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Viewpoint

# The Speech-Language Pathologists' Role in Mild Traumatic Brain Injury for Middle and High School–Age Children: Viewpoints on Guidelines From the Centers for Disease Control and Prevention

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**Purpose:** The Centers for Disease Control and Prevention (CDC) recently released guidelines for rehabilitation professionals regarding the care of children with mild traumatic brain injury (mTBI). Given that mTBI impacts millions of children each year and can be particularly detrimental to children in middle and high school age groups, access to universal recommendations for management of postinjury symptoms is ideal.
**Method:** This viewpoint article examines the CDC guidelines and applies these recommendations directly to speech-language pathology practices. In particular, education, assessment, treatment, team management, and ongoing monitoring are discussed. In addition, suggested timelines regarding implementation of services by speech-language pathologists (SLPs) are provided. Specific focus is placed on adolescents (i.e., middle and high school–age children).
**Results:** SLPs are critical members of the rehabilitation team working with children with mTBI and should be involved in education, symptom monitoring, and assessment early in the recovery process. SLPs can also provide unique insight into the cognitive and linguistic challenges of these students and can serve to bridge the gap among rehabilitation and school-based professionals, the adolescent with brain injury, and their parents.
**Conclusion:** The guidelines provided by the CDC, along with evidence from the field of speech pathology, can guide SLPs to advocate for involvement in the care of adolescents with mTBI. More research is needed to enhance the evidence base for direct assessment and treatment with this population; however, SLPs can use their extensive knowledge and experience working with individuals with traumatic brain injury as a starting point for post-mTBI care.

Adolescents in middle and high school years (e.g., approximately 12–18 years of age) seek medical assistance through emergency department visits following mild traumatic brain injury (mTBI)—often called *concussion*—at a rate of approximately 1,000 per 100,000 individuals annually (Taylor, Bell, Breiding, & Xu, 2017).

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The World Health Organization Collaborating Centre Task Force on Mild Traumatic Brain Injury defines *mTBI* as an acute damage to the brain resulting from external physical force (Carroll, Cassidy, Holm, Kraus, & Coronado, 2004). This injury must also be characterized by at least one of the following: (a) loss of consciousness for 30 min or less, (b) disorientation or confusion, (c) posttraumatic amnesia for less than 24 hr, and (d) presence of neurological abnormality such as seizure. Furthermore, 30 min postinjury, individuals must demonstrate a Glasgow Coma Scale score between 13 and 15. Despite the specific nature of this definition, inconsistencies in the interpretation of these criteria can occur among professionals and the general public, leading to an incorrect perception of the potential impact of the injury on previous levels of functioning. For example, lay persons may perceive concussion as an even more mild form of mTBI when both terms reflect a mild neurological event. This may result from negative connotations from the

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general public associated with the terms *brain injury* or *head injury* (McKinlay, Bishop, & McLellan, 2011). Regardless of the terminology used by professionals and lay individuals, both the terms *mTBI* and *concussion* reflect a mild neurological event. Information found in the literature may be skewed or misrepresented based on differing uses of these terms. For the purposes of this article, we will use the term *mTBI*.

Although the majority of adolescents will report full recovery following mTBI within 4 weeks (McCrory et al., 2017), a portion (i.e., 30%; Babcock et al., 2013) will experience chronic deficits (Moser, Schatz, & Jordan, 2005). Evidence-based recommendations for the care of children post-mTBI are vital to reducing potential short- and long-term effects on physiological, cognitive, and emotional domains, which negatively impact return to preinjury roles and responsibilities. At this time, such care does not follow cohesive or consistent practices (Grubenhoff, Deakyne, Comstock, Kirkwood, & Bajaj, 2015).

Adolescents recovering from concussion can experience a wide range of physical (e.g., headache, fatigue), neurocognitive (e.g., slowed processing speed, decreased recall and problem solving), and emotional (e.g., sadness, irritability) symptoms (Breed, Flanagan, & Watson, 2004), which can negatively influence academic performance for days to years post-mTBI. Specifically, students experience difficulty performing required daily academic tasks (e.g., attending to lectures, note taking, studying for tests, completing homework; Ransom et al., 2013; Wasserman, Bazarian, Mapstone, Block, & van Wijngaarden, 2016). This is especially apparent among high school students who must exhibit greater independence and engagement in academic activities that require heightened cognitive effort and control than elementary or middle school students. In addition, adolescents aged 16 years and older often drive, have part-time jobs, and participate in extracurricular activities requiring higher level executive function, time management, and attentional skills. Because of the fast-paced nature of high school academics, even temporary changes in neurocognitive performance following mTBI can lead to declines in grades and heightened levels of concern among students and their parents (Ransom et al., 2015).

