

Guideline for Concussion/Mild Traumatic Brain Injury & Prolonged Symptoms

Healthcare Professional Version

Third Edition

Adults (18+ years of age)



Complete Version



Ontario Neurotrauma Foundation

Fondation ontarienne de neurotraumatologie

COMPLETE VERSION



Ontario Neurotrauma Foundation

Fondation ontarienne de neurotraumatologie

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Please note, the project team independently managed the development and production of the guideline and, thus, editorial independence is retained.

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The recommendations and resources found within the *Guideline for Concussion/mTBI & Prolonged Symptoms* are intended to inform and instruct care providers and other stakeholders who deliver services to adults who have sustained or are suspected of having sustained a concussion/mTBI (mild traumatic brain injury). This guideline is not intended for use with patients or clients under the age of 18 years. This guideline is not intended for use by people who have sustained or are suspected of having sustained a concussion/mTBI for any self-diagnosis or treatment. Patients may wish to bring their healthcare and other providers' attention to this guideline.

The recommendations provided in this guideline are informed by best available evidence at the time of publication, and relevant evidence published after this guideline could influence the recommendations made within. Clinicians should also consider their own clinical judgement, patient preferences and contextual factors such as resource availability in clinical decision-making processes.

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Unique Features and Symbols in the Current Guideline

Hyperlinks

To improve ease of use, the current guideline has embedded hyperlinks to improve navigation between sections, appendices, and so on. For example, by clicking any heading in the table of contents above, you will be taken directly to that particular section in the current PDF document. Also, anytime there is mention of a particular table, figure, appendix, or section, you can simply click on it (e.g., click “[Table 6.1](#)”) to go directly to that item.

Symbols



The key symbol has been placed to the left of each guideline recommendation that should be prioritized for implementation. This was determined by expert consensus members during the endorsement/prioritization process, where experts were allowed to provide 20 prioritization votes (see [Methodology](#)). Guideline recommendations with a summed prioritization score greater than 30 are key clinical practice guideline recommendations for implementation.



For sections that did not include a Key Recommendation as above, a star has been placed next to the highest prioritization score recommendation in that section. The reason for this is that while a recommendation may not be a priority it is helpful to note the most important step in any area of symptom treatment.

Levels of Evidence

Recommendations have been **colour coded** to indicate the level of evidence

LEVEL A: At least one randomized controlled trial, meta-analysis or systematic review
LEVEL B: At least one cohort comparison, case studies or other types of experimental study
LEVEL C: Expert opinion, experience or consensus panel

At the bottom of each page there is a hyperlinked footer that can be used to return to any particular section or the table of contents as desired. Also, clicking “Return to Last Page” will take you back to the previously viewed page. (Note: When scrolling through the pages, the “Return to Last Page” button will only return to the last page that was scrolled through.)

Introduction

Background Information on Concussion/ Mild TBI and Prolonged Symptoms

Concussion/Mild Traumatic Brain Injury

Concussion/Mild traumatic brain injury (mTBI) is a significant cause of morbidity and mortality, with many survivors of concussion/mTBI dealing with persisting difficulties for years post-injury.¹⁻³ Over the years, various terms have been used synonymously with mild traumatic brain injury, such as mild head injury and concussion. ***It is important to note that all concussions are considered to be a mTBI however mTBI is distinguished from concussion when there is evidence of intracranial injury on conventional neuroimaging or there is persistent neurologic deficit.***

Definition of Concussion/mTBI

Concussion/mTBI denotes the acute neurophysiological event related to blunt impact or other mechanical energy applied to the head, neck or body (with transmitting forces to the brain), such as from sudden acceleration, deceleration or rotational forces. Concussion can be sustained from a motor vehicle crash, sport or recreational injury, falls, workplace injury, assault or incident in the community.

Clinical signs of concussion immediately following the injury include any of the following:

1. Any period of loss of or a decreased level of consciousness less than 30 min.
2. Any lack of memory for events immediately before or after the injury (post-traumatic amnesia) less than 24 hours.
3. Any alteration in mental state at the time of the injury (e.g., confusion, disorientation, slowed thinking, alteration of consciousness/mental state).
4. Physical Symptoms (e.g., vestibular, headache, weakness, loss of balance, change in vision, auditory sensitivity, dizziness).
5. Note: No evidence of Intracranial lesion on standard imaging (if present, suggestive of more severe brain injury)

Clinical symptoms most commonly experienced following concussion are listed in [Table A](#).

Concussion is a traumatic brain injury at the beginning of the brain injury spectrum ranging from mild to severe brain injury. Mild TBI is among the most common neurological conditions with an estimated annual incidence of 500/100,000 in the United States.⁶ One Canadian study examining both hospital-treated cases as well as those presenting to a family physician calculated the incidence of mTBI in Ontario to lie between 493/100,000 and 653/100,000, depending on whether diagnosis was made by primary care physicians or a secondary reviewer.⁷

There has been much research in the role of structural imaging in diagnosing concussion/mTBI and prolonged symptoms, however studies have yet to find a consistent pattern in structural brain changes to diagnose concussion/mTBI and further research is needed.⁸⁻¹⁰ Computed Tomography (CT) and conventional Magnetic Resonance Imaging (MRI) usually fail to detect evidence of structural brain abnormalities in mTBI. Research in Diffusion Tensor Imaging (DTI) to detect white matter changes post-concussion/mTBI has detected structural changes acutely following, but results have not been shown to be consistent across groups, the resolution does not get at the submillimeter level and is only detecting macroscopic changes, therefore these tests are unable to accurately diagnose concussion/mTBI.¹¹⁻¹³ DTI has also been researched in people with chronic prolonged symptoms¹⁴⁻¹⁶ however more research is needed as the association with prolonged symptoms has not been established. Reviews of recent advances in the biomechanical modeling of mTBI in humans and animals conclude that mTBI leads to functional neuronal disruption, and at times structural damage.^{4,17-19}

There are several criteria commonly used to index severity of traumatic brain injuries. One of the most commonly used is the Glasgow Coma Scale (GCS),²⁰ which assesses a patient's level of consciousness. GCS scores can range from 3 to 15; mTBI is defined as a GCS score of 13-15, typically measured at 30 minutes post-injury or "on admission." Post-traumatic amnesia (PTA), measured as the time from when the trauma occurred until the patient regains continuous memory, is another criterion used to define injury severity, and the cut-off for mild injuries is usually placed at 24 hours or less. Finally, a loss of consciousness of less than 30 minutes has also served as an index of mTBI.²¹ However, it should be noted that mTBI can occur in the absence of any loss of consciousness. The acute symptoms that may follow mTBI are often categorized according to the following domains: 1) physical, 2) behavioural/emotional and 3) cognitive. Some of the more common representatives of each symptom category are presented in [Table A](#).

Table A. Common Symptoms of Concussion/mTBI

Physical	Behavioural/Emotional	Cognitive
Headache Nausea Vomiting Blurred or double vision Seeing stars or lights Balance problems Dizziness Sensitivity to light or noise Tinnitus Vertigo	Drowsiness Fatigue/lethargy Irritability Depression Anxiety Sleeping more than usual Difficulty falling asleep	Feeling “slowed down” Feeling “in a fog” or “dazed” Difficulty concentrating Difficulty remembering

Adapted from Willer B, Leddy JJ. Management of concussion and post-concussion syndrome. Current Treatment Options in Neurology. 2006;8:415-426; with kind permission from Springer Science and Business Media.

Disparities exist in the definitions used for mTBI, and several organizations have created formal diagnostic criteria in order to try to overcome inconsistencies. Due to this fact the Expert Consensus Group (see [Methodology](#)) established a sub-committee to review the diagnostic criteria of concussion/mTBI. Experts reviewed recent definitions of concussion/mTBI as published by established mTBI consensus groups (sport, military) and from clinical practice guidelines. Depending on the population studied the literature would suggest that minimally 15% of persons with concussion may experience persisting symptoms beyond the typical 3 month time frame.²² The consequences for these individuals may include reduced functional ability, heightened emotional distress, and delayed return to work²³ or school.⁵ In a Canadian longitudinal study, they found that only 27% of patients diagnosed with concussion and with symptoms lasting greater than 3 months at clinic presentation eventually recovered and 67% of those who recovered did so within the first year. They also found that no patient recovered who had post-concussion syndrome lasting 3 years or longer.²⁴ When symptoms persist beyond the typical recovery period of three months, the term post-concussion syndrome or disorder may be applied.

Prolonged Symptoms

Just as there is confusion surrounding the definition of mTBI, this is also the case with the definition of post-concussion syndrome. There has been debate as to whether prolonged symptoms are best attributed to biological or psychological factors. It now appears that a variety of interacting neuropathological and psychological contributors both underlie and maintain post-concussive symptoms.^{25,26} One source of controversy has been the observation that the symptoms found to persist following mTBI are not specific to this condition. They may also occur in other diagnostic groups, including those with chronic pain,²⁷⁻²⁹ depression³⁰ and post-traumatic stress disorder,³¹ and are observed to varying extent among healthy individuals.³²⁻³⁴ For the purposes of this guideline prolonged symptoms refer to: A variety of physical, cognitive, emotional and behavioural symptoms that may endure for weeks or months following a concussion.³⁵

Overall approach to treatment:

Phase of recovery should be considered in regards to treatment approaches:

- **Acute: (0-4 weeks):** Emphasis should be placed on facilitation of recovery including education, reassurance, subsymptom threshold training and non-pharmacological interventions.
- **Post-Acute: (4-12 weeks):** If patient not improving or symptoms worsening, then referral to an interdisciplinary clinic should be made. Focus should be placed on managing symptoms of sleep impairment, headache, mood, fatigue and memory/attention. The focus is on a graduated return to activity which may include work and school.
- **Persistent: (3 mo. +):** If symptoms persist for more than 3 months, patients require an interdisciplinary team for symptom management using an individualized management approach with focus on returning to pre-injury activities.

Another area of controversy is the potential influence of related litigation and financial compensation on the presentation and outcome for persons who have sustained mTBI. While there is consistent evidence of an association between seeking/receiving financial compensation (i.e., via disability benefits or litigation) and the persistence of post-concussive symptoms, this relationship is complex and the mechanisms through which litigation/financial compensation issues affect rate of recovery are not well studied.³⁶ Further, it must not be assumed that the initiation of a compensation claim arises solely from the pursuit of secondary gain.^{37,38} The intentional exaggeration or manufacturing of symptoms (i.e., malingering) is relatively rare, whereas there are many potential factors which can contribute to symptom expression and accentuation, including levels of emotional distress, fatigue, and pain, as well as pre- and post-injury coping/adaptation.^{39,40} The focus within the healthcare provider-patient interaction must be upon the development of a collaborative therapeutic alliance, as it is from this vantage point that an accurate understanding of the patient's beliefs and experience of symptoms can arise and, in turn, form the basis for an appropriate treatment plan.

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Scope and Purpose

The Need for a Guideline

The Ontario Neurotrauma Foundation (ONF) initiated this project in 2008 with the overall objective to create a guideline that can be used by healthcare professionals to implement evidence-based, best-practice care of individuals who incur a mTBI and experience prolonged symptoms. Prolonged symptoms are not an uncommon complication of mTBI; current research indicates that minimally 15% of individuals who incur concussion/mTBI will continue to experience significant symptoms beyond the typical recovery period of three months,¹⁻³ which can include post-traumatic headache, sleep disturbance, disorders of balance, cognitive impairments, fatigue and mood or affective disorders. The high incidence of mTBI translates into a significant number of individuals who may experience associated disability.

a. Clinical Questions

Prior to the First Edition, the best practice for treatment of those who do not experience spontaneous recovery was not clearly defined. Therefore, the following clinical questions needed to be addressed:

1. Can an approach be devised to screen for and identify patients who are at high risk of prolonged symptoms?
2. Once identified, can a management plan be developed to treat the symptoms commonly associated with post-concussion disorder?

b. Overall Objectives

The purpose of this clinical practice guideline is to improve patient care by creating a framework that can be implemented by healthcare professionals to effectively identify and treat individuals who manifest prolonged symptoms following mTBI. Specifically, the aims of the guideline update were:

- To update the [Guidelines for Concussion/Mild Traumatic Brain Injury and Persistent Symptoms: Second Edition](#) in order to maintain their relevancy and utility for primary care providers (PCPs).
- To modify the guideline format based on feedback from stakeholders and frontline users of the guideline in order to improve the accessibility and utility of the guideline.
- To work with stakeholders to generate further ideas for knowledge translation.

c. Target Population

The present guideline is appropriate for use with adults (≥ 18 years) who have experienced mTBI (note that the [ONF Pediatric Guidelines for Children and Youth](#) were released in 2014). The present guideline is not appropriate for use with patients who have incurred penetrating brain injuries, birth injuries, brain damage from stroke or other cerebrovascular accidents, shaken baby syndrome, or moderate to severe closed head injuries. The guideline addresses early management to only a limited extent because the purpose of this document is to provide guidance on the assessment and treatment of persistent symptoms. Nonetheless, because early management can influence the development and maintenance of prolonged symptoms, the most critical issues regarding early management have been incorporated. For more comprehensive guidance on pre-hospital and acute care, readers are directed to the [NSW Ministry of Health Adult Trauma Clinical Practice Guidelines - Initial Management of Closed Head Injury in Adults 2nd Edition](#) (2011)⁴ or the [Scottish Intercollegiate Guidelines Network Early Management of Patients with a Head Injury - A National Clinical Guideline](#) (2009).⁵

d. Target Users

The present document is targeted toward healthcare professionals providing service to individuals who have experienced mTBI, including primary care providers (family physicians, nurse practitioners), neurologists, physiatrists, psychiatrists, psychologists, occupational therapists, speech-language pathologists, physiotherapists, chiropractors, social workers and counselors.

e. Directives for Use/Implementation

The consequences of mTBI can result in adverse physical, behavioural/emotional and cognitive symptomatology which, in turn, can impact an individual's activities of daily living and participation in life roles. Early diagnosis and management of mTBI will improve a patient's outcome and reduce the impact of prolonged symptoms. The present guideline offers recommendations for the assessment and management of this patient group. Clinicians should assess, interpret and subsequently manage symptoms, taking into consideration other potential pre-injury, injury and post-injury biopsychosocial factors and conditions that may have contributed to an individual's symptoms. Because of the overlap of symptoms with other clinical disorders, there is a necessity to carefully pursue differential diagnoses. Acute assessment should include

standardized assessment of Post-Traumatic Amnesia (see [Appendix 1.2](#)), and immediate complications of traumatic brain injury such as intracranial bleeding and potential neurologic deterioration while subsequent management of the patient should include assessment and monitoring of symptoms, education and reassurance that the symptoms are common and generally resolve within days to weeks. Furthermore, guidance should be provided on the gradual resumption of usual activities and life roles. It should also be noted that patients may not always be well aware of their symptoms and/or the impact of symptoms on their functioning; this should be taken into consideration when examining patients. Primary care providers should also consider providing self-awareness training for patients, as well as education for family members and/or other caretakers on expected symptoms, treatments, and course of recovery.

The format of this guideline is arranged so that an introduction to the topic is provided in the first part of each of the sections, followed by a table presenting the specific recommendations to be implemented. Core sections were written by the project team from the First and Second Editions and have since been reviewed and updated by current project team members. For certain sections, there were additional contributors with particular expertise in that topic area; these expert contributors have been indicated at the beginning of the sections where appropriate. Also, tables presenting resources (e.g., criteria for diagnosis of mTBI and post-concussion disorder) and indexing tools that can aid assessment and management of symptoms (e.g., patient advice sheet, standardized questionnaires, therapeutic options tables) are also included.

Clinicians are encouraged to prioritize treatments in a hierarchical fashion (see [Table B](#)). Individual guideline recommendations that should be prioritized for implementation are highlighted in the [Key Recommendations](#) section and throughout the guideline document with a key symbol (see right). It is recommended that treatment be first targeted at specific difficulties that have both readily available interventions and the potential to yield significant symptomatic and functional improvement. That is, treat those symptoms that can be more easily managed and/or could delay recovery first, before focusing on more complex and/or difficult to treat symptoms. It is assumed that some post-concussive symptoms, such as cognitive difficulties, are more difficult to treat at least in part because they are multifactorial in origin and reflect the interactions between physiological and psychological factors, premorbid vulnerabilities, and coping style, as well as post-injury stressors. For example, if a patient is experiencing sleep disturbance, depression, cognitive dysfunction and fatigue, by targeting and successfully treating the sleep problems and depression first, improvement in other symptom domains (e.g., fatigue and cognitive dysfunction) may occur as well.



Table B. Symptom Treatment Hierarchy

<p>Primary Symptoms (to be addressed early) Depression/anxiety/irritability Sleep disorder Post-traumatic headache</p>
<p>Secondary Symptoms (recommend addressed secondarily) Balance Dizziness/vertigo Cognitive impairment Fatigue Tinnitus/noise intolerance</p>

References

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3. Ponsford J, Willmott C, Rothwell A, et al. Factors influencing outcome following mild traumatic brain injury in adults. *J Int Neuropsychol Soc*. 2000;6(5):568-579.
4. Health NMo. NSW Ministry of Health Adult Trauma Clinical Practice Guidelines - Initial Management of Closed Head Injury in Adults 2nd Edition. North Sydney NSW: NSW Ministry of Health; 2011.
5. Network SIG. Early Management of patients with a head injury: A national clinical guideline. Edinburgh: Scottish Intercollegiate Guidelines Network; 2009.

Glossary of Terms

Concussion/mild Traumatic Brain Injury (mTBI): Concussion denotes the acute neurophysiological event related to blunt impact or other mechanical energy applied to the head, neck or body (with transmitting forces to the brain), such as from sudden acceleration, deceleration or rotational forces. Concussion can be sustained from a motor vehicle crash, sport or recreational injury, falls, workplace injury, assault or incident in the community.

Clinical signs of concussion immediately following the injury include any of the following:

1. Any period of loss of or a decreased level of consciousness less than 30 min.
2. Any lack of memory for events immediately before or after the injury (post-traumatic amnesia) less than 24 hours
3. Any alteration in mental state at the time of the injury (e.g., confusion, disorientation, slowed thinking, alteration of consciousness/mental state).
4. Physical Symptoms (e.g., vestibular, headache, weakness, loss of balance, change in vision, auditory sensitivity, dizziness).
5. Note: No evidence of Intracranial lesion on standard imaging (if present suggestive of more severe brain injury)

Clinical symptoms most commonly experience following concussion are listed in Table A.

Healthcare Professional: A person who is a member of a regulated college. Recommended experience/training of healthcare professionals treating patients for concussion symptoms should include:

- Training involving direct patient care/contact and knowledge of traumatic brain injury and its biopsychosocial effects
- Experience in concussion management with concussion patients; practices according to the most up-to-date, evidence-based guidelines;
- Practices within their college defined scope of practice and recognizes when to refer to other healthcare providers as patient symptoms require.

Prolonged Symptoms: A variety of physical, cognitive, emotional and behavioural symptoms that may endure for weeks or months following a concussion.

Primary care provider (PCP): A physician or nurse practitioner who sees people who have common medical problems and can provide comprehensive management of a health issue. This person provides continuing care to patients and coordinates referrals to other healthcare practitioners.

Key Recommendations



The following recommendations were highlighted by the guideline development group as the key clinical recommendations that should be prioritized for implementation. The grade of recommendation relates to the strength of the supporting evidence on which the recommendation is based. These key recommendations will also be highlighted throughout the full list of recommendations using the key symbol.

Section 1. Diagnosis/Assessment of Concussion/mTBI		
		GRADE
1.1	Concussion should be recognized and diagnosed as soon as possible to improve positive health outcomes for patients. Concussion can be recognized in the community by a non-medical professional, whereas diagnosis should be made by a physician/nurse practitioner. ^a	A
1.2	On presentation, the primary care provider should conduct a comprehensive review of every patient who has sustained concussion/mTBI (see Appendix 1.1). The assessment should include taking a history, examination and cognitive screen for post-concussive symptoms, and review of mental health (see Table 1.2). ^a	A
1.3	The need for early neuroimaging should be determined according to the <i>Canadian CT Head Rule</i> (Figure 1.1). For patients who fulfill these criteria, CT scanning is the most appropriate investigation for the exclusion of neurosurgically significant lesions, such as hemorrhage. Plain skull x-rays are not recommended. ^b	A
Section 2. Management of Concussion/mTBI		
2.1	Initial treatment of a patient with concussion/mTBI should be based upon a thorough evaluation of signs and symptoms, pre-injury history (e.g., prior concussion(s), premorbid conditions) and concurrent potential contributing factors (e.g., comorbid medical conditions, ADHD, medications, mental health difficulties, impact of associated concurrent injuries).	C
2.3	A patient with a first-time concussion/mTBI should be advised through early education, support and/ or assurance that a full recovery of their symptoms, including cognitive functioning, is typically seen within as early as a few days up to 1 to 3 months post-injury. ^b	A
2.4	For patients who have 1) comorbidities or identified health or risk factors (see Table 1.1) and are not on a trajectory of improvement within the first month, or 2) prolonged symptoms greater than 4 weeks post-injury, it is recommended that these patients be referred for more comprehensive interdisciplinary evaluation to specialized concussion services/clinics (see Appendix 2.1). ^a	C
2.5	The primary care provider should routinely screen for the risk of depression and/or anxiety in the first few weeks after concussion/mTBI (see Appendices 8.1 and 8.2), which may be influenced by psychosocial factors and psychological responses to the injury. Patients who screen positive should be managed and referred to specialist services, if needed, since these conditions commonly complicate recovery. ^a	B
2.6	On presentation to healthcare professionals, patients and their support persons should be provided with education that includes verbal and printed information (see Appendices 1.3 and 1.4). This information should be provided at the initial assessment and ongoing as required. ^a Education should be tailored based on the patient's history and symptoms and include information on: a. Symptoms and expected outcomes b. Normalizing symptoms (education that current symptoms are expected and common after injury event) c. Reassurance about expected full recovery in the majority of patients within a few days, weeks or months d. Gradual return to activities as tolerated i.e., in a manner that does not result in a significant or prolonged exacerbation of symptoms and life roles e. Techniques to manage stress ^c	A (a-d) C (e)

a. Adapted from the Motor Accidents Authority NSW, *Guidelines for Mild Traumatic Brain Injury following a Closed Head Injury* (MAA, NSW, 2008).

b. Adapted from the NSW Ministry of Health. *Closed Head Injury in Adults - Initial Management* (PD2012_013)

c. Adapted from the VA/DoD *Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline* (VA/DoD, 2009).

Section 3. Sport-Related Concussion/mTBI		GRADE
3.1	<p>Patients with sport-related concussion may develop symptoms acutely or sub-acutely. If any one of the following signs/symptoms are observed/reported at any point following a blow to the head, or elsewhere on the body leading to impulsive forces transmitted to the head, concussion should be suspected and appropriate management instituted.</p> <ol style="list-style-type: none"> 1. Any period of loss of or decreased level of consciousness less than 30 min 2. Any lack of memory for events immediately before or after the injury (post-traumatic amnesia) less than 24 hours 3. Any alteration in mental state at the time of the injury (e.g., confusion, disorientation, slowed thinking, alteration of consciousness/mental state) 4. Physical symptoms (e.g., vestibular, headache, weakness, loss of balance, change in vision, auditory sensitivity, dizziness) <p>Note: No evidence of intracranial lesion on standard imaging (if present, it is suggestive of more severe brain injury)</p> <p>Refer to Table A for a comprehensive list of signs for possible concussion.^a</p>	C
3.2	<p>When a player shows any symptoms or signs of a Sport-Related Concussion (SRC):</p> <ol style="list-style-type: none"> a. The player should be medically evaluated by a physician or other licensed healthcare professional onsite using standard emergency management principles and particular attention should be given to excluding a cervical spine injury. b. The appropriate disposition of the player must be determined by the treating healthcare professional in a timely manner. If no healthcare professional is available, the player should be safely removed from practice or play and urgent referral to a physician arranged. c. Once the first-aid issues are addressed, an assessment of the concussive injury should be made by a healthcare professional using a sideline assessment tool (e.g., <i>SCAT5 Appendix 3.2</i>). Non-medical professionals should use the <i>Sport Concussion Recognition Tool (Appendix 3.3)</i>. d. The player should not be left alone following the injury, and serial monitoring for increasing symptoms or signs of deterioration is essential over the initial few hours after injury with the aim of detecting an evolving injury. e. A player with suspected SRC should not be allowed to return-to-play on the day of injury.^a 	A (a) C (b-e)
3.4	<p>There is currently insufficient evidence that prescribing complete rest may ease discomfort during the acute recovery period by mitigating post-concussion symptoms and/or that rest may promote recovery by minimizing brain energy demands following concussion.</p> <ul style="list-style-type: none"> • An initial period of rest in the acute symptomatic period following injury (24-48 hours) may be of benefit. • After a brief period of rest, a sensible approach involves the gradual return to school and social activities (prior to contact sports) as tolerated (i.e., in a manner that does not result in a significant or prolonged exacerbation of symptoms. See Table 12.2).^a 	A
Section 4. General Recommendations Regarding Diagnosis/ Assessment of Prolonged Symptoms		
4.5	<p>After a brief period of rest during the acute phase (24–48 hours) after injury, patients can be encouraged to become gradually and progressively more active as tolerated (i.e., activity level should not bring on or worsen their symptoms).^a</p>	A
Section 5. General Recommendations Regarding Management of Prolonged Symptoms		
5.2	<p>Prolonged symptoms after concussion/mTBI should lead primary care providers to consider that many factors may contribute to the persistence of post-concussive symptoms (see Table 1.1). All relevant factors (medical, cognitive, psychological and psychosocial) should be examined with regards to how they contribute to the patient's symptom presentation and considered in the management strategies.^b</p>	A

- a. Adapted from McCrory P, Meeuwisse WH, Aubry M, et al. Consensus statement on concussion in sport: the 5th International Conference on Concussion in Sport held in Berlin, October 2016. *Br J Sports Med* 2017;0:1–10. doi:10.1136/bjsports-2017-097699. Note that this definition was adapted for the purposes of this guideline. For the definition of Concussion as defined by the 2017 Concussion in Sport please visit [HERE](#).
- b. Adapted from the Motor Accidents Authority NSW, *Guidelines for Mild Traumatic Brain Injury following a Closed Head Injury (MAA, NSW, 2008)*.

5.3	Persons with concussion/mTBI and identified factors typically associated with prolonged symp-toms (see Table 1.1) should be considered for early referral to an interdisciplinary treatment clinic including a physician with expertise in concussion/mTBI where available or interdisci-plinary formal network of providers (see Appendix 2.1) capable of managing post-concussive symptoms because these factors have been associated with poorer outcomes.	B
Section 7. Persistent Sleep- Wake Disturbances		
7.5	It is recommended to treat sleep-wake disturbances in patients with concussion/mTBI. Treatment of sleep disorders may help with: <ul style="list-style-type: none"> • Mood • Anxiety • Pain • Fatigue • Cognitive Problems 	C
Section 8. Persistent Mental Health Disorders		
8.1	In assessing common post-concussive mental health symptoms, determine whether the symptoms meet criteria for the presence of common mental health disorders, which include but are not limited to: <ul style="list-style-type: none"> • Depressive disorders (see Appendix 8.1) • Anxiety disorders (see Appendix 8.2) including Post-traumatic Stress Disorder (PTSD) (see Appendices 8.3 and 8.4) • Behavioral changes (e.g. apathy, lability, impulsivity, aggression, irritability) • Emotional regulation issues • Substance use disorders (see Appendix 8.5) • Somatoform disorders Elements of the assessment should include taking a comprehensive history (including discussion with support persons), structured clinical interview, use of self-report questionnaires, and behavioral observation.	C
Section 9. Persistent Cognitive Difficulties		
9.1	A patient sustaining a concussion should be evaluated for the presence of cognitive difficulties, and consideration taken to the impact of such difficulties on functional areas such as performance at work or school and completing tasks within the home and community, etc. This can be done through a focused clinical interview regarding symptoms and administration of a validated post-concussion questionnaire [e.g., <i>Rivermead</i> (Appendix 1.5) or <i>SCAT5</i> (Appendix 3.1)] for the purpose of assessing and tracking symptoms.	B
9.4	Patients who have cognitive symptoms that are not resolving and continue to interfere in daily functioning (e.g., school or work) beyond 4 weeks should be considered for referral for specialized cognitive assessment (e.g., neuropsychological assessment). The evaluation may assist in clarifying appropriate treatment options based on individual patient characteristics and conditions.	A
Section 11. Persistent Fatigue		
11.4	If identified as a significant symptom, some key considerations that may aid in the management of persistent fatigue can include: <ul style="list-style-type: none"> • Aiming for a gradual increase in activity levels (see Appendix 11.4) that will parallel improvement in energy levels, including exercise below symptom threshold. • Reinforce strategies of cognitive and physical activity pacing (see Appendix 2.6) and fragmentation across the day to help patients achieve more without exceeding tolerance levels. • Encouraging good sleep hygiene (especially regularity of sleep-wake schedules and avoidance of stimulants and alcohol), and proper relaxation times. • Using a notebook or a diary to plan meaningful goals, record activity achievement and identify patterns of fatigue. • Acknowledging that fatigue can be exacerbated by low mood or stress. Provide patients with a pamphlet containing advice on coping strategies for fatigue (see Appendix 11.3).	C

a. Adapted from the VA/DoD Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline (VA/DoD, 2009).

