sup>65–68</sup> Patients typically receive seven to nine individual sessions over the 3 weeks of the IOP and treatment planning focuses on reasonable goals to be accomplished in that timeframe. For those with auditory processing deficits, a computerized auditory training program is paired with functional auditory strategies, as is recommended in the literature.<sup>65</sup> Visualization and linking or chaining are commonly used for memory needs. EF is addressed through metacognitive strategy instruction as well as specific structural supports that are created collaboratively between the clinician and the patient. All targeted areas also incorporate practice opportunities, from word finding strategies to social communication in various daily group settings.

### Group Sessions

At the MIBH, SLPs direct the Implementation group, a weekly group targeting skills in a public environment outside of quiet clinic spaces. The initial activity level is based on group needs and becomes increasingly challenging over the course of the IOP. All implementation groups have the same three-step schedule: come together to plan, complete activity, and debrief. The metacognitive

strategy of goal, plan, do, and review often sets the stage for each afternoon's activity.<sup>66</sup> Once being given a description of the environment, patients self-select goals for the afternoon based in part on provider recommendations. Strategies for success are discussed within the group and typically relate to skills/strategies utilized in clinical care disciplines.

Goals typically cross disciplines of speech-language pathology, physical therapy, and behavioral health, and therefore, the strategy use also tends to be multidomain. For example, a goal for a different patient Justin, who avoids busy, open spaces due to vestibular dysfunction, noise sensitivity, and PTS, may be to practice two different self-identified grounding techniques on the second floor of a local hospital. Monique, who has become isolated with depression, auditory processing, and word finding deficits, may partner to engage in conversations at varying locations, considering acoustics, background noise, and cognitive overwhelm. At the end of every session, there is a group debrief about successes and challenges. Frequently, individuals report feeling empowered as the diffuse elements of dysfunction after mTBI, now fit together in a more predictable fashion. A benefit of this transdisciplinary model is that through the umbrella model of metacognitive strategy instruction all work is predicated on speech-language-cognitive therapy, even if a specific daily goal was less SLP-focused.

## INTERVENTION IN PRACTICE

While setting goals, Raymond was asked to focus his energies in speech-language treatment on improved auditory functioning and improvements in EF. For auditory improvements, Raymond was given access to a computerized auditory program with clear instructions about its use and limitations. Together, we made sure that the program was working and that he had a method of access to continue its use once he returned home. This program was utilized for longer-term home treatment rather than the focus of SLP-directed sessions. Functional auditory strategies were discussed first in the clinic setting, but primarily implemented at locations throughout the clinic and broader campus spaces. Raymond's role was to identify positives

and negatives about various environments and how he could modify them. He needed to consider auditory, visual, and additional internal factors like fatigue in each setting. Additionally, education about how emotional stressors impacted auditory functioning was discussed. Raymond used one session of Implementation group to practice this in the local airport. Metacognitive strategy instruction was used to provide a flexible structure that Raymond could use to improve task maintenance as well as implement for his job search. An initial template was created by the clinician but it was modified by Raymond to fit his unique needs and preinjury cognitive style using coaching methods. Overall, Raymond's goals were met. At the end of the 3 weeks, Raymond indicated that he felt additional speech therapy sessions would be useful as he considered return to work. Referrals were made to local providers as well as set open channels of communication for future providers.

## SUMMARY

SLPs working in mTBI continue to be impacted by a lack of broad clinical practice guidelines or characterization of mTBI related to speech-language pathology. At the MIBH, clinicians across disciplines work together to improve clinical outcomes for individuals struggling with the persistent symptoms of mild TBI and changes in psychological health. Care is based on implementation of IPU and valuing the input of all clinical providers and administrators. The role of SLP in mTBI continues to evolve at a rapid rate, and the MIBH offers one vision for interdisciplinary care in this challenging population.

## DISCLOSURES

Kathryn Hardin—Financial: Kathryn Hardin is a faculty member at the University of Colorado School of Medicine and receives accompanying salary support. Nonfinancial: Kathryn Hardin has reviewed works for ASHA focused on traumatic brain injury.

James Kelly—Financial: Principal/sole proprietor, Kelly Neuroscience Consulting, LLC. Principal/proprietor, KLNLP, LLC. Principal/proprietor, Valor Industries, LLC. Medical Advisory Board Member, Prevacus, Inc.

Nonfinancial: Fellow, George W. Bush Institute Military Service Initiative.

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