However, few clinical guidelines exist to provide recommendations for pediatric postinjury care beyond those occurring in organized, sports-related activities (e.g., Zemek, Duval, et al., 2014). To remedy this, the Centers for Disease Control and Prevention (CDC) National Center for Injury Prevention and Control Board of Scientific Counselors established a working group to conduct a systematic literature review and create clinical recommendations for pediatric mTBI. Published in early 2018 (Lumba-Brown et al.), these guidelines include 19 sets of recommendations highlighting prevention, diagnosis, prognosis, and management of mTBI in children. Although these guidelines provide a foundation for interdisciplinary efforts across health care and educational disciplines, neither discussion of specific professionals involved nor that of their distinct roles is provided. In this article, we interpret the CDC guidelines and discuss the potential involvement of speech-language pathologists (SLPs) in the care of middle and high school students post-mTBI.

## *Role of the SLP and Interdisciplinary Efforts*

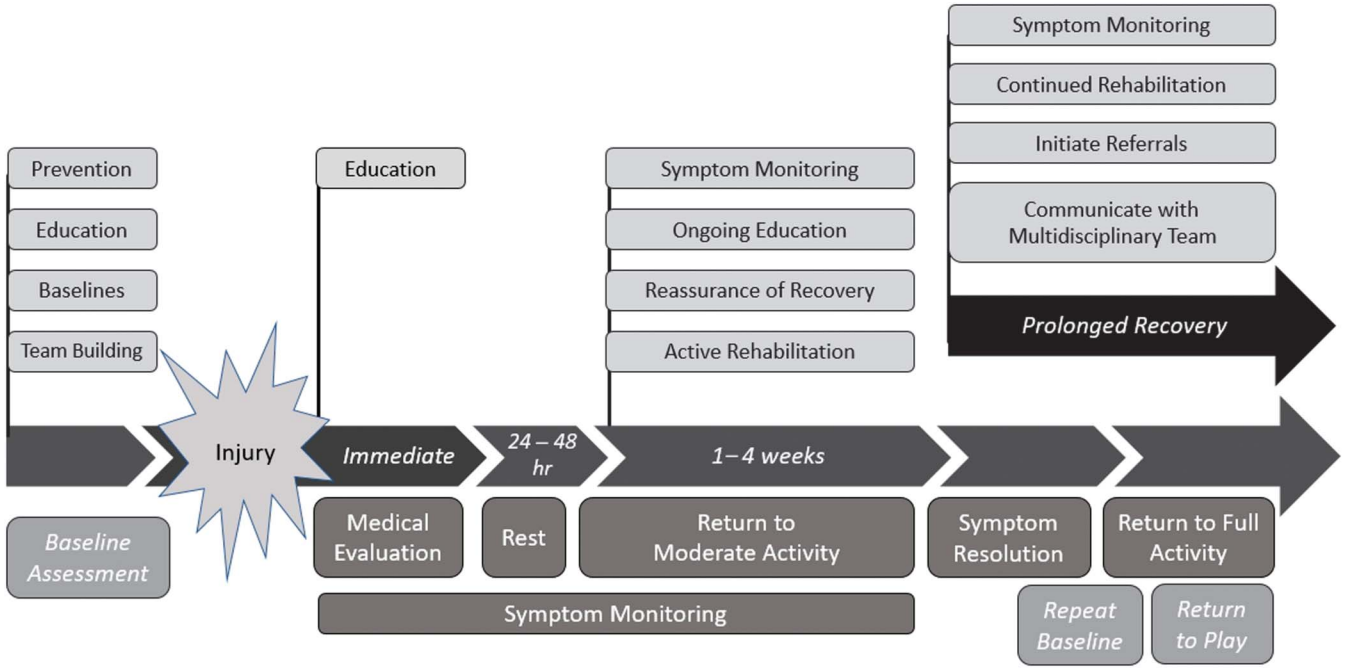
SLPs are among a specialized group of professionals trained to care for people with mTBI (American Speech-Language-Hearing Association, 2016; Knollman-Porter, Constantinidou, & Marron, 2014; MacDonald, 2017). Their extensive training and long history of remediating deficits following moderate–severe TBI ensure SLPs are skilled in delivery of services to support goals for participation and independence at home, school, and work and in the community by addressing relevant health conditions and contextual factors. While distinct differences exist between the care of adolescents with mild compared to moderate–severe injuries, many clinical symptoms are similar, differing primarily in their presentation severity (Duff, 2009).