Section 12. Return-to-Activity/Work/School		
12.1	Immediately following any concussion/mTBI, patients should be provided with recommendations to avoid activities that would increase their risk for sustaining another concussion during the recovery period, particularly in the first 7-10 days. ^a	C
Section 12. Return-to-Activity/Work/School		
		GRADE
12.3	Patients with concussion/mTBI should be encouraged to gradually resume normal activity (activities of daily living, work, physical, school, duty, leisure) based upon their tolerance as long as the activity is not at specific risk for concussion. Patients should be preemptively cautioned that transient symptom exacerbations with increased activity are common. If symptoms increase in severity then a monitored slower progressive return to normal activity as tolerated should be continued. ^a	A
12.8	Patients who have not successfully resumed pre-injury work duties following injury should be referred for a interdisciplinary vocational evaluation that includes an assessment of (see Appendix 12.1): <ul style="list-style-type: none"> • Cognitive and psychosocial functioning • Occupational and job demands • Work environment • Environmental supports • Facilitators and barriers to successful work/return to work 	B
12.10	<p><u>Within 24-48 hours post-injury:</u> If asymptomatic: The student can attend school as tolerated but should not undergo evaluations (tests/exams) or should write with accommodations (such as separate space, paced breaks, rooms where lights can be altered, additional time) and should be monitored for potential symptoms. If symptomatic: The student should refrain from attending school and from participating in all academic and sports activities, including apprenticeship, practicum, and shop related activities, in order to decrease the risk for symptom exacerbation. In addition, the student should be offered psychoeducation and modified at-home study tasks as tolerated. Students should be able to tolerate school and life responsibilities prior to participating in sports or activities that put them at risk.</p> <p><u>After 24-48 hours post-injury: (see Appendix 12.4)</u> If asymptomatic: The student may return to academic/program related activities as tolerated as long as they remain asymptomatic. If symptomatic: the student should refrain from attending academic and/or program-related activities for one full week and up to two full weeks if symptoms remain functionally debilitating.</p> <ul style="list-style-type: none"> • Connect with academic accessibility/disability services to request accommodations and receive additional support. • Be monitored for the emergence of potential symptoms and be provided with support and education. • The healthcare professional (with permission) should ensure that accessibility/disability services are notified that a concussion/mTBI has occurred (see Appendix 12.2) and that the student will require time off, and may require accommodations and support for reintegration. • Reintegration should occur progressively and specific accommodations should match the student's residual symptoms. <p><u>1-2 weeks post-injury: (see Appendix 12.5)</u> If symptoms are still functionally debilitating at 1 week post-injury the student should refrain from attending academic- and/or program-related activities. The healthcare professional should again notify accessibility/disability services that the student is still symptomatic and accommodations and support for reintegration will be required.</p> <p><u>After 2 weeks post-injury:</u> The student should start attending school (non-physical activities) very gradually as tolerated and with accommodations, even if he/she is still experiencing symptoms. A healthcare professional with experience in concussion/mTBI rehabilitation should provide guidance to the student and educators. Accessibility/disability services should be notified again so teachers/professors can subsequently monitor progress with the student and adjust the return-to-school plan, as necessary.</p>	C

a. Adapted from the VA/DoD Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline (VA/DoD, 2009).

1

Diagnosis/Assessment of Concussion/mTBI

Special Contributors: Michael Ellis, Pierre Frémont & Catherine Varner

Diagnosis of concussion/mTBI (see Definition) is the first critical step in successful management leading to improved outcomes and prevention of further injury. Patients commonly present to the Emergency Department (ED) or their primary care provider's (PCP's) office following trauma and may be unaware that they have sustained mTBI. A high level of suspicion is required particularly when there is evidence of direct trauma to the head or mechanism of injury¹ that is frequently associated with mTBI, such as motor vehicle collision, falls, assaults and nonintentional strike by/against an object, including sport and recreational injury.² Patients may present in a post-traumatic amnesic (PTA) state, where they may have a Glasgow Coma Scale (GCS) score of 15/15; however, they may be variably oriented and not able to form continuous memories.

The purpose of the initial medical assessment is to establish the diagnosis of mTBI by ruling out more severe forms of TBI, cervical spine injuries and medical and neurological conditions that can present with concussion-like symptoms.³ The need for neuroimaging should also be determined using the Canadian CT Head Rule (Figure 1.1).^{4,5} Despite the current research on advanced neuroimaging studies (such as DTI and fMRI),⁶ CT scans represent the most appropriate and widely available diagnostic imaging test to rule out acute intracranial hemorrhage. Patients who did present symptoms compatible with a concussion/mTBI following a head injury may also be completely asymptomatic by the time they are medically assessed. Once the medical assessment has excluded more severe forms of TBI, these patients should be presumed to have sustained a concussion/mTBI and be managed accordingly.

The severity of a person's symptoms in the initial few days after a TBI is the strongest and most consistent predictor of slower recovery, and demonstrates clinical utility in tracking recovery.⁷ Therefore, symptoms should be formally documented at the time of the initial assessment for the purpose of subsequent comparative analysis in the event of prolonged symptoms. Blood-based biomarkers⁸ are still considered investigational and therefore are not recommended for use in diagnosing/assessing patients in the ED or PCP's office.

When establishing the diagnosis of mTBI, PCPs should also prepare patients and their support person for possible delayed complications by providing both verbal and written information. Namely, given that the majority of patients will be symptomatic acutely post mTBI, education about anticipated symptoms and duration may assist patients in anticipating and understanding their recovery.⁹ For instance, patients are likely to initially experience reduced cognitive functioning post-injury, which typically resolves in a few days but in some instances may persist for weeks to months.¹⁰ Provision of information regarding mTBI symptoms and expectations for recovery, as well as instructions for follow-up, have been shown to be one of the more effective strategies in preventing the development of prolonged symptoms post mTBI. Follow-up by a PCP should be arranged for all patients with a diagnosed concussion/mTBI especially for those with risk factors outlined in [Table 1.1](#). The PCP, or ED physician, if necessary, can monitor progress and ensure that patient symptoms are resolving along expected timelines and make timely arrangements for specialty referral when indicated. In both the initial assessment and the follow-up period, the ED physician or PCP should also attempt to explore and document risk factors (see [Table 1.1](#)) that may potentially delay recovery following mTBI, and consider closer monitoring of recovery

Canadian CT Head Rule
CT head is only required for minor head injury patients with any one of these findings:

High Risk (for Neurological Intervention)

1. GCS score < 15 at 2 hrs after injury
2. Suspected open or depressed skull fracture
3. Any sign of basal skull fracture*
4. Vomiting ≥ 2 episodes
5. Age ≥ 65 years

Medium Risk (for Brain Injury on CT)

6. Amnesia before impact ≥ 30 min
7. Dangerous mechanism ** (pedestrian, occupant ejected, fall from elevation)

***Signs of Basal Skull Fracture**

- hemotympanum, "raccoon" eyes, CSF otorrhea/rhinorrhea, Battle's sign

**** Dangerous Mechanism**

- pedestrian struck by vehicle
- occupant ejected from motor vehicle
- fall from elevation ≥ 3 feet or 6 stairs

Rule Not Applicable If:

- Non-trauma cause
- GCS < 13
- Age < 16 years
- Coagulatin or bleeding disorder
- Obvious open skull fracture

Shill IG, et al. The Canadian CT Head Rule for Patients with Minor Head Injury. Lancet 2001;357:1391-96.

Figure 1.1 Canadian CT Head Rule (Reproduced with permission)

or an acceleration of intervention strategies if needed. See [Algorithm 1.1](#), which outlines the key steps for diagnosis/assessment and initial management of mTBI.

Table 1.1. Risk Factors Influencing Recovery Post mTBI

<p>Medical Factors: Pre-existing/ concurrent medical conditions or post- injury symptoms that are associated with poor outcomes post mTBI</p>	<ul style="list-style-type: none"> • History of previous traumatic brain injury • History of previous physical limitations • History of previous neurological or psychiatric problems • Skull fracture • Early onset of pain and in particular headache within 24 hours after injury • Confounding effects of other health-related issues, e.g., pain medications, disabling effects of associated injuries, emotional distress • Anxiety • High number of symptoms reported early after injury i.e., high score on the Rivermead or Post Concussion Symptom Questionnaire <ul style="list-style-type: none"> - Vestibular/vestibular-ocular abnormalities - Pre-injury sleep disturbance or post-injury changes - Reduced balance or dizziness - Nausea after injury - Memory problems after injury - Post-traumatic amnesia (PTA)
<p>Contextual Factors: Personal, psychosocial, or environmental factors that may negatively influence recovery post mTBI</p>	<ul style="list-style-type: none"> • Injury sustained in a motor vehicle accident • Potential influence of secondary gain issues related to litigation and compensation • Not returning to work or significant delays in returning to work following the injury • Being a student • Presence of life stressors at the time of the injury • Higher levels of symptom reporting is associated with mood symptoms and heightened self-awareness of deficits • Older age • Lack of social supports • Lower education/low social economic status • Female gender • Lower Resilience • Returning to a contact/ risk of contact sport activity

Adapted from the Motor Accidents Authority of NSW, *Guidelines for Mild Traumatic Brain Injury following a Closed Head Injury* (MAA NSW, 2008)

Table 1.2. Key Features of mTBI Assessment in an Emergency Department or Doctor's Office

<p>(a) A medical history encompassing a review of:</p> <ul style="list-style-type: none"> • Current symptoms and health concerns • Setting and mechanism of injury • Severity/duration of altered consciousness and immediate symptoms • Presence of co-occurring injuries • Pre-existing medical and mental health conditions • Potentially contributing psychosocial factors
<p>(b) An examination including an assessment of:</p> <ul style="list-style-type: none"> • Mental status and cognition • Physical status • Cranial nerves • Extremity tone, strength, and reflexes • Gait and balance
<p>(c) An assessment of the patient's clinical status, including whether there has been improvement or deterioration since the time of injury. This may require additional information from others, including eyewitnesses to the injury.</p>
<p>(d) Determination of the need for urgent neuroimaging to exclude a more severe brain injury (see Figure 1.1), such as a structural abnormality or hemorrhage.</p>

Adapted from the NSW Ministry of Health. *Closed Head Injury in Adults - Initial Management* (PD2012_013).

RECOMMENDATIONS FOR DIAGNOSIS/ASSESSMENT OF mTBI		GRADE
1.1	Concussion should be recognized and diagnosed as soon as possible to improve positive health outcomes for patients. Concussion can be recognized in the community by a non-medical professional, whereas diagnosis should be made by a physician/nurse practitioner. ^a	A
1.2	On presentation, the primary care provider should conduct a comprehensive review of every patient who has sustained mTBI (see Appendix 1.1). The assessment should include taking a history, examination and cognitive screen for post-concussive symptoms, and review of mental health (see Table 1.2). ^a	A
1.3	The need for early neuroimaging should be determined according to the <i>Canadian CT Head Rule</i> (see Figure 1.1). For patients who fulfill these criteria, CT scanning is the most appropriate investigation for the exclusion of neurosurgically significant lesions, such as hemorrhage. Plain skull x-rays are not recommended. ^b	A
1.4	The presence of post-traumatic amnesia should be specifically assessed for during the acute assessment and its impact on the patient's capacity should be considered when planning management (see Appendix 1.2). ^a	A
1.5	<p>Patients presenting to hospital/ clinic acutely with mTBI can be safely discharged for home observation after an initial period of in-hospital observation if they meet the following clinical criteria:</p> <ul style="list-style-type: none"> • Normal mental status (alertness/behaviour/cognition) with clinically improving post-concussive symptoms after observation until at least four hours post-injury. • No clinical risk factors indicating the need for CT scanning or normal CT scan result if performed due to presence of risk factors. • No clinical indicators for prolonged hospital observation such as: <ul style="list-style-type: none"> • clinical deterioration • persistent abnormal <i>Glasgow Coma Scale</i> (GCS) or focal neurological deficit • persistent abnormal mental status • vomiting/ severe headache • presence of known coagulopathy • persistent drug or alcohol intoxication • presence of multi-system injuries • presence of concurrent medical problems • age >65^b 	A
1.6	<p>Patients with mTBI can be safely discharged for home observation after an initial period of observation if they meet the following discharge advice criteria provided in written and oral form:</p> <ul style="list-style-type: none"> • Discharge summary prepared by/for primary care provider. • Written and verbal brain injury advice (see Appendices 1.3 and 1.4) given to patient (and support person) covering: <ul style="list-style-type: none"> • Symptoms and signs of acute deterioration and when to seek urgent follow-up (e.g., worsening or new symptoms). • Lifestyle advice to assist recovery. • Typical post-concussive symptoms and reassurance about anticipated recovery.^b 	C

a. Adapted from the *Motor Accidents Authority NSW, Guidelines for Mild Traumatic Brain Injury following a Closed Head Injury (MAA, NSW, 2008)*.

b. Adapted from the *NSW Ministry of Health. Closed Head Injury in Adults - Initial Management (PD2012_013)*

1.7	If the patient re-attends an emergency department/urgent care service with symptoms related to the initial injury, the following should be conducted: <ul style="list-style-type: none"> • Full re-evaluation, including an assessment for ongoing post-traumatic amnesia (PTA) and/or clinical deterioration. • CT scan, if indicated • Emphasis and encouragement to the patients to attend their primary care provider (PCP) for follow-up after discharge, if a PCP is not available it may be necessary to refer to follow-up at the ED. • Provide written and verbal advice (see Appendices 1.3 and 1.4) to the patient (and support person) as stated in recommendation 1.6. • Extra consideration should be given to persons considered part of a vulnerable population (youth, age >65, psychiatric illness), as they may need closer follow-up.^a 	C
1.8	Somatic, cognitive/ communication and emotional/behaviour symptoms following mTBI should be documented using a standardized assessment scale (see Appendices 1.5 and 1.6) at the initial appointment as well as follow-up appointments until symptoms resolve. ^a	C

a. Adapted from the Motor Accidents Authority NSW, *Guidelines for Mild Traumatic Brain Injury following a Closed Head Injury (MAA, NSW, 2008)*.

RESOURCES		
APPENDICES		
1	Acute Concussion Evaluation - Physician/Clinician Office Version	Appendix 1.1
2	Abbreviated Westmead Post-Traumatic Amnesia Scale (A-WPTAS)	Appendix 1.2
3	Brain Injury Advice Card (Long Version)	Appendix 1.3
4	Brain Injury Advice Card (Short Version)	Appendix 1.4
5	Rivermead Post Concussion Symptoms Questionnaire	Appendix 1.5
6	Post Concussion Symptom Scale	Appendix 1.6
7	Other Links/ Resources	Appendix F
TABLES		
1	Risk Factors Influencing Recovery Post mTBI	Table 1.1
2	Key Features of mTBI Assessment in an Emergency Department or Doctor's Office	Table 1.2
FIGURES		
1	Canadian CT Head Rule	Figure 1.1
ALGORITHMS		
1	Initial Diagnosis/Assessment of Adult mTBI	Algorithm 1.1

References

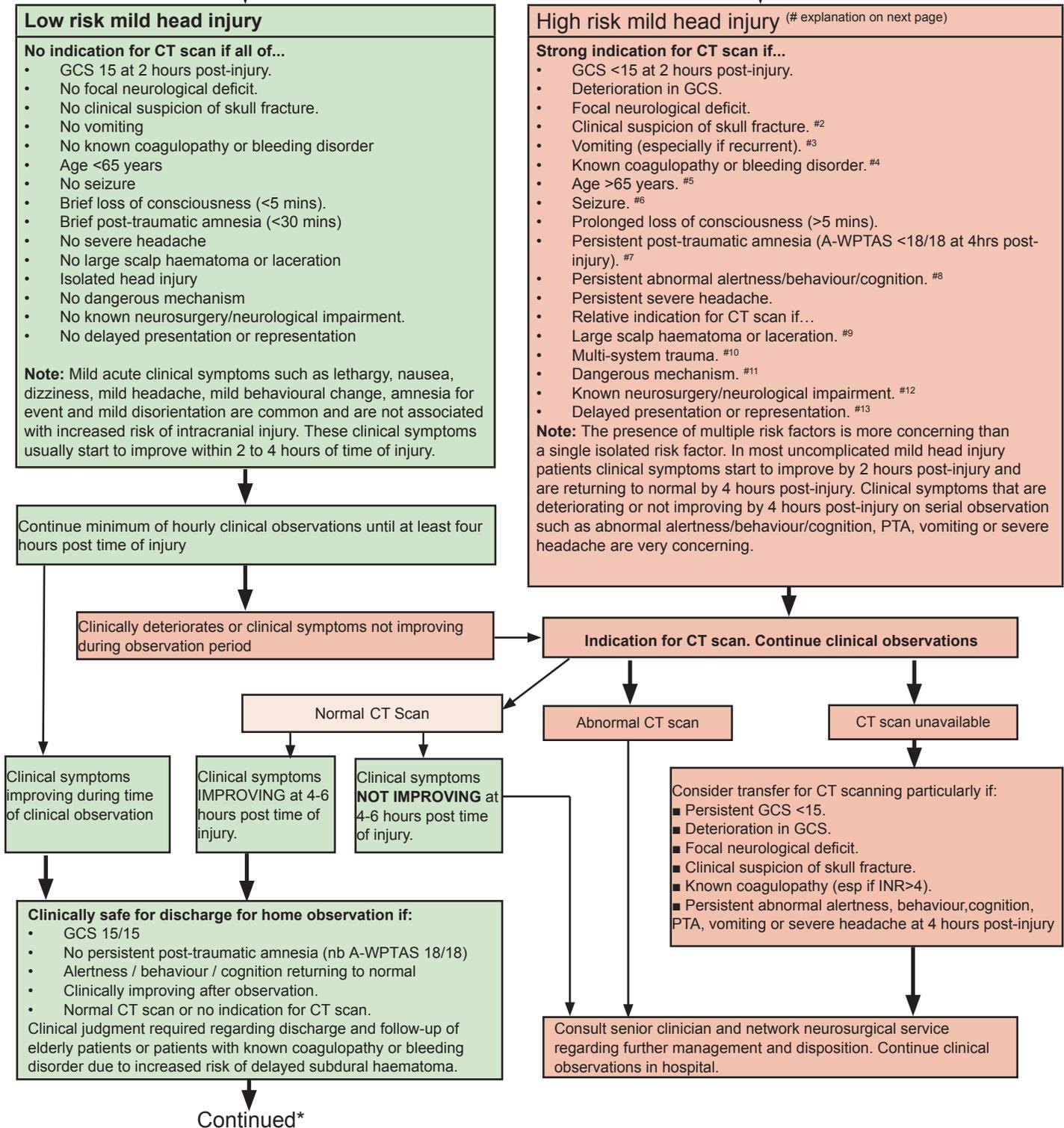
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Algorithm 1.1

Initial Diagnosis/Assessment of Adult mTBI*

Initial GCS 13-15 on arrival following blunt head trauma
Stabilise ABCDEs and assess clinical risk factors.

Commence minimum of hourly clinical observations of vital signs, GCS, pupils, PTA and clinical symptoms



* Adapted from the NSW Ministry of Health. Closed Head Injury in Adults - Initial Management (PD2012_013)

Algorithm 1.1

Initial Diagnosis/Assessment of Adult mTBI* Continued

Continued*



Clinically safe for discharge for home observation if:

- Responsible person available to take home and observe.
- Able to return if deteriorates.
- Discharge advice is understood.



Discharge for home observation if above criteria met:

- Provide written patient advice sheet
- Provide discharge summary for GP
- All patients should be advised to see their GP for follow-up if they are not feeling back to normal within 2 days
- Any patients who have minor CT abnormalities, who suffered significant clinical symptoms or who had prolonged post-traumatic amnesia should be routinely referred to their GP for follow-up due to an increased risk of post concussion symptoms.

Explanatory notes for risk factors:

1. Using GCS<15 at 2 hours post-injury allows clinical judgement for patients who present soon after injury or who have drug or alcohol intoxication. Drug or alcohol intoxication has not been shown to be an independent risk factor for intracranial injury but persistent GCS<15 is a major risk factor and mandates CT.
2. Clinical suspicion of skull fracture includes history of focal blunt assault or injury; palpable skull fracture; large scalp haematoma or laceration; signs of base of skull fracture – haemotympanum / CSF leak / raccoon eyes / Battles sign.
3. Recurrent vomiting more concerning than isolated vomiting but both are indications.
4. Known coagulopathy is both a strong indication for early CT scan and to check the INR. Early reversal of anticoagulation if abnormal CT scan and consider reversal if initially normal CT scan with high INR (>4) depending on clinical situation.
5. Elderly patients have increasing risk of intracranial injury with increasing age; routine CT scanning indicated unless totally asymptomatic patient with no other risk factors.
6. Brief generalised seizures immediately following head injury are not significant risk factors. Prolonged, focal or delayed seizures are risk factors for intracranial injury.
7. Post-traumatic amnesia may manifest as repetitive questioning or short term memory deficits and can be objectively tested using the A-WPTAS. PTA > 30 mins is a minor risk factor and PTA > 4 hours a major risk factor for intracranial injury.
8. Abnormal alertness/behaviour/cognition detects subtle brain injury better than GCS and should be part of the bedside assessment. Family may help establish what is normal.
9. Multi-system trauma – beware patient with unstable vital signs or distracting injuries or who receive analgesia or anaesthesia, as significant head injury is easily missed.
10. Clinical judgement required as to what is a large scalp haematoma or laceration.
11. Dangerous - MVA ejection / rollover; pedestrians / cyclists hit by vehicle; falls >own height or five stairs; falls from horses / cycles etc; focal blunt trauma, eg bat / ball / club.
12. Known neurosurgery/neurological impairment – conditions such as hydrocephalus with shunt or AVM or tumour or cognitive impairment such as dementia make clinical assessment less reliable and may increase risk of intracranial injury.
13. Delayed presentation should be considered as failure to clinically improve during observation. For representation consider both intracranial injury and post concussion symptoms and have a low threshold for CT scanning if not

For a narrative description and recommendations related to this algorithm, please refer to [Section 1](#).

* Adapted from the NSW Ministry of Health. *Closed Head Injury in Adults - Initial Management (PD2012_013)*

2

Initial Management of Concussion/mTBI

Special Contributors:
Michael Ellis & Pierre Frémont

Whether a patient first presents to the Emergency Department (ED) or to the primary care provider's (PCP's) office, ruling out traumatic brain or spine injury that requires emergency intervention is the initial priority. Acutely following injury, it is essential that a management plan be initiated for each patient including: information regarding monitoring for potential acute complications requiring re-assessment, education regarding expected symptoms and course of recovery, and recommendations for healthcare follow-up post-injury.¹ Treatment should be individualized and based on individual patient symptoms and physical examination findings.² Pre-injury or current psychiatric difficulties, such as depression or anxiety, may place a patient at increased risk for prolonged symptoms.² Referral to specialist services and/or interdisciplinary treatment may be required early on for these patients, please follow the link for [Post Concussion Symptom Care Pathway, Referral Indicators, for Concussion Symptom Management and Scope of Practice for Healthcare Professionals](#). Referral to specialists should also be considered if symptoms exhibit an atypical pattern or cannot be linked to a concussion event, and/or when there are other major comorbid conditions present (e.g., depression, PTSD).

The majority of patients will be discharged home; it should be noted that a person who remains symptomatic post mTBI should not drive for at least 24 hours.³⁻⁶ Even asymptomatic patients after 48 hours exhibited poorer vehicle control, especially when navigating curves suggesting that driving impairments may persist beyond when individuals with a concussion have returned to driving.⁷ Also, patients who did present symptoms compatible with a concussion/mTBI following a head trauma but who are completely asymptomatic by the time they are medically-assessed should be presumed to have sustained a concussion/mTBI and receive counselling as described below.

Although the majority of current treatments for concussion are in their infancy of development,⁸ there is preliminary evidence

GENERAL RECOMMENDATIONS FOR MANAGEMENT OF CONCUSSION/mTBI

		GRADE
2.1	Initial treatment of a patient with concussion/mTBI should be based upon a thorough evaluation of signs and symptoms, pre-injury history (e.g., prior concussion(s), premorbid conditions) and concurrent potential contributing factors (e.g., comorbid medical conditions, ADHD, medications, mental health difficulties, impact of associated concurrent injuries).	C
2.2	Persons who report somatic, cognitive and/or psychological difficulties after concussion/mTBI should be assessed and provided with symptom-based treatment even if it has been a prolonged time after injury. ^a	C
2.3	A patient with a first-time concussion/mTBI should be advised through early education, support and/ or assurance that a full recovery of symptoms, including cognitive functioning, is typically seen within as early as a few days up to 1 to 3 months post-injury. ^b	A
2.4	For patients who have 1) comorbidities or identified health or risk factors (see Table 1.1) and are not on a trajectory of improvement within the first month, or 2) prolonged symptoms greater than 4 weeks post-injury, it is recommended that these patients be referred for more comprehensive interdisciplinary evaluation to specialized concussion services/clinics (see Appendix 2.1). ^b	C
2.5	The primary care provider should routinely screen for the risk of depression and/or anxiety in the first few weeks after concussion/mTBI (see Appendices 8.1 & 8.2), which may be influenced by psychosocial factors and psychological responses to the injury. Patients who screen positive should be managed and referred to specialist services, if needed, since these conditions commonly complicate recovery. ^b	B

to support the effectiveness of active rehabilitation such as psychoeducational, psychological and cognitive interventions.⁹⁻¹² The primary forms of treatment have traditionally included a recommendation for physical and cognitive rest until symptoms subside along with other interventions, such as education, coping techniques, support and reassurance, neurocognitive rehabilitation and antidepressants.^{9,13} However, the most recent world Sport-Related Concussion consensus statement

a. Adapted from the VA/DoD Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline (VA/DoD, 2009).

b. Adapted from the Motor Accidents Authority NSW, Guidelines for Mild Traumatic Brain Injury following a Closed Head Injury (MAA, NSW, 2008).

indicated that there is currently insufficient evidence that prescribing complete rest achieves recovery by minimizing brain energy demands following concussion. It is recommended that after a brief period of rest during the acute phase (24–48 hours) post-injury, patients can be encouraged to become gradually and progressively more active while staying below their cognitive and physical symptom-exacerbation thresholds¹³ (see [Appendix 2.2](#)). This emphasizes an approach of “Activity as tolerated” (i.e., in a manner that does not result in a significant or prolonged exacerbation of symptoms). The potential benefit of integrating cognitive behavioral therapy to address thoughts and activities, with cognitive rehabilitation to address difficulties with cognitive abilities, such as attention and memory, has also been noted.^{11,14} Currently, there is limited evidence to support the use of pharmacotherapy.¹³ Medications that may mask worsening symptoms or confuse changes in mental status should be avoided in the early phases of recovery.¹⁵

Several review articles have stated the importance of educational interventions addressing concussion knowledge, symptom interpretation, recovery expectations and thought patterns, and activity levels, in preventing and managing prolonged symptoms after concussion.^{10-12,16-18} Educational interventions for mTBI should validate the current symptomatology, while providing education on the anticipated course of recovery and the importance of gradually achieving realistic functional goals.¹⁹ There is also evidence to suggest that reassurance, in addition to education about symptoms, is more effective for lowering risk of prolonged symptoms than education alone.¹³ Several studies have demonstrated that providing brief single session education-oriented treatment is superior to standard procedures,^{10-12,19-21} and even as effective as more intensive interventions.^{20,21} Education and training for identified patient’s family and caregivers are also important in aiding the patient’s recovery.²² In addition to providing verbal information and reassurance to patients, it is also advised that written patient information sheets are delivered (see Appendices [1.3](#) and [1.4](#)).²³ See [Algorithm 2.1](#), which outlines the key steps for initial management of mTBI.

Overall, management of concussion/mTBI should initially be managed in a standardized and consistent fashion recognizing that the majority of patients will proceed to complete recovery. Interdisciplinary teams are important, particularly for those patients with more complex or prolonged recovery.⁸ By applying the strategies outlined above consistently, both the acute and chronic complications of concussion can be mitigated.

RECOMMENDATIONS FOR MANAGEMENT OF mTBI: PROVIDING EDUCATION AFTER mTBI		GRADE
2.6	On presentation to healthcare professionals, patients and their support persons should be provided with education that includes verbal and printed information (see Appendices 1.3 and 1.4). This information should be provided at the initial assessment and ongoing as required. ^a Education should be tailored based on the patient’s history and symptoms and include information on: <ol style="list-style-type: none"> Symptoms and expected outcomes Normalizing symptoms (education that current symptoms are expected and common after injury event) Reassurance about expected full recovery in the majority of patients within a few days, weeks or months Gradual return to activities as tolerated i.e., in a manner that does not result in a significant or prolonged exacerbation of symptoms and life roles Techniques to manage stress^a 	A (a-d) C (e)
2.7	Scheduled telephone and/or in-person follow-up should be arranged. The focus of these sessions should be to provide education regarding symptom management as well as strategies to encourage a gradual and active resumption of everyday activities as tolerated. These sessions should be provided over the initial 12 weeks post-injury as required.	A
NEW 2.8	Cognitive behavioural therapy could be considered as a supplementary early intervention for patients with psychological risk factors (e.g., pre-injury mental health disorder, negative expectations for recovery, high post-injury anxiety), or as a treatment option for patients with multiple persisting symptoms.	A

RESOURCES

APPENDICES

1	Brain Injury Advice Card (Long Version)	Appendix 1.3
2	Brain Injury Advice Card (Short Version)	Appendix 1.4
7	Specialized Concussion Clinics/ Centers in Ontario	Appendix 2.1

a. Adapted from the VA/DoD *Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline* (VA/DoD, 2009).

8	Parkwood Pacing Graphs	Appendix 2.2
ALGORITHMS		
1	Algorithm: Initial Management of Symptoms Following mTBI	Algorithm 2.1
TABLES		
1	Risk Factors Influencing Recovery Post mTBI	Table 1.1

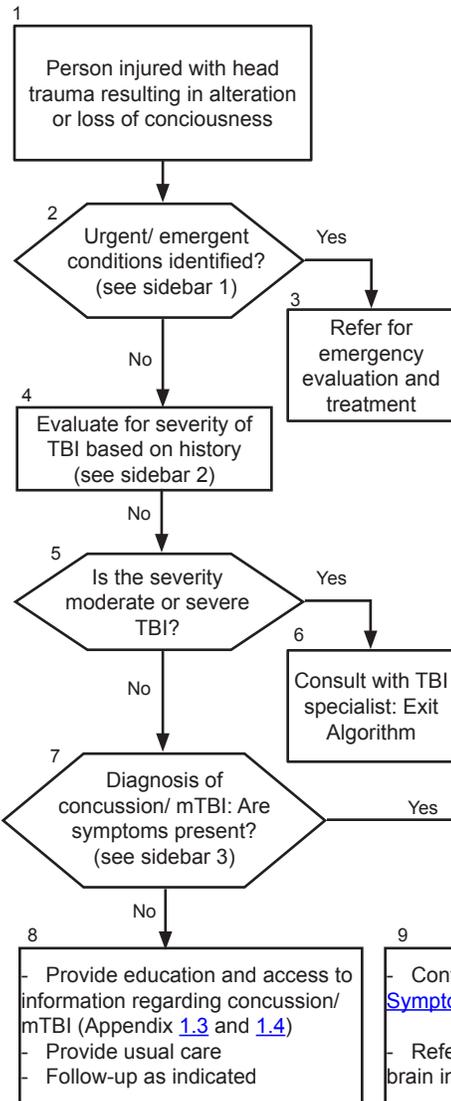
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Algorithm 2.1

Initial Management of Symptoms Following mTBI*

A. Module A: Initial Presentation (>7 Days Post-injury)



Sidebar 1: Indicators for Immediate Referral	
1. Progressively declining level of consciousness	7. Double vision
2. Progressively declining neurological exam (Appendix 3.4)	8. Worsening headache
3. Pupillary asymmetry	9. Cannot recognize people or disoriented to place
4. Seizures	10. Slurred speech
5. Repeated vomiting	11. Unusual behavior
6. Neurological deficit: motor or sensory	

Sidebar 2: Indicators for Immediate Referral (If a patient meets criteria for more than one category of severity, the higher severity level is assigned)			
Criteria	Mild	Moderate	Severe
Structural Imaging	Normal	Normal or abnormal	Normal or abnormal
Loss of Consciousness (LOC)	0-30 min	>30 min and <24 hours	>24 hours
Alteration of Consciousness/ mental state (AOC)*	up to 24 hours	>24 hours; severity based on other criteria	
Posttraumatic Amnesia	0-1 day	>1 and <7 days	>7 days
Glasgow Coma Scale (GCS) (best available score in 24 hours) **	13-15	9-12	<9

Sidebar 3: Possible Post-mTBI Related Symptoms***		
Physical Symptoms: Headache, dizziness, balance disorders, nausea, fatigue, sleep disturbance, blurred vision, sensitivity to light, hearing difficulties/loss, tinnitus, sensitivity to noise, seizure, transient neurological abnormalities, numbness, tingling, neck pain	Cognitive Symptoms: Problems with attention, concentration, memory, speed of processing, judgement, executive control	Behavior/ Emotional Symptoms: Depression, anxiety, agitation, irritability, impulsivity, aggression

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

**In April 2015, the DoD released a memorandum recommending against the use of GCS scores to diagnose TBI. See the memorandum for more information

***Symptoms that may develop within 30 days post-injury.

For a narrative description and guideline recommendations related to this algorithm, please refer to **Section 2**.

* Adapted from the VA/DoD Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline (VA/DoD, 2016).

In the sports literature, the effects of traumatic biomechanical forces on the brain have traditionally been referred to as a concussion. In this Guideline, the term concussion/mTBI will be used to maintain consistency within this document.

A sport-related concussion/mTBI is a traumatic brain injury that may be caused by either a direct blow to the head, face, neck or elsewhere on the body as an indirect force being transmitted to the head during sports activity. A sport-related concussion/mTBI can result in a range of clinical signs and symptoms that may or may not involve a loss of consciousness. While the injury may result in neuropathological changes, the acute clinical signs and reported symptoms largely reflect a functional disturbance rather than a structural injury. Sport-related concussion/mTBIs often present without neurological signs, and can cause a variety of symptoms making the injury complex and potentially difficult to assess and manage. Due to rapidly changing clinical signs and symptoms in the acute phase, sport-related concussion/mTBIs are considered to be among the most complex injuries in sports medicine to diagnose, assess and manage.¹ Sport-related concussion/mTBIs can occur in any population playing sport. A concussion/mTBI injury is more likely to occur when the force or impact suffered is not anticipated by the athlete. Concussion/mTBI's are more likely to occur in contact sports, with the highest incidences (excluding combat sports) being in soccer, football, ice hockey, rugby and basketball.^{2,3} However, non-sport-related concussion/mTBI's also occur in athletes, and can impact their return-to-sport as well. The majority of sport concussion/mTBI symptoms in adults resolve within 10-14 days, although the recovery time frame may be longer in children and adolescents.^{1,3-5} For more information on the management of concussion/mTBI in children and adolescents aged 5-18 years please see the [ONF Guidelines for Pediatric Concussion](#).

Accurate diagnosis, management, and return-to-sport decisions are essential at all levels of participation (i.e., amateur to professional) and for all types of sport. Experts unanimously agree that any player suspected of having experienced a concussion/mTBI should be immediately removed from play, must not return to the game or practice and should be referred for Medical Assessment.^{2,6}

Concussion/mTBI can be recognized in the community by all sport stakeholders including athletes, parents, coaches, officials, teachers, trainers, and licensed healthcare providers, however a formal diagnosis should be made by a physician following a thorough medical assessment. Athletes with a sport-related concussion/mTBI may require onsite (on-field) medical assessments by emergency medical professionals for a more severe head injury, cervical or spine injury, or loss of consciousness.

In cases in which a concussion/mTBI is suspected without a more severe head or spine injury, a player should be removed from the field of play and a sideline assessment can be performed. The Concussion in Sport Group has created a revised Sport Concussion Assessment Tool (SCAT5 and the Concussion Recognition Tool 5, presented in [Appendix 3.1](#) and [Appendix 3.2](#) respectively)³ to aid with this; these tools can also be used during sideline evaluation and include information that can be handed to the athlete. If a player shows any of the signs or symptoms of a concussion/mTBI outlined in [Table A](#), concussion/mTBI should be suspected and a referral for a comprehensive evaluation and medical assessment is required.^{1,4,6}

Athletes diagnosed with a concussion/mTBI should be provided with education about the signs and symptoms of concussion/mTBI, strategies about how to manage initial symptoms, guidance on how to gradually return to school, work, and sport, and risks of returning to sport before a concussion/mTBI has resolved and without medical clearance.⁶ Historically, most consensus statements and guidelines have recommended that concussed athletes rest until they are symptom-free, and prescribed physical and cognitive rest had been a mainstay of care in this population. However, there is currently insufficient evidence that that prescribing complete rest is beneficial for recovery. Therefore, after a brief period of rest during the acute phase (24-48 hours) after injury, patients should be encouraged to become gradually and progressively more active while not increasing symptoms. In fact the term relative rest is more appropriate as patients may partake in activity in the initial stages as long as symptoms do not worsen. A reasonable approach involves the gradual return to daily tasks, school, and light physical activity in a way that does not result in a significant exacerbation of symptoms. Vigorous exertion or return to contact sport should be avoided while athletes are recovering.¹

Most athletes who sustain a sport-related concussion/mTBI will make a complete recovery in 1-4 weeks after injury. However, athletes who do not recover within this time frame may benefit from a referral to a physician with experience in concussion/mTBI in a medically-supervised interdisciplinary concussion clinic that has access to professionals with licensed training in mTBI. Individualized medical and rehabilitative care will be provided for the athlete and medical clearance is required before the athlete can return-to-sport.⁶ The *Buffalo Concussion Treadmill Test* ([Appendix 3.3](#)) can be used to investigate exercise tolerance in people with prolonged symptoms.

Healthcare professionals should counsel amateur athletes with a history of multiple concussion/mTBIs and subjective persistent neurobehavioural impairments about the risk of further concussion/mTBIs, prolonged symptoms and slower recoveries. Return-to-sport and retirement decision-making in patients with prolonged symptoms and multiple concussion/mTBIs requires an individualized approach within an interdisciplinary healthcare team. This may involve a clinical neuropsychologist with certified training in the administration of comprehensive neuropsychological testing, consideration for neuroimaging, and a physician with experience in sport concussion/mTBI management. Considerations for retirement from play: multiple concussion/mTBIs >3, increasing duration of symptoms, subsequent concussion/mTBIs requiring lesser force, inability to return to full-time school or work.^{7,8}

It should be noted that sport-related concussion/mTBI represents one area of study in the mTBI field. Given that the current guideline is not specific to sport-related injuries, the information and guidance included herein for acute and subacute management is limited. Thus, readers interested in further guidance on the assessment and management of concussion/mTBIs in this specific patient population should consult the latest [Consensus Statement on Concussion in Sport: the Fifth International Conference on Concussion in Sport held in Berlin, October 2016](#)¹, [American Academy of Neurology Evidence-based Guideline for Clinicians: Evaluation and Management of Concussion in Sports](#)⁷, the [Concussion Management Guidelines for Certified Athletic Therapists in Quebec](#)⁹, or the [Canadian Guideline on Concussion in Sport](#).⁶ Many sports organizations also formally provide specific guidance and recommendations that are unique to their sport and parallel the principles of existing guidelines; this information can provide further clarity and assistance when making decisions about how to proceed with progressive return to an activity/sport (see resource links in [Appendix F](#)). Further, as discussed above, differences exist between the nature of injuries sustained during sport compared with other types of injuries. Therefore, the application of clinical guidance for sport-related concussion/mTBI may not be appropriate for patients who have sustained other types of injuries.

Table 3.1. Concussion Modifiers

Factors	Modifier
Symptoms	Number Duration (> 10 days) Severity
Signs	Prolonged LOC (> 1 min), amnesia
Sequelae	Concussive convulsions
Temporal	Frequency (i.e., repeated concussions over time) Timing (i.e., injuries close together in time) “Recency” (i.e., recent concussion/TBI)
Threshold	Repeated concussions occurring with progressively less impact force or slower recovery after each successive concussion
Age	Child and adolescent (< 18 years old)
Co- and Pre-morbidities	Migraine, depression or other mental health disorders, attention deficit hyperactivity disorder (ADHD), learning disabilities, sleep disorders
Medication	Psychoactive drugs, anticoagulants
Behaviour	Dangerous style of play
Sport	High-risk activity, contact and collision sport, high sporting level

Adapted from McCrory P, Meeuwisse W, Dvořák J, et al. Consensus statement on concussion in sport. *Br J Sports Med* 2017;51:838-847

Table 3.2. Graduated Return-to-Sport Strategy

Stage	Aim	Activity	Goal of each step
1	Symptom-limited activity	Daily activity that does not provoke symptoms.	Gradual reintroduction of work/school activities
2	Light aerobic exercise	Walking or stationary cycling at slow to medium pace. No resistance training.	Increase heart rate
3	Sport-specific exercise	Running or skating drills. No head impact activities.	Add movement
4	Non-contact training drills	Harder training drills, e.g., passing drills. May start progressive resistance training.	Exercise, co-ordination and increased thinking
5	Full-contact practice	Following medical clearance, participate in normal training activities.	Restore confidence and assess functional skills by coaching staff
6	Return to sport	Normal game play.	

NOTE: An initial period of 24–48 hours of both relative physical rest and cognitive rest is recommended before beginning the RTS progression.
There should be at least 24 hours (or longer) for each step of the progression. If any symptoms worsen during exercise, the athlete should go back to the previous step.
Resistance training should be added only in the later stages (stage 3 or 4 at the earliest). If symptoms are prolonged (e.g., more than 10–14 days in adults or more than 1 month in children), the athlete should be referred to a healthcare professional who is experienced in the management of concussion.

Adapted from McCrory P, Meeuwisse W, Dvořák J, et al. Consensus statement on concussion in sport. *Br J Sports Med* 2017;51:838-847

GENERAL RECOMMENDATIONS FOR ASSESSMENT AND MANAGEMENT OF SPORT-RELATED CONCUSSION

		GRADE
3.1*See Note	<p>Patients with sport-related concussion may develop symptoms acutely or sub-acutely. If any one of the following signs/symptoms are observed/reported at any point following a blow to the head, or elsewhere on the body leading to impulsive forces transmitted to the head, concussion should be suspected and appropriate management instituted.</p> <ol style="list-style-type: none"> 1. Any period of loss of or decreased level of consciousness less than 30 min 2. Any lack of memory for events immediately before or after the injury (post-traumatic amnesia) less than 24 hours 3. Any alteration in mental state at the time of the injury (e.g., confusion, disorientation, slowed thinking, alteration of consciousness/mental state) 4. Physical symptoms (e.g., vestibular, headache, weakness, loss of balance, change in vision, auditory sensitivity, dizziness) <p>Note: No evidence of intracranial lesion on standard imaging (if present, it is suggestive of more severe brain injury) Refer to Table A for a comprehensive list of signs for possible concussion.^a</p>	C

*Note that this definition was adapted for the purposes of this guideline. For the definition of Concussion as defined by the 2017 Concussion in Sport please visit [HERE](#).

a. Adapted from McCrory P, Meeuwisse W, Dvořák J, et al. Consensus statement on concussion in sport. *Br J Sports Med* 2017;51:838-847

3.2	<p>When a player shows any symptoms or signs of a Sport-Related Concussion (SRC):</p> <ol style="list-style-type: none"> The player should be medically evaluated by a physician or other licensed healthcare professional onsite using standard emergency management principles and particular attention should be given to excluding a cervical spine injury. The appropriate disposition of the player must be determined by the treating healthcare professional in a timely manner. If no healthcare professional is available, the player should be safely removed from practice or play and urgent referral to a physician arranged. Once the first-aid issues are addressed, an assessment of the concussive injury should be made by a healthcare professional using a sideline assessment tool (e.g., SCAT5 - Appendix 3.2). Non-medical professionals should use the <i>Sport Concussion Recognition Tool</i> (Appendix 3.3). The player should not be left alone following the injury, and serial monitoring for increasing symptoms or signs of deterioration is essential over the initial few hours after injury with the aim of detecting an evolving injury. A player with suspected SRC should not be allowed to return-to-play on the day of injury.^b 	A (a) C (b-e)
3.3	The need for early neuroimaging should be determined according to the Canadian CT Head Rule (Figure 1.1). For patients who fulfill these criteria, CT scanning is the most appropriate investigation for the exclusion of neurosurgically significant lesions, such as hemorrhage. Plain skull x-rays are not recommended.*	A
3.4	<p>There is currently insufficient evidence that prescribing complete rest may ease discomfort during the acute recovery period by mitigating post-concussion symptoms and/or that rest may promote recovery by minimizing brain energy demands following concussion.</p> <ul style="list-style-type: none"> An initial period of rest in the acute symptomatic period following injury (24-48 hours) may be of benefit. After a brief period of rest, a sensible approach involves the gradual return to school and social activities (prior to contact sports) as tolerated (i.e., in a manner that does not result in a significant or prolonged exacerbation of symptoms. See Table 12.2).^a 	A
NEW 3.5	Schools, teachers, family members, coaches and athletes should be educated on concussion risk factors/ risks.	C
3.6	A range of “modifying” factors may influence the investigation and management of concussion and, in some cases, may predict the potential for prolonged or persistent symptoms. These modifiers would be important to consider in a detailed concussion history and should be managed in an interdisciplinary manner by healthcare professionals with experience in sport-related concussion (see Table 3.1). ^b	C
3.7	Primary care providers should perform a clinical neurological assessment (including evaluation of mood, mental status/cognition, oculomotor function, gross sensorimotor, coordination, gait, vestibular function and balance) on all concussed athletes as part of their overall management (see Appendix 3.4). ^a	C
RECOMMENDATIONS FOR RETURN-TO-PLAY		
3.8	Return-to-play (RTP) protocol following a concussion follows a stepwise process as outlined in Table 3.2 . With this stepwise progression, the athlete should continue to proceed to the next level if asymptomatic at the current level. Generally, each step should take 24 hours so that an athlete would take approximately 1 week to proceed through the full rehabilitation protocol once they are asymptomatic at rest and with provocative exercise. If any post-concussion symptoms occur while in the stepwise program, then the patient should drop back to the previous asymptomatic level and try to progress again after a further 24- hour period of rest has passed. ^c	C
3.9	If pharmacotherapy is used, then an important consideration in return-to-sport is that concussed athletes should not only be free from concussion-related symptoms, but also should not be taking any pharmacological agents/medications that may mask or modify the symptoms of SRC. When pharmacological therapy is begun during the management of an SRC, the decision to return-to-play while still on such medication must be considered carefully by the primary care provider. ^a	C

* NOT AN ORIGINAL RECOMMENDATION - REPEAT OF 1.3

a. Adapted from McCrory P, Meeuwisse W, Dvořák J, et al. Consensus statement on concussion in sport. *Br J Sports Med* 2017;51:838-847

b. Taken from McCrory P, Meeuwisse W, Dvořák J, et al. Consensus statement on concussion in sport. *Br J Sports Med* 2017;51:838-847

c. Adapted from McCrory P, Meeuwisse WH, Aubry M, et al. Consensus statement on concussion in sport: the 4th International Conference on Concussion in Sport held in Zurich, November 2012. *British Journal of Sport Medicine*. 2013;47(5):250-8.

RESOURCES

APPENDICES		
1	Sport Concussion Assessment Tool (SCAT5)	Appendix 3.1
2	Concussion Recognition Tool 5	Appendix 3.2
3	Buffalo Concussion Treadmill Testing	Appendix 3.3
4	Important Components of a Neurological Exam	Appendix 3.4
5	Other Links/Resources to Consider	Appendix F
Figures		
1	Canadian CT Head Rule	Figure 1.1
TABLES		
1	Common Symptoms of mTBI	Table A
2	Concussion Modifiers	Table 3.1
3	Graduated Return-to-Sport Strategy	Table 3.2
4	Stepwise Approach to Return-to-Work Planning for Patients with Concussion/mTBI	Table 12.2

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4

General Recommendations Regarding Diagnosis/Assessment of Prolonged Symptoms

Special Contributors:
Deanna Quon & Mark Bayley

While full recovery is expected within 3 months after concussion/mTBI,^{1,2} not all patients experience such rapid recovery, with minimally 15% or more experiencing prolonged symptoms.^{3,4} A more recent study showed 20 – 48% of veterans had prolonged symptoms up to 60 months post-concussion.⁵ A number of factors influence the rate of recovery, including the mechanism and setting for the initial injury; for example, concussion/mTBI due to non-sport-related causes can be unexpected, emotionally charged, or associated with multiple or even life-threatening injuries. Other potential risk factors (see [Table 1.1](#)) may signal the need to monitor patient recovery more closely, given that these individuals are at higher risk for prolonged symptoms and poorer outcome.⁶⁻⁸ For persons with prolonged symptoms at 1 month post-injury, referral for specialized assessment in an interdisciplinary concussion clinic may be indicated. Patients with prolonged symptoms 3 months post-injury should be referred for interdisciplinary treatment if available.

There is controversy regarding the diagnosis of prolonged post-concussion symptoms because there is significant symptom overlap with other diagnoses that can result as a consequence of a traumatic experience, for example, depression, anxiety, and post-traumatic stress disorder, as well as the sequelae of pain related to comorbid conditions such as post-traumatic headache or whiplash-associated disorder (see [Table 4.1](#), [Appendix 4.1](#)). Regardless of formal diagnosis (e.g., prolonged post-concussion symptoms versus depression), prolonged symptoms following mTBI have the potential to cause functional limitations and need to be addressed in a coordinated and directed fashion in order to assist recovery. Thus, the priority for primary care providers remains managing symptoms and encouraging patients to gradually return to activity guided by symptom tolerance to prevent delays in recovery. Patients who receive education and treatment earlier are more likely to have fewer persisting symptoms later.⁹ The assessment and monitoring of symptoms following mTBI may be facilitated using valid assessment tools, such as the *Rivermead Post Concussion Symptoms Questionnaire* ([Appendix 1.5](#)) or the *Post Concussion Symptom Scale* ([Appendix 1.6](#)).

Table 4.1. Differential Diagnoses Related to Concussion/mTBI

Major depressive disorder
Generalized anxiety disorder
Post-traumatic stress disorder (PTSD)
Chronic pain syndrome
Cervical strain/whiplash associated disorder
Substance abuse or polypharmacy
Somatic symptom disorder
Factitious disorder
Malingering
Post-traumatic headache
Post-traumatic dizziness
Fibromyalgia syndrome (secondary)
Primary sleep disorder: e.g., obstructive sleep apnea

It is also important to note that there is frequently an interplay of symptoms, social circumstances, and subsequent development of complications (e.g., depression) that can complicate and negatively influence recovery. The particular cluster of presenting symptoms will vary among patients, necessitating an individualized approach to management. Accordingly, one of the primary aims of the guideline is to assist in providing recommendations for management of these patients at risk using a symptom-based approach. See the individual sections for more specific treatment information.

GENERAL RECOMMENDATIONS REGARDING DIAGNOSIS/ASSESSMENT OF PROLONGED SYMPTOMS		
		GRADE
4.1	<i>Somatic, cognitive/communication and emotional/behaviour symptoms following mTBI should be documented using a standardized assessment scale (see Appendix 1.5) at the initial appointment as well as follow-up appointments until symptoms resolve.*</i>	C
4.2	The assessment and management of an individual with prolonged mTBI-related symptoms should be directed toward the specific symptoms while considering their etiology and elapsed time from injury. Primary care providers should be aware of symptom interaction as some symptoms may exacerbate others. ^a	C
4.3	The assessment should include a review of currently prescribed medications, over-the-counter medications/supplements and substance use, including alcohol, marijuana and other recreational drugs.	C

4.4	The persisting physical, cognitive, and/or psychological symptoms following mTBI can be nonspecific and may overlap. Therefore, careful and thorough differential diagnoses should be considered as similar symptoms are common in chronic pain, depression, anxiety disorders, sleep disorders and other medical and psychiatric disorders (e.g., headache, pain, fatigue, concentration problems etc.) (see Table 4.1 and Appendix 4.1).	C
4.5	After a brief period of rest during the acute phase (24–48 hours) after injury, patients can be encouraged to become gradually and progressively more active as tolerated (i.e., activity level should not bring on or worsen their symptoms). ^b	A

* NOT AN ORIGINAL RECOMMENDATION - REPEAT OF 1.8

RESOURCES		
APPENDICES		
1	Rivermead Post Concussion Symptoms Questionnaire	Appendix 1.5
2	Post Concussion Symptom Scale	Appendix 1.6
3	ICD-10 Definitions for Differential Diagnosis Related to mTBI	Appendix 4.1
TABLES		
1	Differential Diagnoses Related to mTBI	Table 4.1
2	Risk Factors Influencing Recovery Post mTBI	Table 1.1

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a. Adapted from the *VA/DoD Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline (VA/DoD, 2009)*.

b. Adapted from *McCrorry P, Meeuwisse W, Dvořák J, et al. Consensus statement on concussion in sport. Br J Sports Med 2017;51:838-847*

5

General Recommendations Regarding Management of Prolonged Symptoms

Special Contributors:
Deanna Quon & Mark Bayley

Consistent with general expectations of both patients and healthcare professionals, symptoms following mTBI are anticipated to resolve in a timely fashion in the majority of cases; evidence is emerging that some people (15% or greater) continue to have prolonged symptoms.¹⁻³ There is wide variation in how people recover after concussion/mTBI⁴ even when experiencing similar injuries.² This guideline has been developed to assist in managing those individuals who continue to have prolonged symptoms or delayed recovery following concussion/mTBI.

While there are few treatments for the early stage of concussion recovery, it is notable that providing psychoeducational intervention and supportive reassurance about concussive symptoms, expectations of recovery and strategies for symptom reduction are highly effective for reducing persisting symptoms.⁵⁻⁷ Furthermore there is evidence that complete rest exceeding 48 to 72 hours may slow recovery. Primary care providers must carefully monitor for patients who do not follow the anticipated pattern of recovery. For those who have had complete symptom resolution, no intervention apart from the provision of injury prevention strategies is required. However, for those with prolonged symptoms or decline in function, emphasis needs to be placed on regular monitoring by healthcare professionals and identification of potentially treatable symptoms.

Obtaining a history of medical problems, performing a careful physical examination, an extensive review of concussion symptoms, and considering the response to exertion testing is essential when developing the differential diagnosis of prolonged post-concussion symptoms.^{8,9} Through this process, the primary care provider may be able to link symptoms of prolonged post-concussion symptoms to one or more definable post-concussion disorders.¹⁰ An interdisciplinary process is often helpful and referrals to appropriate specialists should be considered if available.⁹

Development of complications post mTBI, such as depression, can also occur and further alter the course or pattern of recovery. In turn, efforts to update the patient's family on the chosen intervention strategies should be considered, as their support is often a key component to maximizing patient independence and psychosocial adjustment. It is also important to approach the patient's tolerance towards activity with vigilance, as going beyond his or her threshold may result in the worsening of symptoms. Periodic re-evaluation of the patient for worsening of symptoms or presence of new symptoms/problems following mTBI is important for those with a more chronic course of recovery.

While patients with persisting symptoms following mTBI are sometimes portrayed as making claims solely for secondary gain (i.e., disability benefits or litigation), it should be noted that in fact many factors can affect symptom expression and accentuation, including levels of emotional distress, fatigue, and pain, as well as pre- and post-injury coping abilities.^{11,12} Accordingly, suspected symptom exaggeration or perceived compensation seeking should only reinforce the need for a comprehensive assessment and evidence-based treatment with evaluation of outcomes.

Prolonged symptoms describe a constellation of nonspecific symptoms that may be linked to other conditions such as depression, pain, headache, sleep disturbance, vertigo, irritability, anxiety, difficulty with concentration and chronic fatigue, which do not necessarily reflect ongoing physiological brain injury.^{1,13-15} Symptoms associated with persistent post-concussion symptoms are also common in populations who have not sustained a mTBI.¹⁵ Nonetheless, patients are often functionally affected by these symptoms, and therefore they should be addressed. This guideline has been designed to provide an approach that focuses on optimizing management of individual symptoms to enhance function following mTBI. By addressing symptoms in a coordinated manner, improvement in outcome can be achieved. See [Algorithm 5.1](#), which outlines the key steps to management of prolonged symptoms following mTBI.