SLPs often work as collaborators within interdisciplinary teams, an optimal approach in treating people with mTBI because the array of symptoms associated with mTBI is often ineffectively managed in isolation (Knollman-Porter et al., 2014). SLPs can interact effectively in team-based approaches by identifying symptoms requiring referral to other disciplines, exchanging information with the team about impact of symptoms on function and recovery, and providing support and encouragement to adolescents to promote implementation of recommendations by other providers. Interdisciplinary teams should include other school- and medical-based health care professionals such as physicians, athletic trainers, nurses, physical therapists, occupational therapists, neuropsychologists, counselors, and recreational therapists. While some overlap in skills and training may exist among these providers, each field brings a valuable perspective and specialty-specific approach to treatment. Non–health care professionals involved in an adolescent's care and recovery are also key members of interdisciplinary teams, such as coaches, teachers, support staff, parents, and the child himself/herself. SLPs who serve children with mTBI may work in schools and medical settings. Being communication specialists, they sometimes serve as the liaison between teams residing in medical versus school settings and can contribute to shared decision making. In the following sections, we highlight the unique roles of SLPs as they relate to components of the CDC guidelines. Although not exhaustive, this overview is intended to provide a foundation for the potential of SLPs to contribute to pediatric mTBI in a variety of settings and domains. Figure 1 summarizes these efforts.

## *Education and Counseling*

Recommendation 12 from the CDC guidelines describes guidelines for patient and family education about mTBI, its effects, and typical recovery patterns. Adolescents in particular should be educated directly about their injury and care, be made aware of the return-to-learn team,

**Figure 1.** Timeline of mild traumatic brain injury, with current best practice recommendations placed below the timeline. Items below the line on medium gray refer only to students with sports concussions. Items above the timeline describe speech-language pathologist activities appropriate for that phase of prevention or recovery.




and be included in discussions about management and therapy decisions. The CDC notes that reassurance and early education improve outcomes following mTBI (e.g., Ponsford et al., 2001); thus, initiation of educational efforts should occur as soon as possible after injury. Each member of the rehabilitative team should provide education specific to his or her expertise and professional scope of practice. However, team members should also be well versed in education and counseling provided by other professionals to provide a unified message that reflects current best practices. The SLP may be particularly useful in educating students about cognitive and communicative deficits, changes in academic performance, and self-awareness or monitoring of recovery of symptoms.

#### General Education

General information to be provided to students and parents about concussion includes warning signs of a more serious injury, description of the injury, and expected course of symptoms and recovery. The CDC maintains up-to-date, evidence-based information about concussion and mTBI through their HEADS UP Program. Materials are targeted to several populations, including students, parents, teachers, and coaches (CDC, n.d.). SLPs working with this population can provide education on cognitive–linguistic recovery, neurological components of concussion, and short- and long-term management options. Because SLPs may see students after initial medical care, SLPs should be prepared to answer follow-up questions about care and course of recovery.

#### Individualized Education

Three items from Recommendation 12 should be individually adapted: management of cognitive and physical activity/rest, instructions regarding return to school and play/recreation, and clear follow-up instructions for clinical management. The team should ensure that these recommendations are specific to the student's injury, school demands, and extracurricular activities. Schools may be best served by using forms that can be customized to the student's needs and detail current recommendations for activities or limitations and necessary school supports. Current best practice recommendations are for 24–48 hr of strict rest, followed by a return to moderate levels of cognitive activity (McCrory et al., 2017). The CDC specifically emphasizes that students should return to school no more than 2–3 days postinjury. Students may experience symptoms upon returning to school, but these should be under the students' symptom threshold.

### *Assessment*

Health care professionals are guided to assess and determine the etiology of cognitive symptoms and recommend treatment that reflects the presumed etiology (Recommendations 19A and 19B). Currently, most studies of adolescent mTBI focus on the sequelae of sport-related injuries.

However, more than one third of mTBI occurring within this age group is caused by other factors (e.g., struck by object, assault, motor vehicle accident), resulting in the need to objectively consider both the injury mechanism and other factors that may or may not impact performance (Haarbauer-Krupa et al., 2018). For example, biomechanical forces associated with motor vehicle accidents may result in a greater functional and neurological impact of injuries (Seiger, Goldwater, & Deibert, 2015). Furthermore, athletes who sustain sports-related concussions may have higher baseline health levels that facilitate more rapid recovery than individuals who sustain injuries and are not athletes (Ruff & Jamora, 2009).