GENERAL RECOMMENDATIONS REGARDING MANAGEMENT OF PROLONGED SYMPTOMS		GRADE
5.1	<i>A patient with a first-time concussion/mTBI should be advised through early education, support and/or assurance that a full recovery of their symptoms, including cognitive functioning, is typically seen within as early as a few days up to 1 to 3 months post-injury.^{a*}</i>	A
5.2	Prolonged symptoms after concussion/mTBI should lead primary care providers to consider that many factors may contribute to the persistence of post-concussive symptoms (see Table 1.1). All relevant factors (medical, cognitive, psychological and psychosocial) should be examined with regards to how they contribute to the patient's symptom presentation and considered in the management strategies. ^a	A
5.3	Persons with concussion/mTBI and identified factors typically associated with prolonged symptoms (see Table 1.1) should be considered for early referral to an interdisciplinary treatment clinic including a physician with expertise in concussion/mTBI where available or interdisciplinary formal network of providers (see Appendix 2.1) capable of managing post-concussive symptoms because these factors have been associated with poorer outcomes.	B
5.4	If necessary for support, communication with healthcare professionals or understanding information provided, a support person accompanying the patient with post-concussive symptoms to assessment and treatment sessions is recommended. ^b	C
5.5	<i>After a brief period of rest during the acute phase (24–48 hours) after injury, patients can be encouraged to become gradually and progressively more active as tolerated (i.e., activity level should not bring on or worsen their symptoms).^{c**}</i>	C
5.6	New onset pain and concussive injuries are often comorbid. Comprehensive evaluation and management of pain is important as it can be a factor in maintaining prolonged symptoms or can overlap/exacerbate concussion/mTBI symptoms.	C
5.7	<i>On presentation to healthcare professionals, patients and their support person should be provided with educational material that includes a verbal review and written information (see Appendices 1.3 and 1.4). This information should be provided at the initial assessment and ongoing as required. Education should be tailored based on the patient's history and symptoms and include information on:</i> <i>a. Symptoms and expected outcomes</i> <i>b. Normalizing symptoms (education that current symptoms are expected and common after injury event)</i> <i>c. Reassurance about expected positive recovery</i> <i>d. Gradual return to activities and life roles</i> <i>e. Techniques to manage stress^{***}</i>	A (a-d) C (e)
NEW 5.8	It is not recommended to use Hyperbaric Oxygen to treat concussion of symptoms post-concussion.	A

* NOT AN ORIGINAL RECOMMENDATION - REPEAT OF 2.3

c** NOT AN ORIGINAL RECOMMENDATION - REPEAT OF 4.5

*** NOT AN ORIGINAL RECOMMENDATION - REPEAT OF 2.6

- a. Adapted from the Motor Accidents Authority NSW, *Guidelines for Mild Traumatic Brain Injury following a Closed Head Injury* (MAA, NSW, 2008).
b. Adapted from the VA/DoD *Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline* (VA/DoD, 2009).
c. Adapted from McCrory P, Meeuwisse W, Dvořák J, et al. *Consensus statement on concussion in sport. Br J Sports Med* 2017;51:838-847

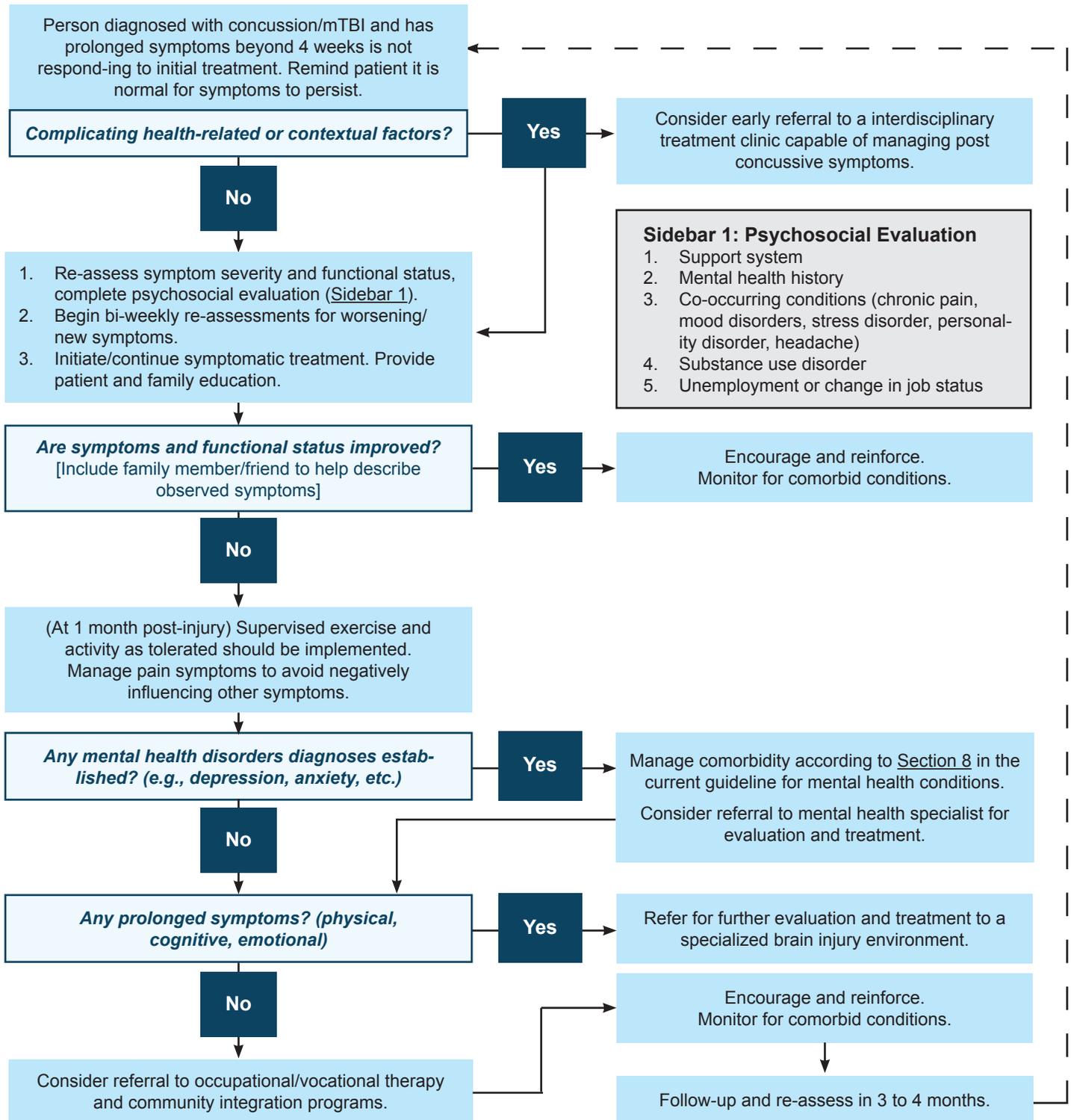
RESOURCES	
APPENDICES	
1 Brain Injury Advice Card (Long Version)	Appendix 1.3
2 Brain Injury Advice Cards (Short Versions)	Appendix 1.4
3 Specialized Concussion Clinics/Centres in Ontario	Appendix 2.1
ALGORITHMS	
1 Management of Prolonged Symptoms following mTBI	Algorithm 5.1
TABLES	
1 Risk Factors Influencing Recovery Post mTBI	Table 1.1

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Algorithm 5.1

Management of Prolonged Symptoms Following concussion/mTBI*



For a narrative description and guideline recommendations related to this algorithm, please refer to **Section 5**.

* Adapted from the VA/DoD Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline (VA/DoD, 2009).

6

Post-Traumatic Headache

Headache is the most common and among the most prevalent prolonged symptoms following mTBI.^{1,4} Studies to date have documented that anywhere from 30-90% of individuals who sustain a mTBI develop post-traumatic headache.^{2,5} Interestingly, several researchers have reported that post-traumatic headache is more common after concussion/mTBI than after severe TBI.⁵⁻¹⁷ Notably, post-traumatic headache is associated with a high degree of disability¹ and is more chronic and persistent than previously thought.¹⁸ The vast majority of people with post-traumatic headache improve within days or weeks; however, for some individuals, headaches may persist beyond this time frame up to months or years. The International Classification of Headache Disorders (ICHD-III)¹⁹ includes diagnostic criteria for both acute (see [Appendix 6.1](#)) and persistent post-traumatic headache following mTBI (see [Appendix 6.2](#)).

Unfortunately, the management of persistent post-traumatic headache is often difficult and there is a paucity of research in the area and no evidence-based treatment guidelines available to guide management. Post-traumatic headache is classified as a secondary rather than primary headache subtype. Headache subtypes are then based upon clinical characteristics that best fit primary headache categories (i.e. migraine- or tension-type headaches).¹³ Comorbid conditions and psychological disorders such as post-traumatic stress disorder (PTSD) contribute to the complexity of managing post-traumatic headache.

^{13,20,21} Accordingly, post-traumatic headache should not be treated as an isolated condition¹⁵ and the management of symptoms is based upon clinical experience and expert opinion.¹⁹

In line with this, diagnostic criteria for the common phenotypes of post-traumatic headache are provided in [Appendix 6.3](#), and individual treatment pathways for these classes of primary headaches can be found in [Algorithm 6.1](#). Clinical studies to date have been conflicting regarding the type of headache that most commonly occurs in post-traumatic headache. Some studies have suggested that the headaches most commonly resemble migraine headaches, whereas other studies have suggested that headaches more commonly resemble tension-type headache.^{3,8,14,16,22-27}

Unfortunately, too frequent use of analgesics is a significant problem in many individuals suffering from persistent post-traumatic headaches.^{8,16} It is well known that too frequent use of analgesics/acute headache medications can, in some, perpetuate and lead to chronification of headaches via the phenomenon of medication overuse (“rebound”) headache. Accordingly, it is important to provide clear instructions on the maximal allowable daily dosing and the maximum allowable monthly frequency of medication consumption - combination analgesics, narcotic analgesics, ergotamines, triptans, and diclofenac potassium oral solution can be utilized no more than 10 days per month to avoid medication overuse (rebound) headache. It is also important to accurately ascertain the frequency and quantity of the patient’s acute headache medication use. Ideally, a blank monthly calendar should be utilized to maintain an accurate headache and medication calendar (*Headache Diary-Appendix 6.4*). For example, advise the patients to put the calendar in their bedroom or beside their toothbrush and fill out nightly, or utilize a notebook to record the information and then transfer to their monthly calendar.

It can be very challenging to determine whether an individual’s persistent post-traumatic headaches are secondary to the severity of their post-traumatic headache disorder or whether they are secondary to medication overuse (rebound) headache. In order to try to determine whether the individual’s headaches may, in fact, be perpetuated by the medication overuse (rebound), it is important to withdraw the individual from the offending medication(s) for a washout period of at least 6-8 weeks.¹ The ICHD-III criteria for Medication Overuse in Headache is presented in [Appendix 6.5](#). Prolonged passive treatment (i.e., many months) is generally not required.

Table 6.1. Important Components to Include in the Focused Headache History

1. Headache frequency
2. Headache duration
3. Headache location
4. Headache intensity
5. Quality of the pain (pressure, throbbing, stabbing)
6. Associated symptoms (e.g., nausea/vomiting)
7. Precipitating/provoking factors
8. Alleviating factors
9. Previous treatment experiences and responses to date (including benefits and side-effects)

RECOMMENDATIONS FOR ASSESSMENT OF POST-TRAUMATIC HEADACHE		
		GRADE
6.1	The primary care provider should take a focused headache history (see Table 6.1) in order to identify the headache subtype(s) that most closely resemble(s) the patient's symptoms. To aid in determining the specific phenotype of headache disorder present, refer to the ICHD-III Beta classification criteria in Appendix 6.3 . It should be noted that some post-traumatic headaches are currently unclassifiable.	B
6.2	Delayed brain imaging (Brain CT or MRI) should be considered when neurologic signs or symptoms are suggestive of possible intracranial pathology, progressive/worsening symptoms without any indications of other cause.	C
6.3	Establish the degree of headache-related disability (i.e. missed work/school, decreased productivity, missed social/recreational activities, bedridden) to assist in stratifying a treatment approach. Markedly limiting or atypical symptoms should be considered for referral to an interdisciplinary concussion clinic, neurologist or headache clinic.	C
6.4	Primary care providers and healthcare professionals treating patient's headaches should perform a neurologic and musculoskeletal exam including cervical spine and vestibular examination (see Appendix 3.4).	B
RECOMMENDATIONS FOR NON-PHARMACOLOGICAL TREATMENT OF POST-TRAUMATIC HEADACHE		
		GRADE
6.5	Education should be provided on lifestyle strategies and simple, self-regulated intervention strategies that may minimize headache occurrence and/or decrease the impact of headaches when they occur. For more details on lifestyle management (see Appendix 6.6).	C
6.6	The treatment of headaches should be individualized and tailored to the clinical features and patient preferences. The treatment may include: <ul style="list-style-type: none"> a. Headache education including topics such as stimulus control, use of caffeine/tobacco/alcohol and other stimulants. b. Non-pharmacologic interventions such as sleep hygiene education, dietary modification, manual therapy and exercise, relaxation and modification of the environment. c. Pharmacologic interventions as appropriate both for acute pain and prevention of headache attacks.^a 	C
RECOMMENDATIONS FOR PHARMACOLOGICAL TREATMENT OF POST-TRAUMATIC HEADACHE		
		GRADE
6.7	All patients with frequent headaches should be strongly encouraged to maintain an accurate headache diary (see Appendix 6.5), medication calendar and activity log in order to accurately gauge symptoms and guide management.	C
6.8	Based upon the patient's headache characteristics, consideration may be given to using acute headache medications, limited to less than 15 days per month, including: <ol style="list-style-type: none"> 1. Over-the-counter or prescription NSAIDs (e.g., Tylenol) 2. Acetylsalicylic acid 3. Acetaminophen 4. Less than 10 days per month for combination analgesics (with codeine or caffeine) 5. Triptan class medications (less than 10 days per month) 	C
6.9	For patients with post-traumatic headaches that are migrainous in nature, the use of migraine-specific abortants including diclofenac potassium oral solution and triptan class medications (i.e., Almotriptan, Eletriptan, Sumatriptan, Rizatriptan, Zolmitriptan, etc.) may be used if effective, but should be limited to fewer than 10 days per month due to risk of developing medication-induced headaches with more frequent use.	B
6.10	Narcotic analgesics should be avoided or restricted solely to "rescue therapy" for acute attacks when other first- and second-line therapies fail or are contraindicated.	C

a. Taken from the VA/DoD Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline (VA/DoD, 2016).

RECOMMENDATIONS FOR PHARMACOLOGICAL TREATMENT OF POST-TRAUMATIC HEADACHE CONTINUED

		GRADE
6.11	Prophylactic therapy should be considered if headaches are occurring too frequently, are too disabling, or if acute headache medications are contraindicated or poorly tolerated or are being used too frequently (see Appendix 6.7).	B
6.12	Post-traumatic headaches may be unresponsive to conventional treatments. If headaches remain inadequately controlled, referral to a neurologist, pain management specialist, or interdisciplinary concussion clinic is recommended.	C

RESOURCES

APPENDICES

1	International Classification of Headache Disorders (ICHD-III) Beta: <u>Acute</u> Headache Attributed to Mild Traumatic Injury to the Head	Appendix 6.1
2	International Classification of Headache Disorders (ICHD-III) Beta: <u>Persistent</u> Headache Attributed to Mild Traumatic Injury to the Head	Appendix 6.2
3	Diagnostic Criteria for Selected Primary Headache Types from the International Classification of Headache Disorders (ICHD-III) Beta	Appendix 6.3
4	Headache Diary	Appendix 6.4
5	International Classification of Headache Disorders (ICHD-III) Beta: Medication-Overuse Headache	Appendix 6.5
6	Important Components to Include in the Neurological and Musculoskeletal Exam	Appendix 3.4
7	Self-Regulated Intervention and Lifestyle Strategies to Minimize Headache Occurrence	Appendix 6.6
8	Prophylactic Therapy	Appendix 6.7
9	Other Links/ Resources to consider	Appendix F

TABLES

1	Important Components to Include in the Focused Headache History	Table 6.1
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ALGORITHMS

1	Assessment and Management of Post-Traumatic Headache following mTBI	Algorithm 6.1
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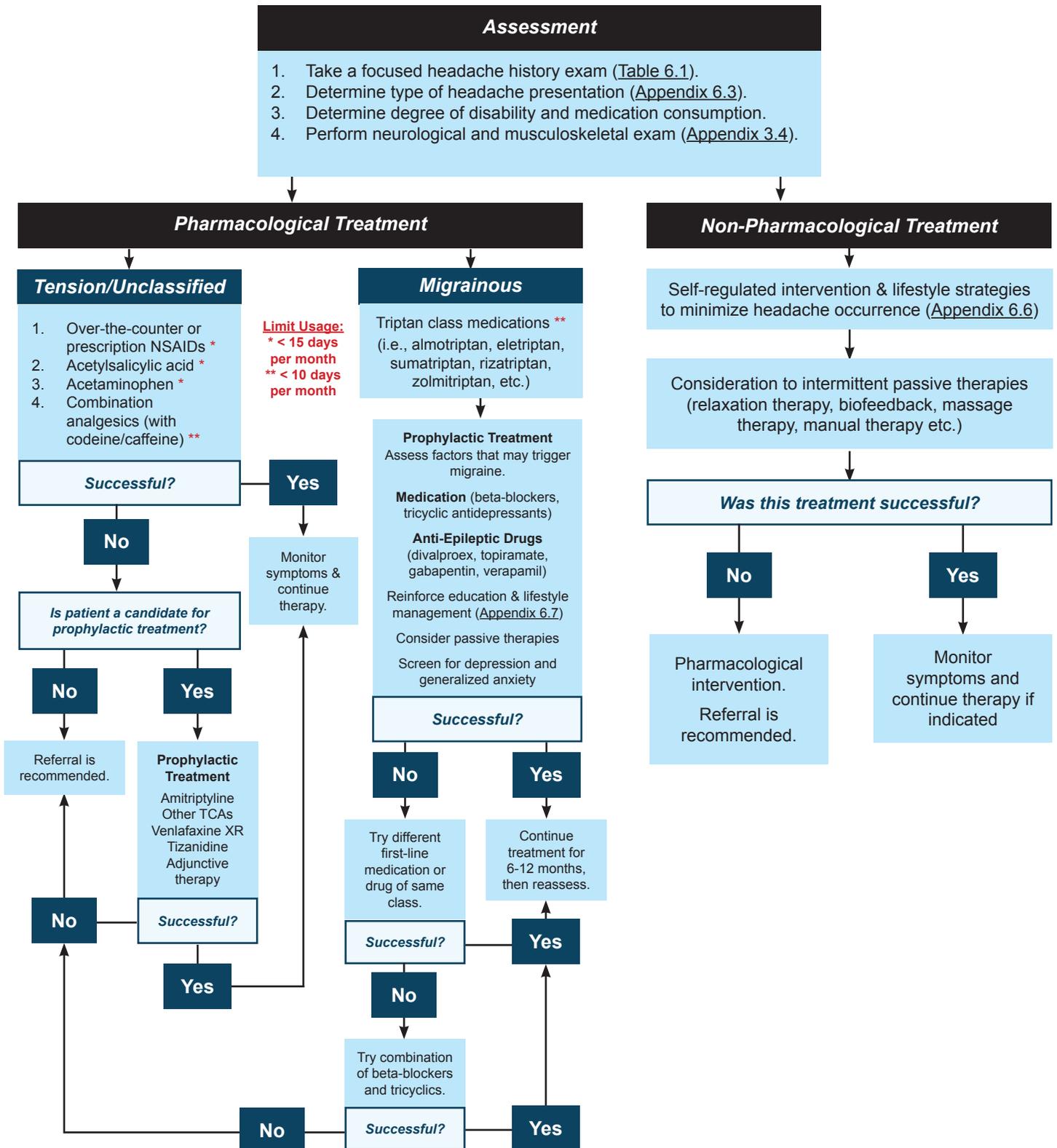
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Algorithm 6.1

Assessment and Management of Post-Traumatic Headache Following mTBI



For a narrative description and guideline recommendations related to this algorithm, please refer to **Section 6**.

7 Sleep-Wake Disturbances

Special contributors:
Marie-Christine Ouellet & Catherine Wiseman-Hakes

More than 50% of patients report sleep disturbances following mTBI, specifically insomnia, hypersomnia, obstructive sleep apnea, poor sleep maintenance, poor sleep efficiency, early awakening, delayed sleep onset, or alterations in circadian cycle. (see [Appendix 7.1](#)).¹⁻⁵ In the immediate acute stage of mTBI, there may be an increased need for sleep⁶ however this decreases over time and insomnia is the most common form of sleep disturbance reported in the subacute and chronic stages of mTBI. Insomnia is characterized by problems with sleep initiation and/or sleep maintenance that can lead to increases in daytime sleepiness and fatigue.^{3,4} Although some research has shown a discrepancy between subjective sleep complaints and objective evidence of sleep disturbance (e.g., obtained via polysomnography), recent data has provided evidence of objectively measured alterations in sleep both in the acute stage and chronic stages of injury.^{6,7} Sleep disturbance itself has been shown to be a prognostic factor for functional and social outcomes up to one year post-injury.⁸ Patients may experience circadian rhythm sleep disorders, specifically delayed sleep phase syndrome and irregular sleep-wake patterns. Patients experiencing sleep disturbances after mTBI commonly find these symptoms to interfere with mood, mental capacities, communication, social or leisure activities, or their principal occupation.^{9,10} It has also been suggested that sleep disturbance among this population may be associated with impairments on neuropsychological and cognitive-communication tests.^{10,11} As is the case with many prolonged symptoms following mTBI, sleep disturbances can be secondary to other conditions such as depression, anxiety, PTSD or pain. Recent studies by Suzuki et al 2017¹² and Lavigne et al 2015,¹³ found that patients experiencing pain in the acute phase of mTBI may require more sleep than those without pain.¹² Management strategies should take this potential interaction of symptoms into account as it may exacerbate poor attention, memory, language processing and learning capabilities.^{9,14-18}

A key feature of diagnosis is obtaining a history from the patient to record the TBI, to rule out pre-existing sleep disorders and to document symptoms after the injury.¹⁹ Once a thorough evaluation has been conducted, treatment of sleep disorders within the mTBI population may take the form of both non-pharmacologic and pharmacologic methods. For insomnia, cognitive behavioural therapy (CBT) is recommended as it addresses factors perpetuating insomnia, such as unhealthy sleep hygiene, maladaptive sleep habits, autonomic and cognitive arousal, and dysfunctional beliefs and attitudes about sleep.^{20,21} Referral to a professional with training and expertise in CBT for insomnia is ideal, however, while waiting for formalized CBT treatment for insomnia, or if this treatment is not available, behavioral recommendations (restriction of time in bed and stimulus control) can still be implemented by primary care providers with weekly monitoring of the patient for the first few weeks (see [Appendix 7.5](#)).^{2,22,23} Referral to a sleep specialist is essential to evaluate and treat less common sleep problems associated with mTBI, such as sleep-related breathing disorder (e.g., obstructive sleep apnea), circadian rhythm shift, restless leg syndrome, periodic limb movement disorder, and REM sleep behaviour disorder.

Some benefits of melatonin have been documented for insomnia, daytime alertness, or circadian rhythm difficulties after mTBI,^{2,16,23} however recent guidelines for the treatment of insomnia²⁴ do not encourage use of melatonin for sleep onset or sleep maintenance issues. There is still very limited data about the efficacy and safety of sleep medications on patients with neurological impairment, and more controlled trials are needed.^{2,25} Caution is therefore recommended when prescribing sleep medications, and the aim should be to use pharmacological agents that will improve sleep-wake patterns but will not produce dependency or adverse side-effects, particularly adverse effects on cognition.²⁶ When prescribing medications the patient should be advised not to drive after taking the medication, and recommended that the patient not have to be somewhere early the next day.¹⁹ Patients should also be advised not to have alcohol in conjunction with the medications.

See [Algorithm 7.1](#), which outlines the key steps for assessment and management of persistent sleep-wake disturbances following mTBI.

Table 7.1 Important Components to Include in the Sleep-Wake Disturbance Screen

Medical Conditions	e.g., endocrine dysfunction, metabolic, pain-provoking
Current Medication Use	e.g., verify if used prescribed or non-prescribed medications impact on sleep because of inadequate type, dosage or timing of administration See Appendix F for useful references regarding specific classes of medications and their impact on sleep.
Comorbid Psychopathology	e.g., mood or anxiety disorder
Unhealthy Habits	e.g., lack of exercise, variable sleep-wake schedule, excessive napping, excessive time spent in bed, exercising close to bedtime, use of nicotine, caffeine, energy drinks, processed foods and processed sugars, alcohol, drugs, medications
Physical	e.g., alterations in menstrual cycle, comorbid physical and pain

RECOMMENDATIONS FOR ASSESSMENT OF SLEEP-WAKE DISTURBANCES		
		GRADE
7.1	Patients should be educated and reassured about the fact that sleep alterations are very common in the acute stages of concussion/mTBI.	B
7.2	Patients who have identified sleep alterations should be monitored for sleep/wake disturbances. Patients who have persisting sleep disturbances should be monitored for sleep-wake disorders (e.g., insomnia, excessive daytime sleepiness). (see Appendices 7.2 and 7.3).	C
7.3	Screen for pre-existing sleep disturbances/ disorders, medical conditions, current medication use, comorbid psychopathology and risk factors for sleep disturbances, which may influence the sleep/wake cycle (see Table 7.1).	C
7.4	Referral for a sleep specialist consultation and polysomnography (e.g., sleep study, Multiple Sleep Latency Test, Maintenance of Wakefulness Test) should be considered if sleep disturbances persist or if there is suspicion of sleep-related breathing disorders, nocturnal seizures, periodic limb movements, or narcolepsy.	C
RECOMMENDATIONS FOR NON-PHARMACOLOGIC TREATMENT OF SLEEP-WAKE DISTURBANCES		
		GRADE
7.5	It is recommended to treat sleep-wake disturbances in patients with concussion/mTBI. Treatment of sleep disorders may help with: <ul style="list-style-type: none"> • Mood • Anxiety • Pain • Fatigue • Cognitive Problems 	C
7.6	All patients with persistent sleep-wake complaints should be placed on a program of sleep hygiene. Behavioural interventions for sleep (e.g., cognitive-behavioral therapy techniques, mindfulness-based therapies) should also be considered. See Appendix 7.4 for a sleep hygiene program and Appendix 7.5 for behavioral recommendations for optimal sleep.	C
7.7	Cognitive behavioural therapy (CBT) for insomnia is established as the treatment of choice for either primary insomnia or insomnia comorbid to a medical or psychiatric condition.	B
7.8	Other non-pharmacologic treatment options that have been found to be useful in the treatment of insomnia include: <ul style="list-style-type: none"> • Melatonin (taken 2 hours before bedtime in conjunction with reduced evening light exposure and light therapy in the morning) • Magnesium and zinc supplementation • Acupuncture and mindfulness-based stress reduction therapy 	C

RECOMMENDATIONS FOR PHARMACOLOGIC TREATMENT OF SLEEP-WAKE DISTURBANCES

		GRADE
7.9	When pharmacologic interventions are used, the aim is to establish a more routine sleep-wake pattern using agents with minimal risk of dependency and adverse effects in patients with concussion/mTBI. Medications to be considered include low-dose trazodone and tricyclic antidepressants (e.g., Amitriptyline, Doxepine), as well as mirtazapine. Prazosin may be considered in patients with nightmares and PTSD. Benzodiazepines should generally be avoided; however, non-benzodiazepine medications (e.g., Zopiclone, Exzopiclone) may have fewer adverse effects and may be considered for short-term use.	C
7.10	The use of Modafinil and Armodafinil can be considered in patients with excessive daytime sleepiness.	A Armodafinil

RESOURCES

APPENDICES

1	Brief Definitions of Sleep Disorders Most Frequently Reported Following TBI	Appendix 7.1
2	Short Clinical Interview for Sleep after Head Injury	Appendix 7.2
3	Sleep and Concussion Questionnaire	Appendix 7.3
4	Sleep Hygiene Program	Appendix 7.4
5	Behavioural Recommendations for Optimal Sleep	Appendix 7.5
6	Sleep Diary	Appendix 7.6
7	Limiting Time Spent in Bed	Appendix 7.7
8	Recreating a Time and Place for Sleep	Appendix 7.8
9	Other Useful Links/References for Resources to Consider	Appendix F

TABLES

1	Important Components to Include in the Sleep-Wake Disturbances Screen	Table 7.1
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ALGORITHMS

1	Assessment and Management of Persistent Sleep-Wake Disturbances Following mTBI	Algorithm 7.1
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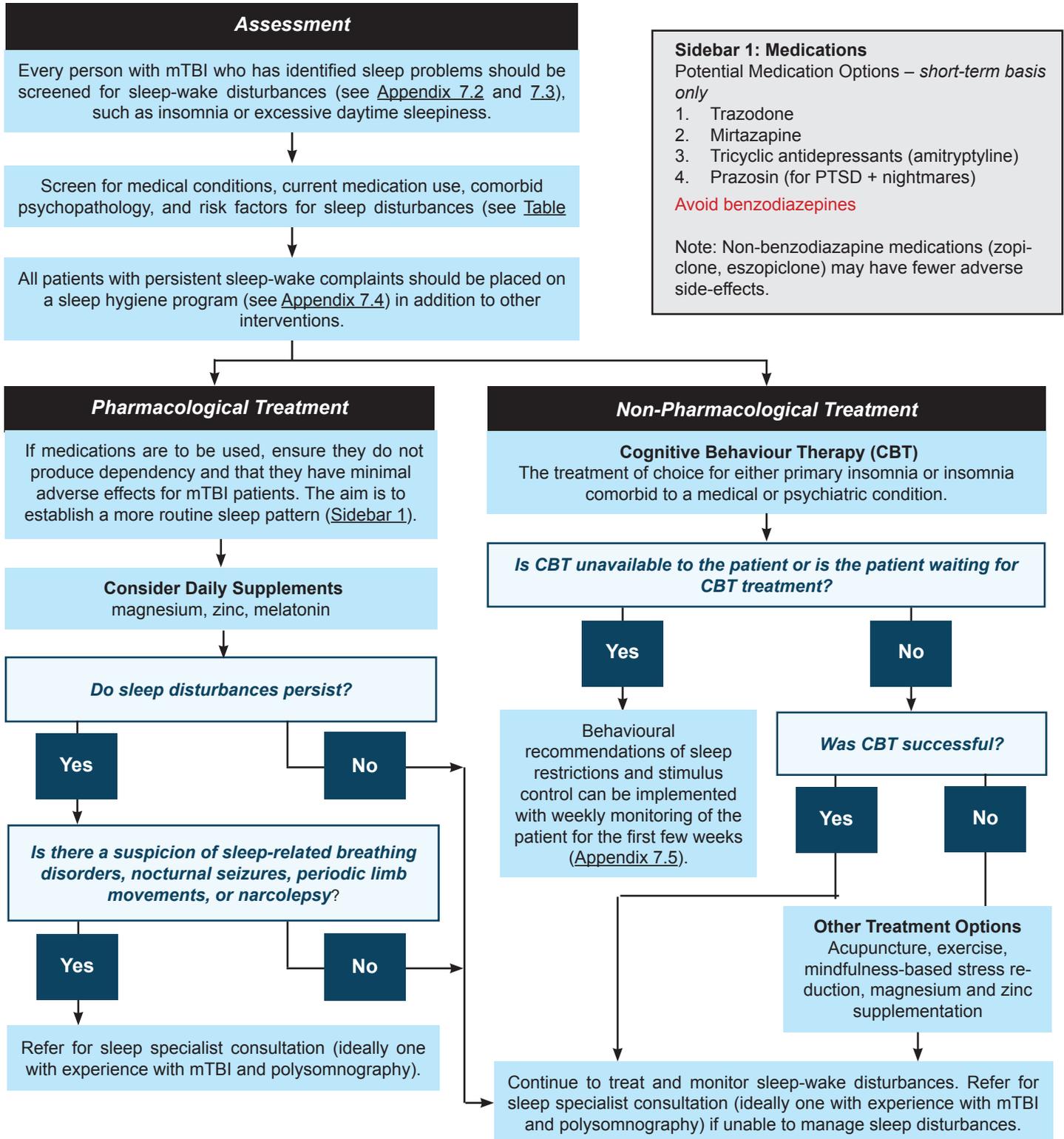
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Algorithm 7.1

Assessment and Management of Sleep-Wake Disturbances Following mTBI



For a narrative description and guideline recommendations related to this algorithm, please refer to **Section 7**.

General considerations

Mental health disorders are common following mTBI, and appear to be major determinants of post-mTBI wellness and functional recovery. This includes disorders of mood which consist of symptoms related to depression and anxiety. The etiology of mTBI/concussive mood disorders may be related to reactive or environmental factors such as the experience of the trauma resulting in the injury (e.g., manifesting in post-traumatic stress symptoms, phobias and related anxieties) or to the negative outcomes following the injury (i.e., depression related to not participating in important roles such as work or school, sports, etc.) They may also manifest in response to the chronic symptoms that can follow concussion/mTBI or any physical injuries such as poor sleep, persistent headaches, chronic pain, medications, etc. Indeed, all of these types of outcomes can contribute, causally, to distress and to disorders of mood. Reciprocally, in what can be considered a 'vicious cycle of pathology', disorders of mood can exacerbate chronic pain, sleep disturbance, anergia and cognitive inefficiencies. This approach to considering disorders of mental health is important when attempting to holistically assess for and manage an individual's outcomes post-mTBI. The disorders of mood related to increased irritability, intolerance, reduced patience and mood reactivity may be related to the neurobiological impact of the injury and/or a reaction to challenges of managing stimulation early on following the injury.

Mental health symptoms and outcomes must be understood within the biopsychosocial context of the individual and that multiple factors can influence related mental health disorders. In the case of mTBI, biologically the individual may suffer an insult to the brain and injuries to the body (e.g., whiplash injuries, etc.), with consequences to their experience of pain and ability to sleep, which can further cause changes in the neurobiology of the brain. At the psychological level they may experience acute stress due to their experience of trauma or injury, as well as in response to the consequences to their functional abilities resulting from the injury. People with prolonged symptoms may become isolated from others as they may be intolerant of or unable to engage in social interactions. Their injury status may disrupt their occupational status, leisure activities and interpersonal interactions. They may also incur losses (e.g., reduced quality of life and independence; lowered income or reduced educational attainment; changes in relationship functioning, etc.). When assessing and managing disorders of mental health post mTBI, it is important to consider all of these potential factors; additionally, individuals who have suffered an mTBI may also have a pre-existing history of biopsychosocial factors/issues that may affect the expression of mental health symptoms or the duration of recovery including the ability to return to pre-injury status.

It is often difficult to obtain timely assessments and treatment interventions from mental health experts. Delays can, and often do, contribute to worse outcomes, and so it is important that primary care providers intervene as soon as possible. Screening for mental health symptoms and determining their etiology as well as prescribing treatment is crucial to facilitating a positive recovery. For example, in a primary care setting this may include screening for disturbances of sleep, or presence of chronic pain, loss, metabolic status etc when patients report low affect. Intervening at the level of improving sleep, managing pain and correcting metabolic imbalances may result in improving reports of low affect. If psychological and social issues appear to be causing mental health symptoms then appropriate therapeutic and/or medication strategies should be employed.

Finally, there is no current evidence to indicate that the mental health problems of individuals who have suffered an mTBI should be treated any differently than mental health problems of other etiologies. For example, we do not have evidence that Major Depressive Disorder (MDD) post-mTBI should be treated differently than MDD that may develop for other psychosocial or biological factors. As such, pharmacological and nonpharmacological interventions including therapeutic interventions that have been found to be helpful in the general population should be considered for individuals who have developed mental health problems post mTBI. Strategies used to treat mental health symptoms post concussion/mTBI should follow the same logic as that applied to similar symptoms found secondary to their conditions or circumstances which include the potential for treatments to worsen other mTBI outcomes. For example, some antidepressant medications, particularly those that are more sedating and/or have greater anticholinergic activity, can worsen the anergia and cognitive impairments that arise directly from mTBI. Another example is the concern for exacerbating seizure risk; fortunately, seizures are a relatively rare outcome of mTBI (although one that must be considered and, depending on the history, assessed for when considering certain psychotropic medications). Some medications can also contribute to worsening of balance impairment, or dizziness, and other symptoms. The need, then, is to select treatment interventions for which there is some evidence of efficacy

(often this will be derived from studies done in the non-mTBI population) while carefully considering and assessing for, the potential to exacerbate other mTBI-related outcomes. In general, psychotropic medications should be used with caution, and non-medication options selected as much as possible. If selecting a medication intervention, start at low doses, allow adequate time for response to be assessed for, and carefully monitor for both efficacy and side effects.

Assessment

Acute concussive symptoms can include irritability, anxiety, emotional lability, depressed mood and apathy.¹⁻³ Early education and treatment focused on symptom management is important. If symptoms persist, the risk of increasing symptom intensity is heightened manifesting in more severe mental health symptoms such as Major Depressive Disorder (MDD) and Post-Traumatic Stress Disorder (PTSD).⁴ Depressive disorders following TBI are commonly associated with increased irritability and often comorbid with anxiety symptoms as well as with fatigue, sleep disturbances, cognitive dysfunction, decreased mobility, emotional processing deficits and anxiety syndromes. The latter include generalized anxiety, panic attacks, phobic disorders, and post-traumatic stress disorder (PTSD).^{2,3,5} These disorders comprise both new conditions that develop *de novo* post-injury, as well as those reflecting an exacerbation of pre-injury conditions or vulnerabilities.¹

Regardless of etiology these disorders require prompt recognition, identification and treatment, given their frequency and potential to impede recovery in other symptom domains^{1,6} as well as result in significant functional declines. Pre-existing difficulties such as substance use disorders and poor psychosocial adjustment also place patients at risk for a protracted recovery or a recovery that is much longer than expected.⁷⁻⁹ Females on average take longer to recover and are at higher risk for anxiety and depressive disorders after TBI.^{4,9,10} Delays in returning to social and vocational roles can in turn produce demoralization and worsened emotional symptoms.^{1,4,11}

The assessment of mental health disorders can be challenging given the overlap in symptoms between mood disorders, sleep disorders, pain syndromes, as well as cognitive difficulties. “Subthreshold” variants of certain conditions, particularly anxiety-based disorders such as PTSD are also observed, in which a symptom cluster falls short of meeting formal diagnostic criteria for a more commonly known disorder, but diagnostically fall into other trauma-related syndromes and require treatment. In general, it is recommended that DSM 5 diagnostic criteria be applied in an “inclusive” manner: for example, counting all relevant symptoms toward a potential diagnosis of depression, regardless of whether the mTBI alone could have caused the symptom^{12,13} Potential contributing medical conditions should also be identified, such as anemia, thyroid dysfunction, B12 deficiency, and so forth. If a mental health condition exists appropriate care should be provided or appropriate referrals made. In situations of diagnostic uncertainty, appropriate referrals should be made.

Various self-report questionnaires can aid the clinician in assessing mental health disorders and offer the advantage of yielding criterion-based diagnoses as well as severity ratings to monitor progress: the *Patient Health Questionnaire 9-item scale* (PHQ-9; [Appendix 8.1](#)) for depression; the *Generalized Anxiety Disorder 7-item scale* (GAD-7; [Appendix 8.2](#)) and the short *Primary Care PTSD Screen* (PC-PTSD; [Appendix 8.3](#)) or the longer *PTSD Checklist* (PCL-5; [Appendix 8.4](#)); and the *CAGE-AID* questionnaire for substance use (i.e., alcohol; [Appendix 8.5](#)). Note that these questionnaires have not been validated specifically with the mTBI population

RECOMMENDATIONS FOR ASSESSMENT OF MENTAL HEALTH DISORDERS

		GRADE
8.1	<p>In assessing common post-concussive mental health symptoms, determine whether the symptoms meet criteria for the presence of common mental health disorders, which include but are not limited to:</p> <ul style="list-style-type: none"> • Depressive disorders (see Appendix 8.1) • Anxiety disorders (see Appendix 8.2) including Post-traumatic Stress Disorder (PTSD) (see Appendices 8.3 and 8.4) • Behavioral changes (e.g. apathy, lability, impulsivity, aggression, irritability) • Emotional regulation issues • Substance use disorders (see Appendix 8.5) • Somatoform disorders <p>Elements of the assessment should include taking a comprehensive history (including discussion with support persons), structured clinical interview, use of self-report questionnaires, and behavioral observation.</p>	C

Management

Treatment is indicated when symptom levels cause distress and negatively impact interactions, function and quality of life or clearly are impeding recovery. Once identified, appropriate psychological and/or pharmacological treatment should be initiated. Medication consultation can be provided by a psychiatrist while therapy interventions may be provided by psychologists or other mental health specialists. Treatment should be initiated early to reduce the risk of worsening symptoms and/or having symptoms become entrenched. Medical issues should be managed concurrently such as headaches, dizziness and comorbid pain. Immediate approaches should include concussion/mTBI education regarding the positive expectations for recovery as well as general support, validation and reassurance.¹⁴⁻¹⁷ Involvement of the family can be very helpful at this stage. Education about regular light exercise should be provided, as well as other important lifestyle information including balanced meals, keeping a routine, seeking social support, etc. General lifestyle measures can have some positive effect on mood, perceived fatigue and well-being, and can counteract deconditioning. See [Algorithm 8.1](#), which outlines care pathways for mild to moderate and severe mental health disorders following concussion/mTBI.

Non-Pharmacological (Psychosocial) interventions

Psychological interventions are critical in the management of primary mental health disorders and include counselling and formal psychotherapies. Cognitive behavioural therapy (CBT) refers to a structured set of strategies focused on managing negative emotion and building coping strategies by altering maladaptive thought patterns and behaviour. There is robust support for the efficacy of this treatment across a range of mental health conditions which include those affecting individuals with concussion/mTBI (e.g., various types of depression and anxieties, insomnia, chronic pain, etc.) with some modifications in procedure indicated for individuals with cognitive challenges.^{9,17-19} The psychotherapeutic intervention applied should be appropriate for the mental health condition diagnosed post concussion/mTBI.²⁰

The decision to recommend psychological intervention will depend on factors such as patient preference and motivation, symptom severity and comorbidity, skills and experience of the treating clinician, and the ease of access to such resources. Primary care providers may be well-suited to provide supportive counselling, along with low-intensity interventions based on CBT principles.²¹ For more difficult symptom presentations cases, such as moderate to severe depression or anxiety, persistent PTSD, or the presence of complex comorbidities referral for specialist treatment should be sought. Combined treatment with medication may also be appropriate.

RECOMMENDATIONS FOR <u>NON-PHARMACOLOGICAL</u> TREATMENT OF MENTAL HEALTH DISORDERS		
		GRADE
8.2	If a mental health disorder is determined to be present, then the treatment of the emotional/behavioural symptoms should be based upon individual factors, patient preference, symptom severity and comorbidity, and existing practice guidelines for the treatment of the diagnosed condition (e.g., depression, anxiety, PTSD). ^a	C
8.3	Immediate referral to a regulated mental health practitioner should be obtained if: <ul style="list-style-type: none"> • The presentation is complex and/or severe (e.g., suicide risk) • Initial treatment is not effective • There is a failure of or contraindication to usual medication strategies It is not necessary for the mental health practitioner to be someone who has a specialty in the treatment of concussion.	C
8.4	While awaiting specialist referral, the primary care provider should clinically manage: <ul style="list-style-type: none"> • Mental health symptoms • General medical issues (e.g., rule out hormonal disturbances, viral infection) • Concussion symptoms (e.g., headache, sleep disturbances, dizziness, pain) • Commence accommodations (return-to-activity, school, work) 	C
8.5	Cognitive behavioural therapy (CBT) and other psychotherapeutic modalities have well-established efficacies for the treatment of primary mood and anxiety disorders in the mental health and other neurological populations; with emerging evidence in the post-concussive population. Given the evidence, psychotherapy should be recommended for patients with persistent mood and anxiety issues following concussion.	A

a. Adapted from the VA/DoD Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline (VA/DoD, 2009).

Pharmacological interventions

Medication may be required for those with moderate to severe, persistent depressive or anxiety symptoms. Selective serotonin reuptake inhibitors (SSRIs) and Serotonin norepinephrine reuptake inhibitors (SNRIs) are recommended as first-line treatments for diagnosed mental health conditions following concussion/mTBI, based upon their side-effect profile and broader utility when compared to agents from other classes.^{9,22} Current evidence supports the utility of SSRIs and SNRIs in treating depression, reducing anxiety and irritability, and, in some reports, improving cognition, somatic symptoms and psychosocial function.²² The efficacy and tolerability of both sertraline²³ (starting at 25 mg; aiming for 50-200 mg/day) and citalopram (starting at 10 mg; aiming for 20-40 mg/day) is supported within the mTBI literature.^{1,24} Common clinical experience suggests that other agents (e.g., alternate SSRIs, venlafaxine, mirtazepine) may also be useful for diagnosed mental health conditions following mTBI, yet clinical data with these agents is lacking. There are no studies indicating specific medication treatment for PTSD for individuals with concussion/mTBI, yet the use of sertraline, paroxetine and venlafaxine are supported by high-quality evidence in the non-TBI population.^{22,25} In the absence of additional data specific to TBI, the use of treatment algorithms developed for primary mental health disorders may be appropriate, albeit with some qualifications.

The concussion/mTBI population may be more sensitive to adverse medication effects upon cognition (alertness, attention, memory), balance and dizziness, sleep and fatigue, and headaches. Anticholinergic effects of certain tricyclic medications (e.g., amitriptyline, imipramine, doxepin) should be carefully monitored. Although uncommon, the risk of post-traumatic seizures (epilepsy) after concussion/mTBI remains elevated and accounts for 10–20% of epilepsy cases in the general population²⁶ at about 1.5 times the rate for the general population for 1-4 years after injury.¹⁰ Up to 86% of patients with one seizure after TBI will have a second seizure within 2 years of their injury.²⁷ Medications with greater impact upon the seizure threshold, such as clomipramine, maprotiline, and the immediate-release formulation of bupropion, should be avoided in favour of newer agents.²⁸ The use of benzodiazepines as first-line therapy or in the long-term treatment for anxiety, agitation or aggressiveness after concussion/mTBI is generally not recommended due to potential effects on arousal, cognition, and motor coordination.^{24,29} The potential for abuse/dependency associated with these agents is also of concern, given the elevated rates of pre-injury substance use disorders observed among TBI patients.^{9,24} Nonetheless, short-term use of these agents may be helpful during periods of crisis or acute distress.

Strategies related to discontinuation of pharmacotherapy should be based on guidelines appropriate to the diagnosed mental health condition. Special consideration is not currently indicated for concussion/mTBI.³⁰ In the absence of strong reasons for early termination (such as tolerance issues), successful pharmacotherapy should be continued for at least 6 months before a trial of slow tapering is considered. Relapse prevention strategies should also be considered with psychological treatment approaches.

Table 8.1 General Considerations Regarding Pharmacotherapy after concussion/mTBI

- Prior to starting treatment, ensure that significant psychosocial difficulties are being addressed (e.g., ongoing domestic abuse, major family/caregiver conflict, other environmental issues).
- Before prescribing a new treatment, review current medications including over-the-counter medicines and supplements. If possible, minimize or stop agents that may potentially exacerbate or maintain symptoms.
- Drug therapy should target specific symptoms to be monitored during the course of treatment (e.g., dysphoria, anxiety, mood lability, irritability, as well as fatigue, sleep, headaches and pain).
- In choosing amongst therapies, aim to minimize the impact of adverse effects upon arousal, cognition, sleep and motor coordination, as well as seizure threshold—domains in which TBI patients may already be compromised.
- A specific selective serotonin reuptake inhibitor (SSRI) is recommended as first-line treatment for mood and anxiety syndromes after mTBI. Other antidepressants may also be considered as described in the accompanying text. The use of benzodiazepines as first-line therapy for anxiety after concussion/mTBI is not encouraged.
- Start at the lowest effective dose and titrate slowly upwards, monitoring tolerability and clinical response, yet also aim for adequate dosing and trial duration. Inadequacies of either are frequent causes of treatment failure. At times the maximum tolerated doses may be required.
- Use of a single agent to alleviate several symptoms is ideal (e.g., tricyclic [TCA] for depression, sleep disruption and headache relief). However, as individual post-concussive symptoms do not necessarily show a coupled response to treatment, a combination of strategies may be ultimately required (e.g., SSRI plus low-dose TCA for mood and headache treatment).
- Limited quantities of medications should be offered to those at an elevated risk for suicide.
- To prevent relapse, consider continuing successful pharmacotherapy for at least 6 months prior to a trial of slowly tapering medication.

Adapted from Silver JM, Arciniegas DB, Yudovsky SC. Psychopharmacology. In: Silver JM, Arciniegas DB, Yudovsky SC, eds. *Textbook of Traumatic Brain Injury*. Arlington, VA: American Psychiatric Publishing Inc;2005:609-640.

RECOMMENDATIONS FOR PHARMACOLOGICAL TREATMENT OF MENTAL HEALTH DISORDERS		GRADE
8.6	<p>When prescribing any medication for patients who have sustained a concussion/mTBI, the following should be considered:</p> <ol style="list-style-type: none"> Use caution when initiating pharmacologic interventions to minimize potential adverse effects on arousal, cognition, motivation and motor coordination. Start at the lowest effective dose and titrate slowly upwards, based upon tolerability and clinical response. Allow adequate time and duration for drug trials. Avoid making more than one medication change at a time (i.e., when adding new medications or changing doses). Doing “one thing at a time” will enable more accurate assessment of drug benefits and potential adverse effects. Follow-up should occur at regular intervals: initially more frequently while increasing medication to monitor tolerability and efficacy. <p>For more details regarding pharmacotherapy after concussion/mTBI, refer to Table 8.1.^a</p>	C
8.7	<p>A SSRI is generally recommended as the first-line pharmacological treatment for mood and anxiety syndromes after concussion/mTBI. In some cases, however, the combination of sedative, analgesic, and headache prophylaxis effects from a tricyclic (TCA) may be desirable, yet these agents may generally be considered second-line. Other second-line options include mirtazapine, an alternate SSRI, or an SNRI.</p>	A
8.8	<p>After successful treatment with an antidepressant, maintenance treatment for at least 6-9 months is advised to reduce the risk of relapse.</p>	C
8.9	<p>SSRIs or SNRI's are recommended as first-line pharmacotherapy for PTSD after concussion/mTBI; both can improve the core symptom of re-experiencing, hyperarousal and avoidance.</p> <ul style="list-style-type: none"> Persisting sleep disruption may require adjunctive treatment with trazodone, mirtazapine, low-dose tricyclic or prazosin. Prazosin in particular can decrease trauma-related nightmares. Benzodiazepines do not reduce the core symptoms of PTSD; their long-term use to manage PTSD is not recommended. 	C

RESOURCES		
APPENDICES		
1	Patient Health Questionnaire 9-Item Scale (PHQ-9) for Depression	Appendix 8.1
2	Generalized Anxiety Disorder 7-Item Scale (GAD-7)	Appendix 8.2
3	Primary Care PTSD Screen (PC-PTSD)	Appendix 8.3
4	PTSD Checklist (PCL-5)	Appendix 8.4
5	CAGE and CAGE-AID Questionnaire	Appendix 8.5
6	Other Links/ Resources to consider	Appendix F
TABLES		
1	General Considerations Regarding Pharmacotherapy after mTBI	Table 8.1
ALGORITHMS		
1	Assessment and Management of Persistent Mental Health Disorders Following mTBI	Algorithm 8.1

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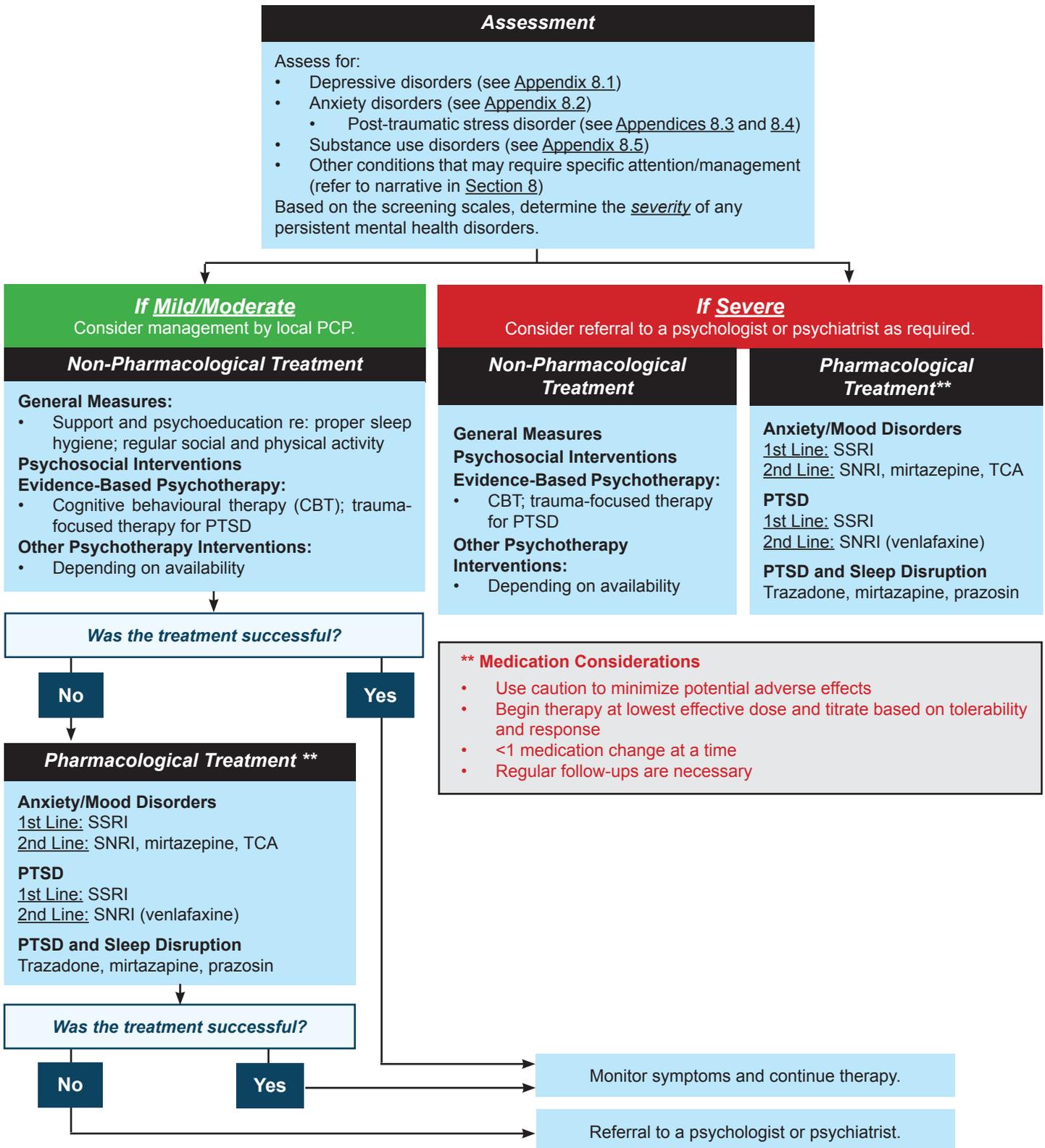
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Algorithm 8.1

Assessment and Management of Mental Health Disorders Following concussion/mTBI



Monitor symptoms and continue therapy.

Referral to a psychologist or psychiatrist.

For a narrative description and guideline recommendations related to this algorithm, please refer to **Section 8**.

The presence and persistence of cognitive symptoms following concussion/mTBI can affect an individual's ability to function in everyday life, including work, academic and social activities.^{1,2} Mild TBI/concussion is associated with disruptions in cognitive skills that include difficulties with attention/concentration, processing speed, learning/memory and executive function.³⁻⁶ In the acute phase of injury there are changes in cerebral metabolic activity and perfusion, particularly in the frontal lobes associated with cognitive changes.⁷⁻¹² Generally, the expected recovery from cognitive-based symptoms following concussion/mTBI ranges from 1 week to 6 months, with more rapid rates of recovery found in young athletes.⁶ However, 15%-33% of individuals^{3,6,7,13} experience persistent cognitive symptoms beyond the acute phase of recovery, which significantly disrupts their capacity to resume many pre-morbid activities.

Currently, it remains unclear whether persistent cognitive symptoms result from the pathophysiological effects of the injury and/or are influenced by other factors that can impact cognitive functioning such as pain, cognitive fatigue, medications, sleep disturbance, vestibular disturbance, visual changes, pre-morbid personality factors, cognitive reserve, psychological factors and emotional disturbance (i.e., anxiety, irritability and depression).¹⁴⁻¹⁹ Additionally, cognitive symptoms do not typically worsen over time as a sole and direct function of the traumatic injury. When such a pattern of complaints is observed, the relative impact of these additional factors should be considered and addressed.

It is important to document cognitive symptoms in order to characterize the nature of these symptoms and to track progress over time. When cognitive dysfunction does not resolve with treatment of potentially contributing factors or if cognitive symptoms persist past 3 months, practitioners should consider referral for neuropsychological assessment to aid in identifying the nature of cognitive strengths and challenges, setting goals for treatment, career and education planning, or provide information about independent functioning.^{7,20} Deficits identified on neuropsychological assessment may be amenable to specific rehabilitation strategies (e.g., compensatory cognitive strategies) as well as cognitive behavioural therapy (CBT) focused on education about the commonality of symptom presentation, facilitation of more effective coping strategies and integration of cognitive compensatory strategies.²⁰ This combination has demonstrated reductions in the presence of prolonged symptoms.^{4,7,21,22}

RECOMMENDATIONS FOR ASSESSMENT OF COGNITIVE DIFFICULTIES

		GRADE
9.1	A patient sustaining a concussion should be evaluated for the presence of cognitive difficulties, and consideration taken to the impact of such difficulties on functional areas such as performance at work or school and completing tasks within the home and community, etc. This can be done through a focused clinical interview regarding symptoms and administration of a validated post-concussion questionnaire [e.g., <i>Rivermead</i> (Appendix 1.5), <i>PCSS</i> (Appendix 1.6) or <i>SCAT5</i> (Appendix 3.1)] for the purpose of assessing and tracking symptoms.	B
9.2	Since certain comorbidities can exacerbate cognitive symptoms (e.g., ADHD, learning disabilities, anxiety or mood disorders, pain, fatigue, sleep disturbance, neuroendocrine dysfunction, substance abuse, existing medications) patients should be provided with education highlighting that their cognitive symptoms may be intensified and prolonged by these comorbidities.	B
9.3	<i>A patient with a first-time concussion should be advised through early education, support and/or assurance that a full recovery of symptoms, including cognitive functioning, is typically seen within as early as a few days up to 1 to 3 months post-injury.*</i>	A
9.4	Patients who have cognitive symptoms that are not resolving and continue to interfere in daily functioning (e.g., school or work) beyond 4 weeks should be considered for referral for specialized cognitive assessment (e.g., neuropsychological assessment). The evaluation may assist in clarifying appropriate treatment options based on individual patient characteristics and conditions.	A

* NOT AN ORIGINAL RECOMMENDATION - REPEAT OF 2.3

There is good evidence that early education intervention is associated with a significant reduction in the persistence and misattribution of symptoms.^{5,10,23,24} Related interventions include education about the mechanisms of brain injury, reassurance, and early management strategies that include graduated reintegration into physical activity, work, and school, as well as the understanding that symptoms should typically resolve within 3 to 6 months.^{25,26} Therefore, attempts should be made to document the specific cognitive complaints/symptoms in conjunction with other symptoms as early as possible, provide or refer to educational material, and track recovery or reported worsening of symptoms over time. Educational material regarding expected outcome following mTBI is readily available and can be accessed by the individual and/or provided by various practitioners within the area of concussion/mTBI (e.g., occupational therapists, speech-language pathologists, psychologists, family physicians, nursing staff, community therapists).