Cognitive symptoms in particular may be a direct result of the injury to the brain and/or may be caused by secondary effects of other symptoms, such as headache, anxiety, depression, or sleep disturbances (Lumba-Brown et al., 2018). While it can be challenging to tease apart the exact influence of primary and secondary factors, asking specific questions regarding secondary symptoms (e.g., "Has your sleeping changed since you had your injury?") can help clarify whether additional assistance from another provider on the team is needed to help ameliorate symptoms. This difficulty is often heightened when developing treatment plans for children with preexisting conditions (e.g., attention-deficit disorder, substance abuse) or when recovery patterns are atypical following mTBI. These factors combined emphasize the value of interdisciplinary teams in the management of post-injury symptoms. Specifically for SLPs, collaborating with teachers and athletic trainers who have long-term relationships with the student-athlete may reveal functional changes in behaviors and performance not detected by formal neurocognitive assessment measures. Similarly, because physicians have proficiency in neurological, cardiac, spinal, musculoskeletal, and other sports-related injuries, they may help the interdisciplinary team determine if prolonged recovery is secondary to physical (i.e., cervicogenic headache), neurological (i.e., mTBI), or psychological (i.e., depression) factors. SLPs, however, are skilled in the integration of formal and functional neurocognitive assessment measures, which can directly inform postinjury management.

Reliance by an SLP on a single screening or assessment may not detect subtle changes in function following mTBI (Recommendation 10A; McCrory et al., 2017) and delay the implementation of appropriate, necessary services. The majority of current research in mTBI focuses on early identification of sports-related injury via computer-based assessments (e.g., ImPACT, CANTAB; Maerlender et al., 2013). However, these tests do not diagnose concussion; rather, they demonstrate the effects of the concussion by highlighting performance changes and should be used in conjunction with other measures (e.g., symptom reports; Alsalaheen, Stockdale, Pechumer, Broglio, & Marchetti, 2017). While it is possible to compare postconcussion neurocognitive results to age and gender norms, the effectiveness of such tests is enhanced with baseline data. In cases of non–sports-related mTBI, there may be no such information.

While no specific evidence-based guidelines exist to inform the selection of testing measures appropriate for this population, CDC Recommendations 10B and 10C suggest use of a battery of assessments, including validated self-report symptom measures and standardized neurocognitive assessments (Lumba-Brown et al., 2018). Examples of self-report measures that may be utilized by SLPs for children and adolescents with mTBI are the Post-Concussion Symptom Inventory (Sady, Vaughan, & Gioia, 2014) and the Behavior Rating Inventory of Executive Function–Second Edition (Gioia, Isquith, Guy, & Kenworthy, 2015). Ransom et al. (2016) determined that self-reported symptom severity and executive dysfunction measures were the strongest predictors of perceived academic problems during mTBI recovery. These measures, when combined with pre- and postinjury academic artifacts obtained from the adolescent, teachers, and parents (e.g., writing, assignment, and test samples), can more clearly highlight the subtle influences of impaired cognitive performance than standardized tests alone. However, SLPs may also use standardized neurocognitive assessments such as the Student Functional Assessment of Verbal Reasoning and Executive Strategies (MacDonald, 2013) or the Repeatable Battery for the Assessment of Neuropsychological Status Update (Randolph, 2012). Additional standardized assessments or subtests may be of value to SLPs when evaluating domain-specific abilities post-mTBI. For example, the Hopkins Verbal Learning Test–Revised (Brandt & Benedict, 2001) can facilitate assessment of verbal learning and memory for individuals aged 16 years and older. Additionally, the Stroop test is a viable option for assessing selective attention and inhibition skills and may be suitable for use in pediatric populations (Oliveira, Mograbi, Gabrig, & Charchat-Fichman, 2016).

Regardless of the selected tests, use of both self-report and standardized outcome measures not only provides a better perspective on the cognitive domains impacted by mTBI but also identifies factors that may influence academics (Recommendations 10B and 10C) than using either of these methods in isolation. Furthermore, SLPs may wish to consider conducting assessments consisting of functional, real-world tasks in relevant environments outside the therapy room, which can challenge higher level executive function processing and tax multiple cognitive domains simultaneously (e.g., Brown & Hux, 2016, 2017; Brown & Wollersheim, 2018). Research in functional assessments that is focused on the mTBI population is beginning to emerge and provides initial data to support the benefits of ecologically valid assessment practices for this population.