RECOMMENDATIONS FOR TREATMENT OF COGNITIVE DIFFICULTIES		
		GRADE
9.5	Evidence-based neurorehabilitation strategies should be initiated if: a. The individual exhibits persisting cognitive impairments on formal evaluation, and/or b. To facilitate the resumption of functional activities, work and school.	A
9.6	If persisting cognitive deficits are identified by neuropsychologists or other healthcare professionals, implement temporary work or school accommodations or modifications and provisions for assistance (e.g., implement schedules, avoid excessive anxiety, pace activities, etc.). See Section 12 .	C

RESOURCES		
APPENDICES		
1	Rivermead Post Concussion Symptoms Questionnaire	Appendix 1.5
2	Post Concussion Symptom Scale	Appendix 1.6
3	SCAT5	Appendix 3.1
4	Other Useful Links/References for Resources to Consider	Appendix F

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10

Vestibular (Balance/Dizziness) & Vision Dysfunction

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John Rutka & Martin Ten Hove

Vestibular (Balance/Dizziness) Dysfunction

Persistent vertigo, dizziness, imbalance and visual disturbance are common symptoms of patients with concussion/mTBI and are often associated with objective impairments of the vestibular system.^{1,2} Vestibular impairments can occur peripherally in the inner ear, or centrally in nuclei that integrate vestibular signals in order to maintain balance and posture. The vestibular system also affects eye movement through a variety of mechanisms including the vestibulo-ocular reflex (VOR).

The most common cause of post-traumatic peripheral vestibular dysfunction is benign paroxysmal positional vertigo (BPPV).^{3,4} Patients experience episodes of vertigo, nystagmus and nausea with sudden changes in position, often including rolling over in bed or looking up. These attacks typically last less than 30 seconds but can be quite disabling and can occur multiple times per day. BPPV is caused by dislodged otoconia in the posterior semicircular canal (SCC). *The Dizziness Handicap Inventory* (Appendix 10.1) can help to assess the functional impact of dizziness. Other causes of dizziness can also be caused by post-concussion migraines, autonomic dysregulation, medications and other peripheral vestibular disorder. Patients with dizziness frequently experience concurrent psychological disorders such as anxiety.⁵ These may exacerbate the feeling of dizziness and should be managed along with primary vestibular treatments (see [Section 8](#)).

Assessment of vestibular function following mTBI identifies vestibular deficits that could lead to evidence-based interventions that will benefit the patient. Evaluation should minimally include a focused history⁶, a balance screen, VOR screen and the Dix-Hallpike manoeuvre. Balance testing should reference normal values to document impairment. These can be found in Iverson et al 2008⁷ and Vereeck et al 2008.⁸

When the history suggests BPPV, posterior semi-circular canal involvement can be diagnosed by the Dix-Hallpike manoeuvre (see [Appendix 10.2](#) for more information and [Appendix F](#) for links to video demonstrations). VOR abnormalities from peripheral vestibular dysfunction usually present with unilateral directed nystagmus in the acute phase of injury. Central compensation usually occurs and as a result spontaneous nystagmus is rarely seen. The presence of bilateral gaze evoked nystagmus or nystagmus in one or more planes is either congenital or representative for central nervous system pathology somewhere in the brain.

When assessment suggests vestibular dysfunction, vestibular interventions can be considered. While historically, medications have been used to suppress vestibular symptoms, including nausea, current evidence does not support this approach.⁹ A Cochrane review by Hillier and Hollohan (2007) identifies vestibular rehabilitation as an effective intervention for unilateral peripheral vestibular dysfunction¹; this has been supported by Gurley et al.⁶ Weaker evidence also suggests vestibular rehabilitation may be helpful for central vestibular dysfunction.¹⁰ Vestibular rehabilitation is typically provided by a specialized a healthcare professional with specialized training and involves various movement-based regimens to bring on vestibular symptoms and desensitize the vestibular system, coordinate eye and head movements, and improve functional balance and mobility. However, for the specific treatment of BPPV, Hillier and Hollohan (2007) conclude that canalith or particle repositioning manoeuvres are more effective than vestibular rehabilitation techniques.¹

RECOMMENDATIONS FOR VESTIBULAR (BALANCE/DIZZINESS) DYSFUNCTION

		GRADE
10.1	Evaluation by an experienced healthcare professional(s) with specialized training in the vestibular system, should include a thorough neurologic examination that emphasizes vision, vestibular, balance and coordination, and hearing. The evaluation should be conducted prior to 3 months post-injury. See Appendix 3.4 for specific exam details. ^a	B
10.2	If symptoms of benign positional vertigo are present, the Dix-Hallpike Manoeuvre (Appendix 10.2) should be used for assessment once the cervical spine has been cleared.	A

a. Adapted from the VA/DoD Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline (VA/DoD, 2016).

10.3	A canalith repositioning maneuver should be used to treat benign positional vertigo (BPPV) if the Dix-Hallpike manoeuvre is positive. The Epley manoeuvre (Appendix 10.3) should be used on patients with positive Dix-Hallpike manoeuvre for both subjective and objective BPPV. Others should be referred to an otolarynthologist or a healthcare professional certified in vestibular therapy.	A
10.4	People with functional balance impairment who screen positive on a balance measure should undergo further balance assessment and treatment by a qualified physician or healthcare professional certified in vestibular therapy pending clinical course.	C
10.5	Vestibular rehabilitation therapy is recommended for unilateral peripheral vestibular dysfunction.	A
10.6	When the patient identifies a problem with hearing the following steps should be followed: 1. Take a detailed patient history, including auditory history to rule out common causes of hearing complications. 2. Perform an otologic examination, including otoscopy. 3. Refer to audiology for hearing assessment if no other apparent cause is found. ^a	C
NEW 10.7	There is no evidence to suggest for or against the use of any particular modality for the treatment of tinnitus after concussion/mTBI. ^b	C

Vision Dysfunction

Patients presenting with vision disorders post-concussion/mTBI may have impairment of visual acuity, accommodation, versional eye movements, vergence eye movements, visual field integrity and may experience photosensitivity. Practitioners should take a detailed history of vision symptoms and screen for potentially unrecognized visual deficits with using simple confrontational field testing.^{11,12} Mild TBI/concussion patients with complex visual symptoms including diplopia and/or impaired vision should be referred to a neuro-ophthalmologist.¹³⁻¹⁵ Patients with impairments of accommodation, version or vergence movements, and/or photosensitivity may benefit from rehabilitative techniques rendered by qualified optometrists.¹¹⁻¹³

Vision rehabilitation can be beneficial for some patients^{11,12,16,17} and should be considered for the treatment of persistent vision disorders. Rehabilitative interventions include vision therapy, reading spectacles, prism spectacles and/or tinted spectacles.^{11,14,16}

RECOMMENDATIONS FOR VISION DYSFUNCTION		
		GRADE
10.9	Vision changes can occur post concussion and should be screened for (see Appendix 10.4). If vision symptoms are reported, take an appropriate case history and complete a visual examination.	C
10.10	When assessed in a medically-supervised interdisciplinary concussion clinic, patients with significant functionally-limiting visual symptoms could be considered for a referral to a regulated healthcare professional with training in vision assessment and therapy (i.e. ophthalmologist, optometrist) for assessment. ^a	C

RESOURCES		
APPENDICES		
1	Dizziness Handicap Inventory	Appendix 10.1
2	Dix-Hallpike Manoeuvre and Particle Repositioning Manoeuvre (PRM)	Appendix 10.2
3	The Epley Manoeuvre	Appendix 10.3
4	Screening Techniques for Vision Dysfunction	Appendix 10.4
5	Other Links/ Resources to consider	Appendix F

a. Adapted from the VA/DoD Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline (VA/DoD, 2016).

b. Taken from the VA/DoD Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline (VA/DoD, 2016).

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11

Fatigue

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Fatigue has been conceptualized as an experience of weariness or tiredness following mental or physical exertion, often resulting in a reduced capacity for work and limited efficiency to respond to stimuli. Fatigue can be caused by psychological or physiological forces¹ and can be central or peripheral, which in lay terms is experienced as cognitive fatigue and physical fatigue or weariness.²⁻⁴ Fatigue is one of the most pervasive symptoms following concussion/mTBI, with 27.8% of individuals experiencing persistent fatigue at 3 months post-injury.⁵ The perception of fatigue can be out of proportion to exertion or may even occur without any exertion.⁶ One study reported a level of fatigue in patients with concussion/mTBI comparable to that of individuals with multiple sclerosis, a condition which is known to be associated with clinically-significant disease-related fatigue levels.⁷ Fatigue is multidimensional and can affect physical, cognitive, motivational and psychological (i.e., depression, anxiety) spheres.⁸ Individuals with fatigue can experience poorer problem-solving and coping skills, which then increases stress, depression which creates an ongoing cycle that contributes to disability.⁷ For instance, a state of chronic stress may be present following mTBI, which compromises the biological stress system and increases the likelihood for fatigue and stress-related disorders.⁹ Fatigue following TBI has also been found to significantly impact well-being and quality of life, and is strongly associated with somatic symptoms and perceived situational stress.^{8,9}

Due to its prevalence and effects, it is recommended that all patients be assessed for fatigue through a personal history with the patient and/or support person. A review of the relevant items from the *Rivermead Post Concussion Symptoms Scale* ([Appendix 1.5](#)) and/or a specific measure of fatigue, such as the *Barrow Neurological Institute (BNI) Fatigue Scale*¹⁰ ([Appendix 11.1](#)). The *Fatigue Severity Scale*¹¹ ([Appendix F](#)), the *Fatigue Impact Scale*¹² ([Appendix F](#)) or the *Mental Fatigue Scale*¹³ ([Appendix F](#)) can also assist with this.

Post-concussion/mTBI fatigue can be persistent and has been shown to still be present up to five years post-injury.⁸ Those who experience fatigue at three months post-injury are increasingly likely to continue to experience fatigue beyond six months post-injury.¹¹ Due to the relationship between pituitary dysfunction, specifically growth hormone deficiency, and fatigue some have suggested a relation between the two; however recent literature has not found a significant relationship.¹⁴⁻¹⁶ As certain medications can cause fatigue, the practitioner should also conduct a thorough review of the patient's medications. If the patient has been prescribed a medication that is associated with fatigue, alternatives that produce the same treatment effect without inducing fatigue should be considered. A list of medications commonly associated with fatigue can be found in [Appendix 11.2](#). As persistent fatigue may cause other symptoms to worsen, early intervention is required in order to prevent interference with the patient's ability to participate in rehabilitation therapies.^{8,17} Patients should also be provided with advice on how to cope with fatigue (see [Appendix 11.3](#)), such as general stress management techniques.⁸ If debilitating fatigue persists, consider referral to an interdisciplinary concussion clinic.

Research into treating fatigue has revealed few studies varying from non-pharmacological to pharmacological treatment. Methylphenidate has been found to improve mental fatigue and processing speed in patients with persistent post-concussion symptoms,^{18,19} including up to 6 months post-treatment.²⁰ Caution is recommended in the use of stimulants however; as clinical experience has identified that some individuals report that stimulants provide a burst of energy followed by increased fatigue. Some non-pharmacological treatments such as exercise (e.g., aquatic therapy), mindfulness-based stress reduction, cognitive behavioural therapy²¹ and blue-light therapy²² could potentially be helpful in treating fatigue however more research is needed.²³

RECOMMENDATIONS FOR ASSESSMENT AND MANAGEMENT OF FATIGUE		
		GRADE
11.1	Determine whether cognitive and/or physical fatigue is a significant symptom by taking a focused history and reviewing the relevant items from administered questionnaires (see Appendix 11.1).	C
11.2	Characterize the dimensions of fatigue (e.g., physical, mental, impact on motivation) and consider alternative or contributing, treatable causes that may not be directly related to the injury. Please refer to Table 11.1 for further information about primary and secondary causes, as well as appropriate treatment strategies for different types of fatigue.	C

11.3	After a brief period of rest during the acute phase (24–48 hours) after injury, patients can be encouraged to become gradually and progressively more active as tolerated (i.e., activity level should not bring on or worsen their symptoms).*	C
11.4	<p>If identified as a significant symptom, some key considerations that may aid in the management of persistent fatigue can include:</p> <ul style="list-style-type: none"> • Aiming for a gradual increase in activity levels (see Appendix 11.4) that will parallel improvement in energy levels, including exercise below symptom threshold. • Reinforce strategies of cognitive and physical activity pacing (see Appendix 2.6) and fragmentation across the day to help patients achieve more without exceeding tolerance levels. • Encouraging good sleep hygiene (especially regularity of sleep-wake schedules, and avoidance of stimulants and alcohol), and proper relaxation times. • Using a notebook or a diary to plan meaningful goals, record activity achievement and identify patterns of fatigue. • Acknowledging that fatigue can be exacerbated by low mood or stress. • Provide patients with a pamphlet containing advice on coping strategies for fatigue (see Appendix 11.3). 	C

* NOT AN ORIGINAL RECOMMENDATION - REPEAT OF 4.5

Table 11.1 Fatigue: Assessment and Management Factors for Consideration

Characteristics	<ul style="list-style-type: none"> • Frequency • Intensity • Time of day • Aggravating factors
Assessment	<ul style="list-style-type: none"> • Focused history • Physical examination • <i>Barrow Neurological Institute (BNI) Fatigue Scale</i> to assess fatigue (Appendix 11.1) • Consider blood test screening if appropriate (CBC, TSH, electrolytes)
Secondary Causes of Fatigue	<ul style="list-style-type: none"> • Affective disorder, including depression, anxiety • Sleep disorder post-concussion/mTBI • Metabolic causes, including hypothyroidism, anemia • Electrolyte abnormality (e.g., hyponatremia, hypocalcemia, etc.) • Polypharmacy or medication adverse effect

RESOURCES

APPENDICES

1	Rivermead Post Concussion Symptoms Questionnaire	Appendix 1.5
2	Barrow Neurological Institute (BNI) Fatigue Scale	Appendix 11.1
3	List of Medications Associated with Fatigue, Asthenia, Somnolence, and Lethargy from the Multiple Sclerosis Council (MSC) Guideline	Appendix 11.2
4	Patient Advice Sheet on Coping Strategies for Fatigue	Appendix 11.3
5	Increasing Physical Activity to Better Manage Fatigue	Appendix 11.4
6	Parkwood Pacing Graphs	Appendix 2.6
6	Other Useful Links/References for Resources to Consider	Appendix F

TABLES

1	Fatigue: Assessment and Management Factors for Consideration	Table 11.1
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12

Return-to-Activity/Work/ School Considerations

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Returning to usual activities after an concussion/mTBI can be challenging because of physical, cognitive and emotional impairments¹; however, current evidence indicates graded resumption of regular pre-injury activities as tolerated (i.e., in a manner that does not result in a significant or prolonged exacerbation of symptoms), within the first few days to weeks post-injury should be encouraged because, regardless of symptomatic status, activity is more likely to speed up rather than delay recovery.² A prospective, multicenter cohort study demonstrated for school-aged children physical activity within 7 days of acute injury compared with no physical activity was associated with reduced risk of prolonged post-concussive symptoms.³ For workers, the literature demonstrates brain injury patients who are employed report better health status, improved sense of well-being, greater social integration within the community, less usage of health services and a better quality of life than do those who are not employed.⁴ In order to facilitate early and safe resumption of activities following concussion/mTBI, healthcare professionals should advise patients on appropriate restrictions and limitations when they exist and then focus on abilities to ensure the optimal timing and nature of return-to-work and school activities.

General Considerations Regarding Rest and Return-to-Activity

Determining the optimal timing and nature of return-to-activity for patients with concussion/mTBI must carefully consider the risks and benefits of activity resumption. While a short period of physical and cognitive rest may be beneficial, particularly to limit symptom aggravation, evidence suggests prolonged rest and/or avoidance of activities may worsen outcomes. Evidence indicates complete bed rest in excess of 3 days should be avoided^{2,5} and gradual resumption of pre-injury activities should begin as soon as tolerated.^{2,6-9} Activities with high concussion/mTBI exposure risk should be avoided in the first 7-10 days.

When advising patients on return-to-activity, it is important to consider both physical and cognitive activities because both have the potential to exacerbate symptoms^{10,11}. Cognitive load refers to mental activities requiring attention, concentration and problem solving. Patients should be educated on the concept of cognitive load and advised on how to go about minimizing cognitive load in circumstances where cognitively demanding activities are aggravating symptoms. Work or school tasks requiring sustained concentration, attention or problem-solving

- Reading
- Activities associated with high cognitive training (video games)
- Demanding social interactions

When planning return-to-activity, the patient's tolerance level for both cognitive and physical activity should be considered. Activity resumption recommendations should seek to achieve maximal participation in pre-injury activities while minimizing symptom exacerbations. Patients should be advised that subsymptom threshold levels of activity are recommended. When symptom exacerbations occur, patients should be advised to temporarily reduce their physical and cognitive demands and resume graduated return-to-activity at a slower pace.²

GENERAL CONSIDERATIONS REGARDING REST AND RETURN TO ACTIVITY

		GRADE
12.1	Immediately following any concussion/mTBI, patients should be provided with recommendations to avoid activities that would increase their risk for sustaining another concussion during the recovery period, particularly in the first 7-10 days. ^a	C
12.2	<p><i>There is currently insufficient evidence that prescribing complete rest may ease discomfort during the acute recovery period by mitigating post-concussion symptoms and/or that rest may promote recovery by minimizing brain energy demands following concussion.</i></p> <ul style="list-style-type: none"> • <i>An initial period of rest in the acute symptomatic period following injury (24-48 hours) may be of benefit.</i> • <i>After a brief period of rest, a sensible approach involves the gradual return to school and social activities (prior to contact sports) as tolerated, (i.e., in a manner that does not result in a significant or prolonged exacerbation of symptoms).^{b*}</i> 	C

a. Adapted from the VA/DoD Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline (VA/DoD, 2009).

12.3	Patients with concussion/mTBI should be encouraged to gradually resume normal activity (activities of daily living, work, physical, school, duty, leisure) based upon their tolerance as long as the activity is not at specific risk for concussion. Patients should be preemptively cautioned that transient symptom exacerbations with increased activity are common. If symptoms increase in severity then a monitored slower progressive return to normal activity as tolerated should be continued. ^a	A
12.4	If a person's normal activity involves significant physical activity and there are concerns about resuming daily activities, exertion testing can be conducted that includes stressing the body (e.g., graded treadmill exercise test). If exertion testing results in symptoms, the symptom threshold should be identified and a progressive return to activity based on sub-symptom threshold activities should be encouraged. ^a	C
12.5	<i>After a brief period of rest during the acute phase (24–48 hours) after injury, patients can be encouraged to become gradually and progressively more active as tolerated (i.e., in a manner that does not result in a significant or prolonged exacerbation of symptoms).^{**}</i>	A

* NOT AN ORIGINAL RECOMMENDATION - REPEAT OF 3.4

**NOT AN ORIGINAL RECOMMENDATION - REPEAT OF 4.5

General Considerations Regarding Return-to-work (RTW)

The literature suggests the majority of workers with concussion/mTBI return to work within one to two weeks following injury; however, rates vary widely across studies.^{14,15} Predictors for return-to-work (RTW) in workers with concussion/mTBI extend beyond injury severity and medical comorbidities, with recovery expectations, the advice of healthcare providers, and socioeconomic factors all having a strong influence on disability duration.^{7,16-18}

Table 12.1. Factors Associated with Poor Functional Outcomes

- Dizziness¹³
- Number of symptoms reported at follow-up¹⁴
- Post-traumatic stress^{14,15}
- Cognitive impairments on tests of memory and executive functioning¹⁶
- Reduced social interaction (compared to pre-injury)¹⁷
- Financial compensation-seeking¹⁸
- Loss of consciousness¹⁹
- Pre-existing mental health difficulties (i.e., anxiety, depression, mania, psychotic symptoms)¹⁹
- Lower pre-morbid intelligence/cognitive ability¹⁹
- Pre-injury work history (i.e., prior work stability, earnings)²⁰
- Cognitive Difficulties

Medically unnecessary delays in RTW must be avoided because employment is an important determinant of health and unsuccessful RTW can have profound negative economic and psychosocial consequences for affected individuals.^{19,20} Systematic reviews and one experimental study have demonstrated the health benefits of staying at or returning to work in a variety of populations, times, and settings.^{19,21} Specific to concussion/mTBI, workers with brain injury who are employed report better health status, improved sense of well-being, greater social integration within the community, less usage of health services and a better quality of life compared to those who remain unemployed.⁴ Therefore, remaining at or promptly returning to some form of productive work, provided it does not pose risk of re-injury, should be encouraged, recognizing that individuals unable to RTW can experience greater physical ailments and poorer psychosocial adjustment including increased anxiety, depression and social isolation.^{20,22}

Barriers to return-to-work are varied and include both medical and non-medical factors. Cognitive difficulties (i.e., thinking, concentrating, and fatigue) are the most commonly reported medical factors that interfere with workability. Other factors include the invisibility of the injury, prolonged symptoms affecting the ability to do the job, and lack of advice and guidance on returning to work. In addition to these barriers, RTW support systems were considered to be poorly coordinated and managed.²³ Workers reported common factors perceived in facilitating RTW were the support of family, friends, treatment providers and employers who provided accommodations.²³

To facilitate timely and effective return to work for patients with concussion/mTBI, healthcare providers should use a structured approach to assess fitness for duty being cognizant of predictors and factors influencing outcomes of RTW (see [Table 12.1](#)).²⁴⁻³¹ An accepted and effective approach to assess work readiness is for the healthcare provider to define “risk” (medical restrictions), “capacity” (limitations), and “tolerance”^{32,28} The healthcare provider should then

a. Adapted from the VA/DoD Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline (VA/DoD, 2009).

b. Adapted from McCrory P, Meeuwisse W, Dvořák J, et al. Consensus statement on concussion in sport. *Br J Sports Med* 2017;51:838-847

communicate the specific medical restrictions, limitations and abilities to the employer and other stakeholders, with appropriate consents, to facilitate temporary accommodations where necessary.³³ See [Table 12.2](#) for the stepwise approach to RTW planning for patients with concussion/mTBI.

Table 12.2 Stepwise Approach to Return-to-work (RTW) Planning for Patients with concussion/mTBI

Healthcare Professional	<ol style="list-style-type: none"> 1. Identify medical restrictions (risk) 2. Identify limitations (functional capacity: physical, cognitive, emotional) 3. Identify and document symptom triggers
Employer	<ol style="list-style-type: none"> 4. Review information on restrictions, limitations and symptom triggers 5. Review information on job demands 6. Identify opportunities for accommodations/work modification
Employer and Worker	<ol style="list-style-type: none"> 7. Formulate progressive RTW plan

Assessing risk involves defining impairments that could result in harm if the worker were to engage in the given work task.³² Risk of harm encompasses any situation where performance error in a physical or decision-critical task could result in injury to the worker, coworkers or the general public, and/or disruption of equipment, production or the environment.³⁴ For example, if a worker has impaired balance then a reasonable medical restriction would be “no working at heights”. Similarly, if a patient has impaired concentration or visual disturbance then a reasonable medical restriction would be “no operation of heavy equipment”.

Assessment of capacity refers to defining a patient’s functional impairments; activities that the patient physically, psychologically and/or cognitively is unable to perform. Limitations may not pose risk or harm to the patient or others *per se*, but they would reasonably interfere with a worker’s ability to perform a given task (e.g., photophobia, sonophobia, slowed cognitive processing) and they are therefore important to define to ensure the worker is not expected to perform tasks the worker is not currently capable of performing.

Tolerance refers to the ability of a patient/worker to tolerate symptoms and is not a medically-answerable question. The healthcare provider may comment on tolerance based on the patient’s reported symptoms, but should only do so if it is significant barrier to RTW and therefore requires accommodation in which case it would more appropriately be defined as a limitation.

It is imperative when assessing workers with concussion/mTBI for medical restrictions and limitations, to consider all three domains of physical, cognitive and psychosocial/emotional status. Defining levels of physical exertion that exacerbate symptoms can often be achieved based on a detailed history. Cognitive evaluations have been reported to be effective in identifying an individual’s capacity to return to work in complex cases. These should focus on executive functioning, attention, memory, information processing and verbal skills, as these were found to increase the likelihood of successful RTW.³⁵ The evaluation should also take into account the worker’s psychosocial status given studies show that concussion/mTBI can cause re-organization of a person’s psychosocial identities, affecting their ability to perform.³⁶ In turn, this is related to mood disorders, such as depression. Mood disorders post-injury create problems with interpreting and regulating emotions, displaying inappropriate responses to stimuli/events and cause the patient to be more/less susceptible to the need for approval in the workplace. As a result, other difficulties associated with concussion/mTBI may worsen due to poor job performance.³⁷ It is also important to note that concussion/mTBI impacts executive functions, affecting skills such as multi-tasking, prioritization, organization, prospective memory and time management. The contextual work-related factors listed above should be identified by the healthcare provider so this information can be communicated to the employer and other relevant stakeholders, with appropriate consents, to help facilitate successful RTW.

The goal of any RTW plan for concussion/mTBI is to enable the worker to fully participate in work tasks (maximizing work capacity) while remaining below symptom-exacerbation threshold levels. It is important to note that the existence of symptoms at baseline is not, in and of itself, a basis for no return to work. Symptoms are common in the general population and do not necessarily impair workability.³⁸ At issue is whether the work tasks exacerbate symptoms. Workers with symptoms that are present but do not change with an increase in the work activity can begin to transition back to work. Defining tasks that would cause the patient to exceed symptom-exacerbation threshold could reasonably be considered under medical restrictions because the medium- and long-term risks of exertion sufficient to exacerbate symptoms are

unknown. Therefore, reasonable advice is to encourage the worker to engage in activities (physical, cognitive, emotional/behavioral) as much as possible and, in response to symptom exacerbations, the worker should temporarily reduce the physical and cognitive demands and resume graduated return to work at a slower pace.²

While it is the responsibility of the healthcare practitioner to provide information on a patient’s restrictions, limitations and abilities, it is the responsibly and role of the employer, based on the information provided by the healthcare practitioner, to determine the type of work available and whether the patient can be accommodated.^{33,39} Under provincial human rights laws, an employer may not discriminate on the basis of disability or other illness and has a duty to accommodate workers with medical impairments to the point of undue hardship.³⁹ See Rec. 12.7 for examples of work modifications that could be considered by employers to accommodate restrictions and limitations associated with concussion/mTBI.

There is no common RTW template that fits the needs of all individuals in all circumstances; in some instances workers may return to work regular duties, while in others accommodation with temporary workload restrictions or placement in a completely different job function may be necessary.^{40,41} Therefore, each program should be individually prescribed and should support the reintegration and rehabilitation of the person with the injury or disability back into the workplace.³³

In complex cases where the healthcare practitioner is having difficulty clearly defining a patient’s restrictions and limitations, or where questions arise regarding the suitability of the accommodated work being offered by the employer (or lack thereof), an interdisciplinary vocational evaluation may be necessary. This is particularly true in instances where the worker’s usual job tasks are safety-sensitive or decision-critical.

RETURN-TO-WORK CONSIDERATIONS: VOCATIONAL SCREENING AND EVALUATION		GRADE
12.6	If the work environment and/or duties pose potential risk to self or others, an in-depth fitness for duty evaluation and in-depth job analysis are advised. ^a	C
12.7	<p>Individualized work limitations should be identified if:</p> <ul style="list-style-type: none"> The worker is not able to perform specific work tasks as a result of symptoms. There is a work task that places the person at risk of repeat concussion. <p>Individualized work restrictions should be identified if:</p> <ul style="list-style-type: none"> The work/duty environment cannot be adapted to the patient’s symptom-based limitation. Symptoms reoccur with return to work. The deficits cannot be accommodated. <p>If restrictions or limitations are identified, they should be communicated to the patient’s employer (with the worker’s consent) to facilitate appropriate accommodation and enable timely and safe return to work.</p> <p>Examples of vocational accommodations include:</p> <ul style="list-style-type: none"> Assistance with commuting to and from work. Flexible work hours (e.g., starting later or ending earlier). Gradual work re-entry (e.g., starting at 2 half days/week and expanding gradually). Additional time for task completion. Have a quiet space available for the individual to take breaks in throughout the day. Change of job Environmental modifications (e.g., quieter work environment; enhanced level of supervision, decreased computer work, ability to work from home; only day shift hours).^a 	C
12.8	<p>Patients who have not successfully resumed pre-injury work duties following injury should be referred for a interdisciplinary vocational evaluation that includes an assessment of (see Appendix 12.1):</p> <ul style="list-style-type: none"> Cognitive and psychosocial functioning Occupational and job demands Work environment Environmental supports Facilitators and barriers to successful work/return to work 	B

a. Adapted from the VA/DoD Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline (VA/DoD, 2009).

RETURN-TO-WORK CONSIDERATIONS: COMMUNITY RE-INTEGRATION AND FUTURE VOCATIONAL PLANNING		
		GRADE
12.9	When prolonged post-concussive symptoms impede return to pre-injury employment, educational activities, community roles and activities that promote community integration (e.g. volunteer work) may be considered as an alternative focus for meaningful activities. ^a	B

RESOURCES		
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1	Components of the Vocational Evaluation following mTBI	Appendix 12.1
TABLES		
1	Factors Associated with Poor Functional Outcomes	Table 12.1
2	Stepwise Approach to Return-to-Work Planning for Patients with Concussion/mTBI	Table 12.2
ALGORITHMS		
1	Return-to-Work Considerations	Algorithm 12.1

General Consideration Regarding Return-to-school (Post-Secondary)

There has been an increasing appreciation of the impact that concussion/mTBI symptoms have on the ability for students to manage their academic programs. More specifically there is a growing body of literature indicating that cognitive exertion can exacerbate concussion/mTBI symptoms and affect recovery time from these injuries.⁴² This has led to the development of specific academic management strategies for students who have sustained an concussion/mTBI to provide guidance on the steps that should be followed to resume cognitive activity. The essential premise of managing cognitive exertion is that cognitive activity must be paced in order to avoid exceeding the threshold at which concussion/mTBI symptoms are exacerbated.⁴³ See [Table 12.2](#) for an example of a gradual return-to-academics. Many individuals who sustain concussion/mTBI injuries are students who require integration into elementary, secondary or post-secondary institutions. Following an concussion/mTBI, resuming academic activity requires students to manage work in the classroom that includes listening, note-taking, presentations, homework, assignments and examinations, as well as managing additional volunteer activities and memberships in school-based clubs. The cognitive demands therefore span activities that would be conducted at school, and also at home and in the community. Considerable focus in the literature has been placed on developing strategies to manage these cognitive demands, such as duration for cognitive rest, concessions and accommodations, as well as education for academic staff on the symptoms and strategies for reintegration.⁴² It is recommended that the management strategies that are implemented should be highly individualized in the context of this guideline because the manifestation of concussion/mTBI symptoms and their impact upon the student are as variable as is their recovery.^{29,35,40,41,44,45} Contacting the school registrar immediately following concussion/mTBI is also important, even if symptoms are short-lived, to make sure that the student has as much support as possible. Other people who might be involved in the management plan, that includes cognitive rest and academics, may include academic support staff, team physician, course instructors and disabilities services.⁴²

However, many excellent guidelines focus primarily on cognitive management strategies that can be employed with the elementary and secondary school student in mind, and they have limited applicability for the post-secondary student. Not only does the nature of program requirements differ at the post-secondary level, but so does the nature of the accommodations and concessions that can be provided, which limit the applicability of the aforementioned guidelines.⁴² The following post-concussion cognitive management strategies were developed to take into consideration the unique issues faced by students who are either entering post-secondary institutions with an identified concussion/mTBI and/or have sustained an concussion/mTBI in the course of their post-secondary program. The applicability of the recommendations provided for managing the cognitive demands of post-secondary education are considered to be pivotal to maximizing successful academic integration or reintegration. See [Algorithm 12.2](#), which outlines key return-to-school timelines and considerations for students 18 years of age or older following concussion/mTBI.

Students, professors/instructors and appropriate administrators may also require education regarding concussion/mTBI and the associated symptoms, the functional impact in the classroom, and the fact that this is an unseen/hidden injury but can be functionally very debilitating. Regular communication between the student, the primary care provider and teachers/administrators regarding progress, challenges and changes in symptoms (i.e., improvements or recurrences) are beneficial. Symptoms of anxiety and/or depression should also be monitored in students with prolonged symptoms.

a. Adapted from the VA/DoD Management of Concussion/Mild Traumatic Brain Injury Clinical Practice Guideline (VA/DoD, 2009).

RETURN-TO-SCHOOL (POST-SECONDARY) CONSIDERATIONS		GRADE
12.10	<p><u>Within 24-48 hours post-injury:</u> If asymptomatic: The student can attend school as tolerated but should not undergo evaluations (tests/exams) or should write with accommodations (such as separate space, paced breaks, rooms where lights can be altered, additional time) and should be monitored for potential symptoms. If symptomatic: The student should refrain from attending school and from participating in all academic and sports activities, including apprenticeship, practicum and shop-related activities, in order to decrease the risk for symptom exacerbation. In addition, the student should be offered psychoeducation and modified at-home study tasks as tolerated. Students should be able to tolerate school and life responsibilities prior to participating in sports or activities that put them at risk.</p> <p><u>After 24-48 hours post-injury: (see Appendix 12.4)</u> If asymptomatic: The student may return to academic/program related activities as tolerated as long as they remain asymptomatic. If symptomatic: the student should:</p> <ul style="list-style-type: none"> • Refrain from attending academic and/or program-related activities for one full week and up to two full weeks if symptoms remain functionally debilitating. • Connect with academic accessibility/disability services to request accommodations and receive additional support. • Be monitored for the emergence of potential symptoms and be provided with support and education. • The healthcare professional (with permission) should ensure that accessibility/disability services are notified that a concussion/mTBI has occurred (see Appendix 12.2) and that the student will require time off, and may require accommodations and support for reintegration. • Reintegration should occur progressively and specific accommodations should match the student's residual symptoms. <p><u>1-2 weeks post-injury: (see Appendix 12.5)</u> If symptoms are still functionally debilitating at 1 week post-injury the student should refrain from attending academic- and/or program-related activities. The healthcare professional should again notify accessibility/disability services that the student is still symptomatic and accommodations and support for reintegration will be required.</p> <p><u>After 2 weeks post-injury:</u> The student should start attending school (non-physical activities) very gradually as tolerated and with accommodations, even if the student is still experiencing symptoms. A healthcare professional with experience in concussion/mTBI rehabilitation should provide guidance to the student and educators. Accessibility/disability services should be notified again so teachers/professors can subsequently monitor progress with the student and adjust the return-to-school plan, as necessary.</p>	C

- Continued on next page -

RETURN-TO-SCHOOL (POST-SECONDARY) CONSIDERATIONS		GRADE
12.11	<p>If re-integration into school is ineffective or unproductive at 4 weeks (i.e., symptoms plateau/continue to get worse), consider the following:</p> <p>Further Clinical Assessment:</p> <ul style="list-style-type: none"> • Screen for ADHD, learning disabilities, anxiety and depression. If present seek assistance from specialized services • Conduct re-assessment by a rehabilitation provider with concussion/mTBI knowledge to evaluate possible determinants of return-to-school barriers. • Refer student for neuropsychological assessment. <p>Review Accommodations:</p> <ul style="list-style-type: none"> • Work with the professor/instructor or appropriate administrator and the student to look at the cognitive demands of various classes, with consideration of the student's current symptoms, to determine if appropriate accommodations can be made in the following areas as necessary: curriculum, environment, activities and timetable (see Appendix 12.3). • Move the student's courses to audit status, allowing them to participate in some academic activity without significant pressure from course requirements and examination. • Review whether the student should continue in the program for that term if there will be substantially negative consequences to their grades and program participation. 	C

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APPENDICES		
1	Acute Concussion Evaluation: Physician/Clinical Office Version	Appendix 1.1
2	Example Concussion/mTBI Accessibility Intake Package for Student Services/Special Needs Department	Appendix 12.2
3	Greater Accommodations for Students with Prolonged Symptoms following mTBI	Appendix 12.3
4	Managing Your Return to Post-Secondary Activities: Package Template and Activity Log	Appendix 12.4
5	ACE: Work Version	Appendix 12.5
6	ACE: School Version	Appendix 12.6
TABLES		
1	Key Features of an mTBI Assessment in an Emergency Department or Doctor's Office	Table 1.2
ALGORITHMS		
1	Return-to-School (Post-Secondary) Considerations	Algorithm 12.2

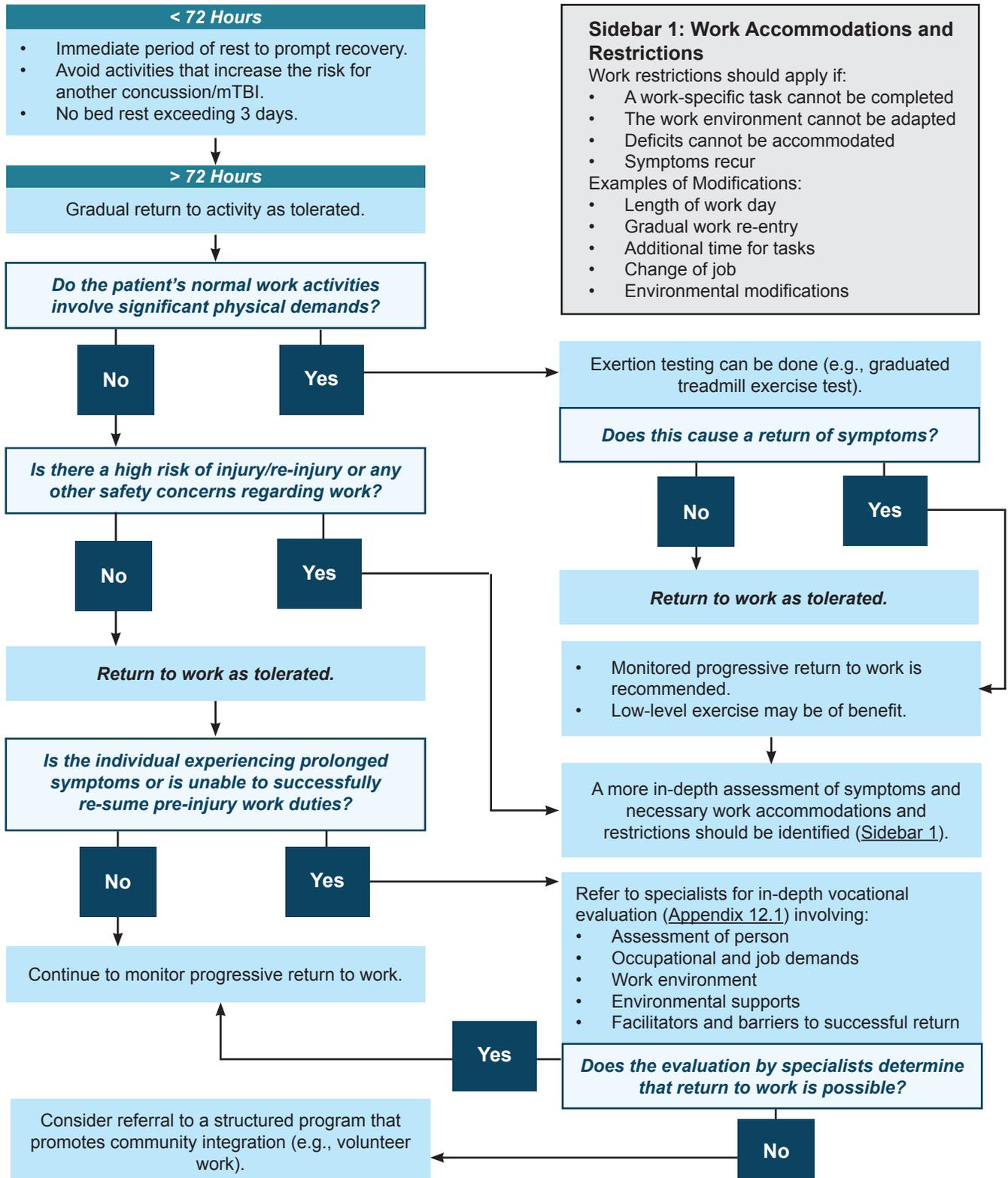
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Algorithm 12.1

Return-to-Work Considerations



Sidebar 1: Work Accommodations and Restrictions

Work restrictions should apply if:

- A work-specific task cannot be completed
- The work environment cannot be adapted
- Deficits cannot be accommodated
- Symptoms recur

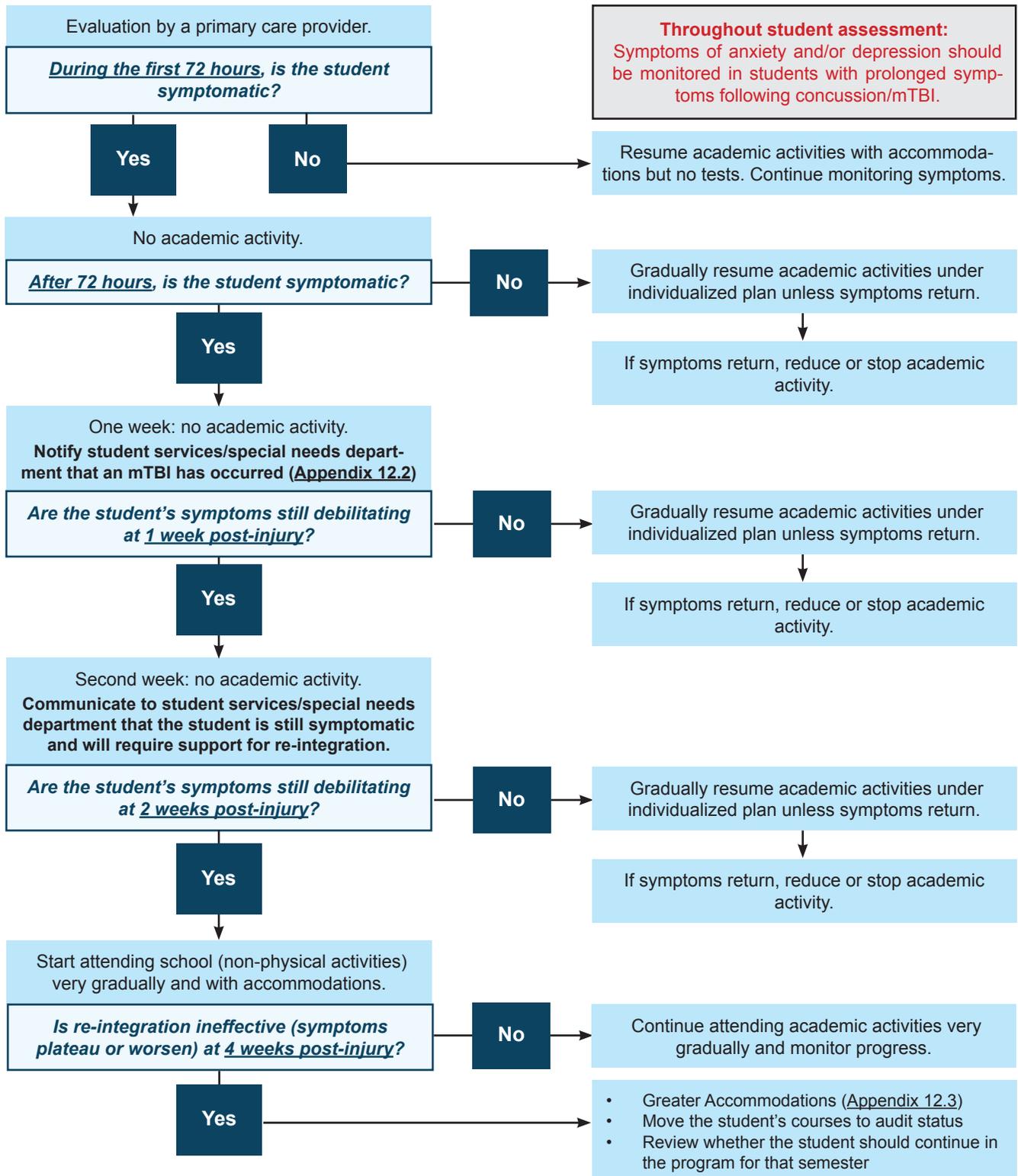
Examples of Modifications:

- Length of work day
- Gradual work re-entry
- Additional time for tasks
- Change of job
- Environmental modifications

For a narrative description and guideline recommendations related to this algorithm, please refer to **Section 12**.

Algorithm 12.2

Return-to-School (Post-Secondary) Considerations



For a narrative description and guideline recommendations related to this algorithm, please refer to **Section 12**.

Methodology

Identification of a Clinical Area of Interest

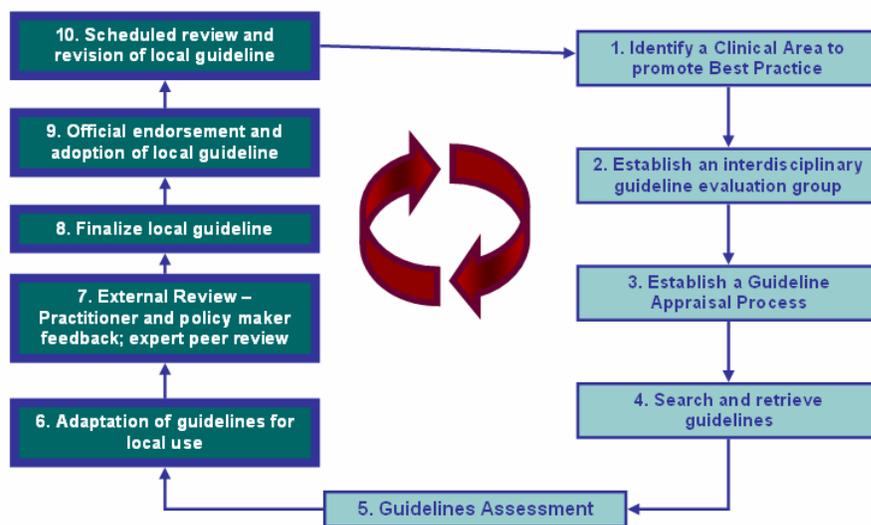
The Guidelines Adaptation Cycle process¹ was used to guide the development of the original guideline, as well as the current update. Figure A illustrates the elements involved in this process. Initially, the concussion/mTBI Project Team identified there was a need for evidence-based treatment guidelines for the assessment and management of symptoms persisting after concussion/mTBI. Although some guidance for the acute care of mild injuries is available, the concussion/mTBI Project Team identified the specific area of prolonged symptoms as a priority, due to a lack of guidance for healthcare professionals for the assessment and management of those individuals who do not spontaneously recover.

The current update represents Step 10 in the Guidelines Adaptation Cycle process – a scheduled review and revision of the guideline to maintain the relevancy and utility of these recommendations. Steps 2 through 9 were revisited and improved to enhance development and efficient use of the guidelines for healthcare professionals.

Establishment of the Expert Consensus Group

In the current update, the concussion/mTBI Expert Consensus Group (see [Appendix A](#)) was expanded to ensure greater representation of (1) the various healthcare professions servicing the concussion/mTBI patient population, (2) domain of expertise, and (3) geographic location.

Figure A. Practice Guidelines Evaluation and Adaptation Cycle*



In regard to healthcare professions, a wide range of disciplines including emergency medicine, family medicine, sports medicine, neurology, physical medicine and rehabilitation, radiology, psychiatry, psychology, physical therapy, chiropractor and occupational therapy were represented. In addition, representatives of relevant organizations, such as the Ontario Neurotrauma Foundation (sponsoring organization), the Ontario Brain Injury Association and persons who had experienced prolonged symptoms following concussion/mTBI, were also included in the expert consensus group. In regard to domain of expertise, individuals recognized as experts in treatment of the different spheres of symptoms (i.e., physical, behavioural, and cognitive) were involved in the project. Also, experts on objective evidence of concussion/mTBI, quality of life and outcomes or knowledge translation took part in the consensus group. In terms of the variety of injuries associated with concussion/mTBI, individuals with expertise in sport-related, worker safety, and military and veteran health were all represented. Lastly, in regard to geographic location, the members forming the expert consensus group were recruited from Ontario, across Canada and the United States. A formal schema identifying these factors was created prior to the meeting to assist in establishing balanced representation [Appendix B](#).

At the beginning of the guideline development process, members of the guideline development team and the expert consensus group were asked to declare any possible conflicts of interest. All declared conflicts of interest are listed in [Appendix C](#).

Updating the Evidence: Search and Retrieval of Existing Guidelines and New Evidence

Search and Retrieval of Existing Guidelines

Building upon the review conducted for the Second Edition, a new search (July 2012 – May 2017) for existing clinical practice guidelines addressing concussion/mTBI and a systematic review of the literature evaluating treatment of concussion/mTBI and prolonged symptoms was conducted. First, a comprehensive search for existing clinical practice

* Reproduced from Graham ID, Harrison MB. Evaluation and adaptation of clinical practice guidelines. *Evidence Based Nursing*. 2005;8(3):68-72; with permission from BMJ Publishing Group Ltd.

guidelines (CPGs) published in English or French between 2012 and 2016 that were relevant to concussion/mTBI and included recommendations for the care of individuals with concussion/mTBI was undertaken. This allowed the Project Team to identify quality recommendations that could be adapted to minimize repetition of previously completed work. The search for existing CPGs was conducted using six bibliographic databases (MEDLINE, PubMed, EMBASE, PsycINFO, CINAHL, Cochrane Library), guideline search sites (e.g., National Guidelines Clearing House, Scottish Intercollegiate Guidelines Network), websites of relevant organizations (e.g., Canadian Medical Association, National Institute of Clinical Excellence) and a general web search (i.e., first 10 pages screened in Google and Google Scholar). The following key words were used in combination for all searches: brain injuries, head injuries, traumatic brain injury, concussion, guidelines, practice guidelines, and best practice. Documents obtained via the search were excluded from further review if: 1) they were more than four years old, (2) did not address concussion/mTBI, (3) they were found to be reviews only and did not include practice recommendations, (4) they only addressed pre-hospital and/or acute care, or (5) they only addressed pediatric care. This search was repeated again in May 2017 to ensure to capture any guidelines released within that year.

Two reviewers independently compiled a list of all guidelines they found related to concussion/mTBI. After applying the exclusion criteria, 30 relevant CPG's containing recommendations were considered. A third reviewer was consulted to finalize the list, from which 9 CPGs remained.

Table C. Existing TBI Guidelines Evaluated in the Process of Developing the Current Guideline

Abbreviation	Group	Guideline Title	Year
VA/DoD	Department of Veterans Affairs/ Department of Defense	VA/DoD Clinical Practice Guidelines for the Management of Concussion-Mild Traumatic Brain Injury	2016
CISG*	Concussion in Sport Group	Consensus statement on concussion in sport—the 5th international conference on concussion in sport held in Berlin, October 2016	2016
EAST	Eastern Association for the Surgery of Trauma	Evaluation and management of mild traumatic brain injury: An Eastern Association for the Surgery of Trauma practice management guideline	2012
EFNS	European Federation of Neurological Societies	Mild traumatic brain injury	2012
AAN	American Academy of Neurology	Summary of evidence-based guideline update: Evaluation and management of concussion in sports	2012
SNC	Scandinavian Neurotrauma Committee	Scandinavian guidelines for initial management of minimal, mild and moderate head injuries in adults: an evidence and consensus-based update	2013
SIGN	Scottish Intercollegiate Guidelines Network	Brain injury rehabilitation in adults	2013
CTSQ	Corporation des Thérapeutes du Sport du Québec	Concussion Management Guidelines for Certified Athletic Therapists in Quebec	2014
NATA	National Athletic Trainers' Association	National Athletic Trainers' Association Position Statement: Management of Sport Concussion	2014

*Note: The Summary and Agreement Statement of the 4rd International Conference on Concussion in Sport, Zurich 2012 was identified in the comprehensive search for existing guidelines, but then later replaced with the release of the Consensus Statement on Concussion in Sport from the 5th International Conference on Concussion in Sport, Berlin 2016.

Search and Retrieval of New Evidence

An extensive search of the literature was conducted to capture all published research evaluating the effectiveness of treatments or interventions intended to manage prolonged symptoms following concussion/mTBI. A professional librarian working at the Ottawa Hospital Research Institute (Ottawa, Ontario) was consulted to develop a systematic search strategy, ensuring a thorough search was conducted for all databases. Bibliographic databases (MEDLINE, PubMed, EMBASE, PsycINFO, CINAHL, and Cochrane Library) were searched using the following key words: brain injury, concussion, brain concussion head injury, traumatic brain injury, post-concussion syndrome and commotion cerebri. The list of search terms

indexed in each database was also reviewed to ensure that all relevant search terms were included. All search terms were also truncated to ensure that every alteration of that search word was captured (e.g., searching “concuss\$” retrieved results for “concussive”, “concussion”, “concussions”, etc). See [Appendix D](#) for the stepwise search strategies employed for each database. The search was performed in May 2016 and again in May 2017.

All results were included for further review if they met the following inclusion criteria: published in English or French, a 50% adult population (18+ years of age) and if at least 50% of the sample was composed of patients with mild injuries/prolonged symptoms following concussion/mTBI or statistical analyses for studies of mixed samples were performed according to level of TBI severity. Studies were included for full review if they:

- met the above inclusion criteria
- were on the prevention or prognosis of developing prolonged symptoms
- treated prolonged symptoms
- diagnosed/ assessed concussion/mTBI

Studies examining penetrating brain injuries, birth injuries, brain damage incurred from stroke or other cerebrovascular accidents, shaken baby syndrome or moderate to severe closed head injuries that did not meet the above inclusion criteria were excluded from further review. Non-systematic review papers (i.e., narrative reviews), clinical review papers, conference abstracts, letters to the editor and editorials without data, studies using non-human subjects and unpublished studies or data were not reviewed. However, the reference lists of narrative review papers were examined to ensure all relevant literature was included.

Review Process (Figure B): Due to the large number of articles, article title/abstract review were performed simultaneously by two reviewers in [DistillerSR](#)®. After which a 10% randomized spot check was conducted on the opposing reviewers articles to ensure accuracy and consistency between reviewers. A team of four reviewers then screened the articles included for full review for inclusion. A third reviewer was consulted after the full article review stage to resolve any discrepancies between reviewers’ decisions.

Figure B. PRISMA Flow Diagram:² Results from the Systematic Review of the Literature (2012 – May 2017) Evaluating Treatment of Persistent Symptoms.

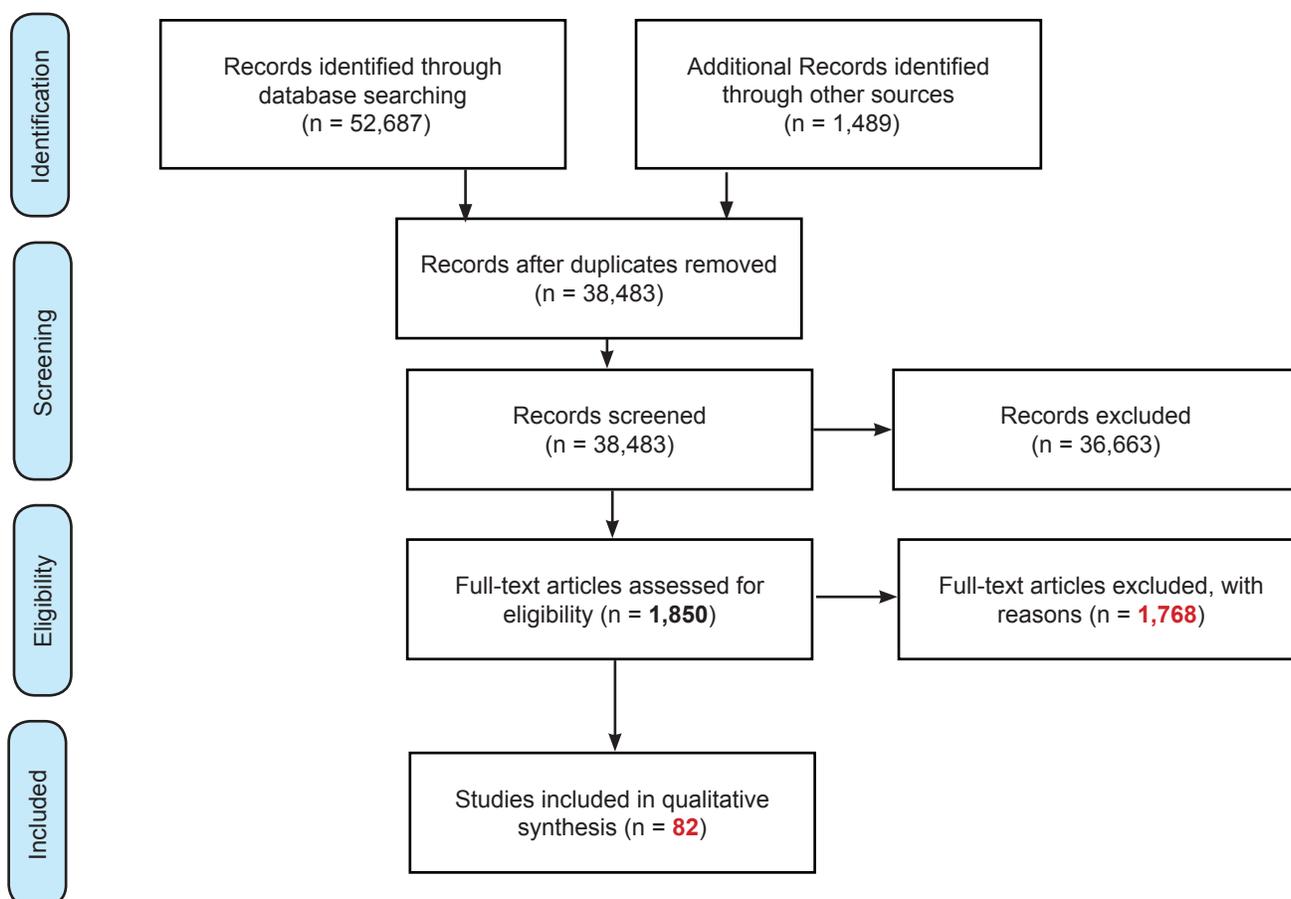


Figure B represents an overview of all of the articles screened at each step across all databases. In the end, 82 articles evaluating the effectiveness of prognosis, prevention, treatments/interventions of prolonged symptoms or diagnosis/assessment of concussion/mTBI were added to the evidence base for the current update. [Appendix G](#) contains the full list of evidence.