## *Treatment*

### Intervention Timeline

In the first days and weeks after injury, SLPs may monitor and assess cognitive–communication needs and provide supportive education on cognitive rest and graded increase in cognitive activity (Recommendations 13A, 13B, and 15A–15F). Children experiencing persistent symptoms in chronic injury stages may benefit from targeted interventions

(Recommendations 8, 9, and 11B). While evidence-based comprehensive guidelines for the management of persistent cognitive symptoms in children have yet to be established, there have been a number of studies on adults with mTBI and several systematic reviews of TBI literature that offer some guidance (e.g., Bayley et al., 2014; Duff, 2009; Haskins, Cicerone, & Trexler, 2011; MacDonald, 2017; Ponsford et al., 2014; Sohlberg & Ledbetter, 2016; Togher et al., 2014; Velikonja et al., 2014). Management of persistent cognitive–communication symptoms should be aimed at both reducing the impairment and increasing participation. Such treatment methods should be directed toward maximizing function and performance on patient-centered goals.

Research supporting active physical rehabilitation has emerged, giving credence to the potential for early, active cognitive rehabilitation (e.g., Broglio, Collins, Williams, Mucha, & Kontos, 2015; Lempke, Jaffri, & Erdman, 2019; Thomas, Alves, Vaska Mlis, & Magalhaes, 2017). While a progressive concept, providing cognitive support initially can help prevent the development of maladaptive behaviors that may interfere with treatment (e.g., thoughts or behaviors that exacerbate symptoms) and reduce barriers to recommendation adherence (e.g., forgetting to take prescribed medicines or difficulty planning times to complete therapy exercises; Hardin, 2015; Sohlberg & Ledbetter, 2016). This support may be especially needed by middle and high school students who are developing ownership and responsibility for their learning but may not yet have a strong foundation in advocacy skills or developed executive function skills to effectively select and execute strategies.

**Treatment Parameters**

While guidance on timing of cognitive treatment is provided, guidance regarding treatment type, intensity, and duration is not discussed in the CDC guidelines. Furthermore, specific guidance is not provided for the management of communication problems (e.g., social skills or speech fluency). Despite this, SLPs can be readily involved in care for adolescents post-mTBI.

*Direct intervention.* SLPs may implement direct intervention to target remediation of deficits in both the acute and chronic recovery stages. Although little evidence exists to guide decisions regarding direct therapy in the adolescent population post-mTBI, interventions appropriate for and evaluated in the adult populations seem feasible given the high demands on students' independent thinking and completion of daily activities in middle and high school years. Intervention to target issues with domains such as attention, working memory, processing speed, executive functioning, word finding, and literacy may be of particular utility given the prominence of these deficits following mild injuries. Direct training of cognitive–communication is built on principles of neuroplasticity, which requires a high rate of practice of targeted drills. The level of repetition required is often at a rate higher than the frequency of therapy provided in this population, thereby necessitating the development of graded home exercise programs to support both practice and generalization to real-world contexts.

Given the academic demands of middle and high school students, such exercises should be rooted in these contexts. For example, word finding may be addressed through activities such as verbal summarization of expository texts or working memory through reading comprehension of these texts or text-based mathematical exercises (for a review, see Krause, Byom, Meulenbroek, Richards, & O'Brien, 2015). Attention may be addressed by engaging the client in such therapeutic tasks while the client ignores alerts on a nearby smartphone. For executive function, students may develop prioritized plans for academic and extracurricular demands. Intervention should also ensure that the student is actively planning to engage in their mTBI management, for example, by building in breaks during school or studying; scheduling extra time to complete tests; completing therapeutic exercises on a regular schedule; and developing scripts to advocate for their needs to teachers, peers, or employers as need be.

*Strategy training*. Cognitive strategy training can help increase participation through development of internal strategies, training of assistive technology tools, and implementation of environmental modifications or supports (Sohlberg & Mateer, 2001). These interventions are often adequate for children with subjective complaints who perform within normal limits on objective measures of cognitive function and for those who are simultaneously receiving direct interventions after injury. Training both task-specific and process-specific strategies, such as verbal rehearsal, pacing, goal management, or structured problem solving, can be beneficial for this population. Age and individual differences mean that students may or may not be successful self-regulated learners. However, because greater use of self-regulated learning strategies is associated with higher academic performance in typical high school students (Zimmerman & Martinez-Pons, 1986) and may be even more critical as students transition to the independence of college (Nandagopal & Ericsson, 2012; O'Brien, Schellinger, & Kennedy, 2018; Ruban, McCoach, McGuire, & Reis, 2003), training in self-regulation to monitor performance and strategy use is appropriate for students of this age range. Training methods should include instructing students to systematically evaluate their needs, identify appropriate strategies for consideration, monitor effectiveness of those strategies, and develop new strategies as necessary. Common in clinical practice with adults with brain injury (Kennedy, 2017; Kennedy & Coelho, 2005; Sohlberg & Turkstra, 2011), the benefit of such an approach to the management of mTBI in adolescents is that the student learns to develop and tailor strategies and supports to their unique profile of needs.

Assistive technology tools and associated strategies include low- and high-tech solutions for management and compensation of transient and persistent cognitive–communication deficits. Assistive technology selection and use should be individualized and follow person-centered care approaches (e.g., the Matching Person & Technology assessment process; Scherer & Craddock, 2002). Such

solutions may include applications for smart devices (e.g., text-to-speech technology, smart recording pens) and external aids to enhance independence and daily task completion (e.g., electronic schedules and calendars, medication pill-boxes). As an alternative option, training adolescents on the use of environmental modifications may be helpful to decrease the effects of cognitive–communication symptoms on performance. Example environment modifications include establishing a dedicated study space (e.g., organizing study materials ahead of time) or moderating the amount of exposure to high-stimulus environments (e.g., reducing auditory or visual distractions).

*Academic adjustments.* If we expect students to return to moderate levels of cognitive activity during their recovery, this implies that accommodations or adjustments will be made to reduce student demands (e.g., students may complete only odd-numbered math problems rather than the full set, read for 15 min at a time with 5- to 10-min breaks, take quizzes with extra time but not tests, or be allowed to leave class a few minutes early to avoid noisy hallways). Accommodations should be mapped to specific student needs and symptom presentations. For example, students with photophobia may be better able to tolerate classes with sunglasses, while those with persistent headaches may need frequent breaks during class. Students with cognitive symptoms such as slowed processing may benefit from note takers. Given that we generally anticipate relatively rapid recovery from mTBI (1–4 weeks), accommodations should be provided with a limited, temporary time frame. Setting limitations avoids overaccommodation that can complicate recovery and encourages the student to return to care providers or the support team if it is necessary for renewal. This also requires the team to reassess the student on a regular basis and for appropriate referrals to be made to mitigate complicated recoveries.

### Team Management

The CDC also provides general recommendations for the team management process citing guidelines relative to academics (Recommendation 15). These efforts may initially serve less formal purposes such as SLP assistance with accommodations, creating and implementing 504 plans, and developing return-to-learn timelines. Students and schools benefit by having a return-to-learn specialist who clearly defines team roles and responsibilities, which may be coordinated by an SLP.

## *Advocacy and Call to Action*

Practice guidelines for concussion management have changed rapidly, and professionals must make efforts to educate themselves about current standards of care. Surveys of SLP knowledge about TBI and concussion reveal varying levels of expertise, with particular gaps in knowledge about the risks of pediatric TBI. Specifically, SLPs express low confidence about TBI knowledge (Duff & Stuck, 2015; Riedeman & Turkstra, 2018); however, low confidence is associated with openness to learning and information seeking (Berner & Graber, 2008; Meyer, Payne, Meeks, Rao, & Singh, 2013). These knowledge and experience barriers are further documented in other rehabilitation professionals. For example, family medicine residents answer concussion knowledge questions with only 58% accuracy (Mann, Tator, & Carson, 2017), and frontline medical professionals (e.g., family and emergency room physicians) only suggest academic accommodations 60% of the time (Zemek, Eady, et al., 2014).

Furthermore, few students with mTBI will formally qualify for services and be added to SLP caseloads; the typically transient nature of impairments post-mTBI means that evaluations performed as part of an individualized education plan likely could not be performed quickly enough to benefit the student. Therefore, it is critical that SLPs advocate for their roles on return-to-learn teams in health care and educational settings early in the recovery process and for recognition of their efforts dedicated to monitoring students, providing recommendations, and making appropriate referrals.

The field of speech-language pathology is currently underutilized in serving children with mTBI. A lack of evidence-based clinical research leaves clinicians with little information on when and how to implement services and the most beneficial practices to enhance short- and long-term outcomes. Interdisciplinary collaboration with educational and health care professionals is also insufficient. In both research and clinical efforts, we propose a call to action for SLPs to contribute to efforts enhancing care for this population and readily incorporate our practices into routine assessment and treatment for children following mTBI.

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