Resource Evaluation:

While completing the literature search the project team flagged any tools, tables, resources algorithms or figures that could be used in the guideline. A manual search was then completed to look for updates of existing clinical tools.

The project team completed a Resource Evaluation for each of the clinical tools in the guideline. Resource Evaluations were developed by the Project Team to aid in determining whether a resource was a viable option for use in the clinical population. These descriptions contain information on the reliability, validity, accessibility (e.g., proprietary), ease of use and information on the administration of the tool. See below for an example Resource Evaluation. Key determinants in the use of a resource were accessibility of the tool and ease of use.

EXAMPLE

Resource Evaluation

Updating the Guidelines for the Management of Concussion / Mild Traumatic Brain Injury and Prolonged Symptoms



Ontario Neurotrauma Foundation

Fondation ontarienne de neurotraumatologie

Section 1: Diagnosis and Assessment

Title of Resource: Abbreviated Westmead Post-Traumatic Amnesia Scale (A-WPTAS)

Reference: Shores A, Lammel A. Abbreviated Westmead PTA Scale (A-WPTAS): GCS & PTA testing of patients with MTBI following mild head injury. <http://psy.mq.edu.au/GCS/>. 2007.

Description: The A-WPTAS was developed as a screening tool for promptly assessing any cognitive problems, such as memory loss or amnesia directly following concussion/mTBI. It identifies the duration of post-traumatic amnesia (PTA) in order to assess the level of brain damage. It should be used hourly in combination with a standardized Glasgow Coma Scale (GCS) assessment in order to assess the patient.

Resource Criteria:

Population	Mild Traumatic Brain Injury
Reliability/ Validity	The A-WPTAS is a valid measure. The A-WPTAS may reduce the risk of failing to classify patients with concussion/mTBI by identifying and documenting acute cognitive impairment. ¹ The R-WPTAS significantly improves diagnostic accuracy in identifying patients with mTBI/concussion who may be in PTA. Administration takes less than 1 min, and since early identification of a patient's cognitive status facilitates management decisions, it is recommended for routine use whenever the GCS is used. ² The addition of the R-WPTAS to the GCS can help to rapidly identify patients with concussion/mTBI who may need further management. ³
Proprietary?	No
Time to Administer	20 Minutes
Method to Administer	A healthcare professional would administer the assessment and evaluate the patient's performance in order to determine the level of brain damage.
Formal Instructions (Mention if special environment/ equipment is needed)	None
Instructional Video Available?	No

Ease of Use (By Patient)	1	2	3	4	5
Ease of Administration (By Administrator)	1	2	3	4	5
Other Comments	None				

1. Meares S, Shores EA, Taylor AJ, Lammel A, Batchelor J. Validation of the Abbreviated Westmead Post-traumatic Amnesia Scale: a brief measure to identify acute cognitive impairment in mild traumatic brain injury. *Brain Inj.* 2011;25(12):1198-205, Epub 2011 Sep 8.
2. Shores EA, Lammel A, Hullick C, Sheedy J, Flynn M, Levick W, Batchelor J. The diagnostic accuracy of the Revised Westmead PTA Scale as an adjunct to the Glasgow Coma Scale in the early identification of cognitive impairment in patients with mild traumatic brain injury. *Journal of Neurology, Neurosurgery & Psychiatry.* 79(10):1100-1106. October 2008.
3. Sharp, David J. Cognitive impairment after mild traumatic brain injury – the value of memory testing. *Nature Clinical Practice Neurology.* 4(8):420-421. August 2008.

Strengths and Limitations of the Body of Evidence

In order to assess the body of evidence upon which the current guideline is based, all included guidelines and new evidence of treatment/intervention for persisting symptoms were subject to evaluation:

i) Assessment of Existing Guidelines

There was only one guideline - the VA/DoD Clinical Practice Guidelines for the Management of Concussion-Mild Traumatic Brain Injury - that was included in the Third Edition of the guideline. It was independently evaluated using the Appraisal of Guidelines for Research and Evaluation II ([AGREE II](#)) instrument³ by at least three Project Team members. The AGREE II instrument assesses the quality of a CPG across six domains: (1) Scope and purpose, (2) Stakeholder involvement, (3) Rigour of development, (4) Clarity of presentation, (5) Applicability and (6) Editorial independence. Reviewers are also asked to provide an overall quality assessment of the guideline taking into account the criteria considered in the assessment process, as well as whether he/she would recommend use of the guideline. Each guideline was given six standardized domain scores ranging from 1-100 (100 representing a strong score) based on the ratings from the reviewing experts.

ii) Assessment of New Evidence ([Appendix G](#))

All included articles on treatment/intervention for persisting symptoms following concussion/mTBI were evaluated using a validated checklist for methodological quality:

a) For systematic literature reviews/meta-analyses of healthcare interventions, the PRISMA² rating checklist was used. The PRISMA Statement contains a 27-item checklist and a four-phase flow diagram. The purpose of the PRISMA is to help authors improve the reporting of systematic reviews and meta-analyses. The PRISMA has primarily focused on randomized trials but can also be used as a basis for reporting systematic reviews of other types of research (i.e., evaluations and interventions). The PRISMA is also useful for critical appraisal of published systematic reviews, although the checklist is not considered a quality assessment instrument to gauge the quality of a systematic review.³ There is currently no quality assessment instrument available for systematic reviews, which is why we used the PRISMA to assess systematic reviews and meta-analyses that were included as evidence for the guideline. Scores from these rating scales were provided with the respective article summary to all experts before, during and after the consensus conference in the Excel sheets.

b) For randomized studies of healthcare interventions, the PEDro⁴ rating scale was used. The PEDro scale is a modified 11-item, expert consensus-based Delphi list developed by Verhagen and colleagues at the Department of Epidemiology, University of Maastricht. The purpose of the scale is to assist the users of the PEDro database to quickly identify which of the known or suspected clinical trials are likely to be internally valid (criteria 2-9) and could have sufficient statistical information to make their results interpretable (criteria 10-11). The PEDro scale should not be used as a measure of the validity of a study's conclusions and should not be used to compare the quality of trials performed in different areas of therapy. Thus, for our purposes, the PEDro scale was used to objectively measure the methodological quality of randomized healthcare intervention studies.

c) For non-randomized studies of healthcare interventions, the Downs and Black⁵ rating scale was used. The Downs and Black rating is a methodological quality checklist based on epidemiological principles, reviews, and existing checklists for randomized studies. The checklist contains 27 items which are added to provide a total score out of 32. Answers were

scored 0 or 1, except for one item in the reporting subscale, which scored 0 to 2 and the single item on power, which is scored 0 to 5. The checklist is broken down into 5 sections:

- i. Reporting (criteria 1-9): assesses whether the information provided in the paper is sufficient to allow a reader to make an unbiased assessment of the findings of the study.
- ii. External validity (criteria 11-13): assesses the extent to which the findings from the study can be generalized to the population from which the study subjects were derived.
- iii. Bias (criteria 14-20): assesses biases in the measurement of the intervention and the outcome.
- iv. Confounding (criteria 21-26): assesses bias in the selection of study subjects.
- v. Power (criterion 27): attempts to assess whether the negative findings from a study could be due to chance.

Articles were marked N/A for criterion 27, which is reflected in the lower scores for all articles rated using this checklist.

Scores from these rating scales were provided with the respective article summary to all experts after the consensus conference in the Recommendation Endorsement phase of voting. See [Appendix G](#) for the rating scores and summaries for all 82 articles that were added to the evidence base for the current update.

Recommendation Level of Evidence:

The level of evidence used by each of the existing guidelines varied depending on the individual methodology followed. To achieve consistency among the recommendations, whether adapted from existing guidelines or generated by the expert consensus group, the level of evidence for each recommendation included in the current guideline was reviewed and assigned a grade according to the scheme outlined in [Table D](#).

Table D. Levels of Evidence

A	At least one randomized controlled trial, meta-analysis, or systematic review.
B	At least one cohort comparison, case studies, or other type of experimental study.
C	Expert opinion, experience of a consensus panel.

iii. Quality of the Body of Evidence

The body of evidence upon which the current guideline is based includes high levels of evidence (e.g., RCT, meta-analysis) supporting many of the recommendations for the acute assessment and management of concussion/mTBI. Furthermore, there is high alignment across treatment/intervention studies, as well as across different guidelines from other groups, on the acute diagnosis and treatment of mTBI. Due to gaps in research recommendations for the management of prolonged symptoms post-injury are primarily supported by expert consensus opinion, due to limited high-quality studies evaluating treatment for prolonged symptoms following concussion/mTBI and limited guideline recommendations on chronic management. Nevertheless, while there are limitations to the body of evidence supporting the current guideline, the recommendations listed herein address a large gap in the current literature on treatment following concussion/mTBI. Further research is needed on the effectiveness of treatments or interventions intended to manage prolonged symptoms following concussion/mTBI.

Sex and Gender Considerations

An increasing amount of research and clinical discussion is occurring that addresses the influence of sex and gender on concussion symptom presentation, recovery trajectory, risk profile and coping differences. There is body of literature that addresses the epidemiology, clinical manifestations, injury characteristics and outcomes. It appears as if females have a higher risk of prolonged post-concussion symptoms (Table 1). The current gap in the evidence is in the need for sex-specific assessment (although female sex is a risk-factor) and approaches to treatment. It is important that clinicians be aware that there do seem to be differences based on sex and gender and that as an at-risk group females should be assessed and managed as others who are also at risk for prolonged post-concussion symptoms. The recommendations included in this guideline can be applied to any person post-concussion exhibiting the guideline-specific symptom in question. There is much more understanding required about sex, gender and concussion in order to inform policy and practice and future editions of this guideline will aim to include sex and gender-specific recommendations and strategies for post-concussion management.

Adaptation of Existing Recommendations and Development of Novel Recommendations

The objective of updating the guideline recommendations was to:

- a) strengthen the level of evidence of the recommendations based on new research
- b) create more specific recommendations
- c) introduce new recommendations based on consensus level agreement or new research

To accomplish this Expert Consensus Group members were organized into four Working Groups. Group composition was determined based on members' expertise and interest. Each group worked on updating their assigned recommendations prior to sending out to the entire expert group. This allowed for the targeted review of recommendations by experts in their specific field.

Review of the new evidence, guidelines and resources occurred in a 7-step process:

STEP 1: Pre-Conference Voting

The Working Groups were sent the Second Edition recommendations that were assigned to them, i.e., group 1 reviewed sections 1,4,7,11. The experts were given a choice to "Keep, Modify, or Delete" the Second Edition recommendations. All new evidence (guideline recommendations, articles) related to the current recommendations was available to the experts for review using the networking software [Alfresco](#). The votes were compiled and each recommendation was assigned status as "Keep", "Modify" or "Delete".

STEP 2 Online Meetings

Results of the pre-conference voting were then reviewed during online meetings using [Adobeconnect](#) meeting software. Approximately 2-3 meetings were held per group. The experts collaboratively discussed what edits were to be made to each of the recommendations based on feedback from the votes (e.g., major or minor edits). The Project Team took notes on this discussion and afterwards began drafting the updated recommendation. Recommendations reviewed in adobeconnect that were voted as major edits were saved to review at conference.

STEP 3 Expert Consensus Conference

The expert consensus group convened for a one-day conference on April 6, 2017 in Toronto, Ontario. Conference members broke into their respective Working Groups to review the recommendations marked as major edits from the Working Group and to review the Project Team's edits. All information (e.g., source documents, presentations, summary tables etc.) were directly available to all consensus panel members during the meeting. After the Working Groups convened, the Working Group team leaders presented the results (e.g., recommendation deletions, additions and major revisions) to the entire expert consensus group. The conference also allowed group members to discuss other important issues including a discussion on the alignment of the Third Edition with the other guidelines and the [ONF Standards For Post-Concussion Care](#), published shortly after the meeting.

STEP 4 Post Conference

i. Working Group Final Recommendation Review

Post-conference any groups requiring further review of recommendations participated in final online meetings. Once all recommendations were reviewed within the Working Groups a "Final Internal Group Vote" was conducted. This was to ensure that the changes were synthesized correctly and the relevant section experts approved of the recommendation prior to send out to the entire consensus group. The Project Team made any final edits and a list of 106 recommendations were sent for review.

ii. Resource voting

A significant component of the guideline are the resources that accompany the guideline recommendations. A thorough search for updated/ new resources was completed during the literature review. Working Group members were sent a list of the current resources, along with any updated versions and possible new resources that could be added to the guideline. Working Group members voted on whether to keep, use updated, edit or add a resource. Resource Descriptions were completed by the Project Team and were available to the Working Group. These contained information on reliability/validity, method of administration, ease of use, whether it is proprietary or not, time to administer, etc.

iii. New Recommendation Voting

During the literature review the Project Team identified 51 new topics/areas that could support the creation of a new recommendation. These were either taken from studies marked as include in the literature review, or from current guidelines. Evidence was grouped according to topic Working Groups were sent a list of new potential recommendations (according to section) and voted to "Create Recommendation", "Add to Existing Recommendation" or "Do Not Use". From this five recommendations were voted to include in the updated guideline.

STEP 5 Post Conference Recommendation Review

Upon completion of the post conference online meetings the Working Groups were sent a finalized list of recommendations.

Experts voted on whether to “approve” or “edit” the recommendation before it was sent for final review by the entire Consensus Team. Project Team members reviewed feedback and edited recommendations based on comments. The Project Team then reviewed the recommendations and modified the phrasing of some of the recommendations in order to achieve standardized terminology or to clarify the intent of the specific recommendations. Care was taken not to alter the meaning of the recommendations.

STEP 6 Round 1 All Recommendation Review

The experts then voted independently on these recommendations using a modified Delphi voting technique⁶ to collect feedback from the other Consensus Group members to narrow them down to the most important and relevant recommendations and ensure that everyone had a chance to provide feedback. Experts were asked to vote to “Keep Original” “Approve Update” or “Edit” each recommendation. Recommendations that did not have an 80% agreement were reviewed by the Project Team and edited based on expert’s comments and feedback. Persons who were unable to comment due to the recommendation being outside their area of expertise were able to skip recommendations.

STEP 7 Recommendation Endorsement

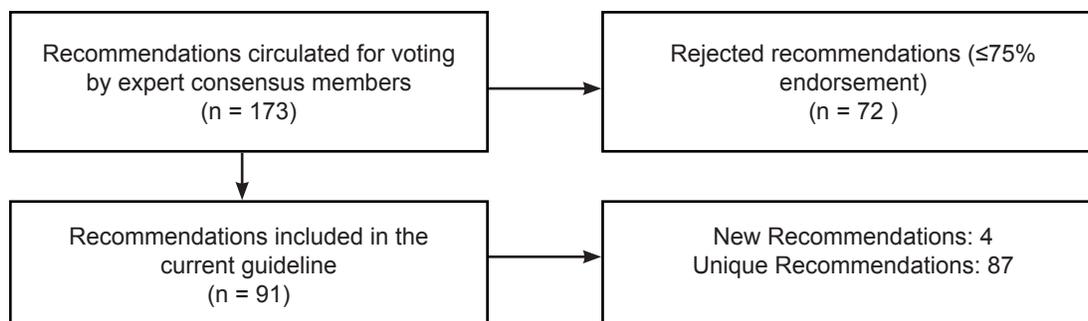
Following the first round of complete recommendation voting the Project Team collated all revisions and comments and edited the recommendations before final send out. Experts were asked to either “Endorse” or “Reject” each of the unique recommendations. If a recommendation met at least one of the following criteria, it was retained: 1) based on level A evidence; 2) received either a minimum of 75% endorsement by the Expert Consensus Group; or 3) represented an important care issue (i.e., addressed a topic relevant to a large proportion of the concussion/mTBI population and clearly represented a current gap in treatment guidance).

Experts were also asked to prioritize the top 20 most important recommendations for implementation. Specifically, experts were allowed to provide four priority votes for each of the five ranking categories (5-high to 1-highest) for a total of 20 prioritization votes. Guideline recommendations with a summed prioritization score greater than 30 are highlighted in the current guideline as key recommendations for implementation. This can help the treating healthcare professional with evaluation and implementation of the guideline recommendations, since it can guide where and how efforts should be made to change practice, especially early on. See “Key Recommendations” at the beginning of this guideline, which are also highlighted using a key symbol throughout the full list of recommendations.

Summary

A total of 173 recommendations (102 from Second Edition and 51 novel recommendations) were voted on during the update process. After review 91 recommendations remained comprising of 4 novel recommendations, 87 unique recommendations. It should be noted that each section of recommendations in the current guideline has been written to stand alone to some extent; accordingly, nine recommendations that are applicable across multiple topics (e.g., provision of education) have been repeated in more than one section of the guideline. These recurring guideline recommendations are noted to signal that they are not unique statements.

Figure C. Guideline Recommendation Review



External Review

A draft of the guideline was circulated to recognized experts in the field and stakeholders (see [Appendix A](#)) who did not participate in the development process. The external reviewers were requested to provide input about the validity and relevance of the guideline. This feedback was incorporated into the final draft.

Evaluation

The Second Edition of the guideline was evaluated to ensure that any gaps/areas of improvement were addressed. To complete this evaluation sports medicine and military physicians who participated in the pilot project in 2012 on the First Edition of the guideline were contacted, as they were most likely familiar with the guideline. An online survey was developed by the executive committee on areas including: content, format and barriers to use.

A majority of responders noted that the guideline did help to facilitate patient care, including using the resources for patient education and the treatment of prolonged symptoms. There were no reported barriers to use of the guideline; however those who did not endorse using the guideline cited not having a copy as the reason. Algorithms, patient handouts and reference guides were reported as the most frequently used tools; however it was important that tools and resources were created to be more printer friendly. More specific information regarding pharmacological treatment was noted as an important aspect to include in the updated guideline.

Ongoing Update and Review

Further feedback from frontline clinicians and their patients during the implementation phase, as well as findings from an ongoing literature review, will inform the update of these recommendations scheduled for 2021. Any updates to the guideline in the interim period will be noted on the ONF website: www.onf.org. Procedures for the next update will follow a similar stepwise process to those outlined herein.

References

- 1 Graham ID, Harrison MB. Evaluation and adaptation of clinical practice guidelines. *Evidence-based Nursing*. 2005;8:68-72.
- 2 Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med*. 2009;6(6):e1000097.
- 3 Brouwers MC, Kho ME, Browman GP, Burgers JS, Cluzeau F, Feder G, et al. AGREE II: advancing guideline development, reporting and evaluation in health care. *CMAJ*. 2010;182:E839-42. doi: 10.1503/cmaj.090449.
- 4 Maher CG, Sherrington C, Herbert RD, Moseley AM, Elkins M. Reliability of the PEDro scale for rating quality of randomized controlled trials. *Physical Therapy*. 2003;83(8):713-721.
- 5 Downs SH, Black N. The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. *Journal of Epidemiology and Community Health*. 1998;52:377–384.
- 6 Linstone HA, Turoff M, eds. *The Delphi Method. Techniques and Applications*. Reading, MA: Wesley; 1975.

Appendix 1.1

Acute Concussion Evaluation (ACE): Physician/Clinician Office Version

ACUTE CONCUSSION EVALUATION (ACE)

PHYSICIAN/CLINICIAN OFFICE VERSION

Gerard Gioia, PhD¹ & Micky Collins, PhD²
¹Children's National Medical Center
²University of Pittsburgh Medical Center

Patient Name: _____
 DOB: _____ Age: _____
 Date: _____ ID/MR# _____

A. Injury Characteristics Date/Time of Injury _____ Reporter: Patient Parent Spouse Other _____

1. Injury Description _____

1a. Is there evidence of a forcible blow to the head (direct or indirect)? Yes No Unknown
 1b. Is there evidence of intracranial injury or skull fracture? Yes No Unknown
 1c. Location of Impact: Frontal Lft Temporal Rt Temporal Lft Parietal Rt Parietal Occipital Neck Indirect Force
 2. Cause: MVC Pedestrian-MVC Fall Assault Sports (specify) _____ Other _____
 3. Amnesia Before (Retrograde) Are there any events just BEFORE the injury that you/ person has no memory of (even brief)? Yes No Duration _____
 4. Amnesia After (Anterograde) Are there any events just AFTER the injury that you/ person has no memory of (even brief)? Yes No Duration _____
 5. Loss of Consciousness: Did you/ person lose consciousness? Yes No Duration _____
 6. EARLY SIGNS: Appears dazed or stunned Is confused about events Answers questions slowly Repeats Questions Forgetful (recent info)
 7. Seizures: Were seizures observed? No Yes Detail _____

B. Symptom Check List* Since the injury, has the person experienced any of these symptoms any more than usual today or in the past day?

Indicate presence of each symptom (0=No, 1=Yes).

*Lovell & Collins, 1998 JHTR

PHYSICAL (10)		COGNITIVE (4)		SLEEP (4)	
Headache	0 1	Feeling mentally foggy	0 1	Drowsiness	0 1
Nausea	0 1	Feeling slowed down	0 1	Sleeping less than usual	0 1 N/A
Vomiting	0 1	Difficulty concentrating	0 1	Sleeping more than usual	0 1 N/A
Balance problems	0 1	Difficulty remembering	0 1	Trouble falling asleep	0 1 N/A
Dizziness	0 1	COGNITIVE Total (0-4) _____		SLEEP Total (0-4) _____	
Visual problems	0 1	EMOTIONAL (4)		Exertion: Do these symptoms <u>worsen</u> with: Physical Activity <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A Cognitive Activity <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A Overall Rating: How <u>different</u> is the person acting compared to his/her usual self? (circle) Normal 0 1 2 3 4 5 6 Very Different	
Fatigue	0 1	Irritability	0 1		
Sensitivity to light	0 1	Sadness	0 1		
Sensitivity to noise	0 1	More emotional	0 1		
Numbness/Tingling	0 1	Nervousness	0 1		
PHYSICAL Total (0-10) _____		EMOTIONAL Total (0-4) _____			
(Add Physical, Cognitive, Emotion, Sleep totals)					
Total Symptom Score (0-22)					

C. Risk Factors for Protracted Recovery (check all that apply)

Concussion History? Y ___ N ___	✓	Headache History? Y ___ N ___	✓	Developmental History	✓	Psychiatric History
Previous # 1 2 3 4 5 6+		Prior treatment for headache		Learning disabilities		Anxiety
Longest symptom duration Days ___ Weeks ___ Months ___ Years ___		History of migraine headache ___ Personal ___ Family		Attention-Deficit/ Hyperactivity Disorder		Depression
If multiple concussions, less force caused reinjury? Yes ___ No ___				Other developmental disorder _____		Other psychiatric disorder _____

List other comorbid medical disorders or medication usage (e.g., hypothyroid, seizures)

D. RED FLAGS for acute emergency management: Refer to the emergency department with sudden onset of any of the following:

- * Headaches that worsen
- * Looks very drowsy/ can't be awakened
- * Can't recognize people or places
- * Neck pain
- * Seizures
- * Repeated vomiting
- * Increasing confusion or irritability
- * Unusual behavioral change
- * Focal neurologic signs
- * Slurred speech
- * Weakness or numbness in arms/legs
- * Change in state of consciousness

E. Diagnosis (ICD): Concussion w/o LOC 850.0 Concussion w/ LOC 850.1 Concussion (Unspecified) 850.9 Other (854) _____
 No diagnosis

F. Follow-Up Action Plan Complete ACE Care Plan and provide copy to patient/family.

No Follow-Up Needed
 Physician/Clinician Office Monitoring: Date of next follow-up _____
 Referral:
 Neuropsychological Testing
 Physician: Neurosurgery ___ Neurology ___ Sports Medicine ___ Psychiatrist ___ Psychologist ___ Other _____
 Emergency Department

ACE Completed by: _____

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This form is part of the "Heads Up: Brain Injury in Your Practice" tool kit developed by the Centers for Disease Control and Prevention (CDC).

ACE Instructions

The ACE is intended to provide an evidence-based clinical protocol to conduct an initial evaluation and diagnosis of patients (both children and adults) with known or suspected MTBI. The research evidence documenting the importance of these components in the evaluation of an MTBI is provided in the reference list.

A. Injury Characteristics:

1. Obtain **description of the injury** – how injury occurred, type of force, location on the head or body (if force transmitted to head). Different biomechanics of injury may result in differential symptom patterns (e.g., occipital blow may result in visual changes, balance difficulties).
2. Indicate the **cause of injury**. Greater forces associated with the trauma are likely to result in more severe presentation of symptoms.
- 3/4. **Amnesia:** Amnesia is defined as the failure to form new memories. Determine whether amnesia has occurred and attempt to determine length of time of memory dysfunction – before (retrograde) and after (anterograde) injury. Even seconds to minutes of memory loss can be predictive of outcome. Recent research has indicated that amnesia may be up to 4-10 times more predictive of symptoms and cognitive deficits following concussion than is LOC (less than 1 minute).¹
5. **Loss of consciousness (LOC)** – If occurs, determine length of LOC.
6. **Early signs.** If present, ask the individuals who know the patient (parent, spouse, friend, etc) about specific signs of the concussion that may have been observed. These signs are typically observed early after the injury.
7. Inquire whether **seizures** were observed or not.

B. Symptom Checklist:²

1. Ask patient (and/or parent, if child) to report presence of the four categories of symptoms since injury. It is important to assess all listed symptoms as different parts of the brain control different functions. One or all symptoms may be present depending upon mechanisms of injury.³ Record “1” for Yes or “0” for No for their presence or absence, respectively.
2. For all symptoms, indicate presence of symptoms as experienced within the past 24 hours. Since symptoms can be present pre-morbidly/at baseline (e.g., inattention, headaches, sleep, sadness), it is important to assess change from their usual presentation.
3. **Scoring:** Sum total number of symptoms present per area, and sum all four areas into Total Symptom Score (score range 0-22). (Note: most sleep symptoms are only applicable after a night has passed since the injury. Drowsiness may be present on the day of injury.) If symptoms are new and present, there is no lower limit symptom score. Any score > 0 indicates positive symptom history.
4. **Exertion:** Inquire whether any symptoms worsen with physical (e.g., running, climbing stairs, bike riding) and/or cognitive (e.g., academic studies, multi-tasking at work, reading or other tasks requiring focused concentration) exertion. Clinicians should be aware that symptoms will typically worsen or re-emerge with exertion, indicating incomplete recovery. Over-exertion may protract recovery.
5. **Overall Rating:** Determine how different the person is acting from their usual self. Circle “0” (Normal) to “6” (Very Different).

C. Risk Factors for Protracted Recovery:

Assess the following risk factors as possible complicating factors in the recovery process.

1. **Concussion history:** Assess the number and date(s) of prior concussions, the duration of symptoms for each injury, and whether less biomechanical force resulted in re-injury. Research indicates that cognitive and symptom effects of concussion may be cumulative, especially if there is minimal duration of time between injuries and less biomechanical force results in subsequent concussion (which may indicate incomplete recovery from initial trauma).⁴⁻⁸
2. **Headache history:** Assess personal and/or family history of diagnosis/treatment for headaches. Research indicates headache (migraine in particular) can result in protracted recovery from concussion.⁹⁻¹¹
3. **Developmental history:** Assess history of learning disabilities, Attention-Deficit/Hyperactivity Disorder or other developmental disorders. Research indicates that there is the possibility of a longer period of recovery with these conditions.¹²
4. **Psychiatric history:** Assess for history of depression/mood disorder, anxiety, and/or sleep disorder.¹³⁻¹⁶

D. Red Flags:

The patient should be carefully observed over the first 24-48 hours for these serious signs. Red flags are to be assessed as possible signs of deteriorating neurological functioning. Any positive report should prompt strong consideration of referral for emergency medical evaluation (e.g. CT Scan to rule out intracranial bleed or other structural pathology).¹⁷

E. Diagnosis:

The following ICD diagnostic codes may be applicable.

850.0 (Concussion, with no loss of consciousness) – Positive injury description with evidence of forcible direct/ indirect blow to the head (A1a); plus evidence of active symptoms (B) of any type and number related to the trauma (Total Symptom Score >0); no evidence of LOC (A5), skull fracture or intracranial injury (A1b).

850.1 (Concussion, with brief loss of consciousness < 1 hour) – Positive injury description with evidence of forcible direct/ indirect blow to the head (A1a); plus evidence of active symptoms (B) of any type and number related to the trauma (Total Symptom Score >0); positive evidence of LOC (A5), skull fracture or intracranial injury (A1b).

850.9 (Concussion, unspecified) – Positive injury description with evidence of forcible direct/ indirect blow to the head (A1a); plus evidence of active symptoms (B) of any type and number related to the trauma (Total Symptom Score >0); unclear/unknown injury details; unclear evidence of LOC (A5), no skull fracture or intracranial injury.

Other Diagnoses – If the patient presents with a positive injury description and associated symptoms, but additional evidence of intracranial injury (A 1b) such as from neuroimaging, a moderate TBI and the diagnostic category of 854 (Intracranial injury) should be considered.

F. Follow-Up Action Plan:

Develop a follow-up plan of action for symptomatic patients. The physician/clinician may decide to (1) monitor the patient in the office or (2) refer them to a specialist. Serial evaluation of the concussion is critical as symptoms may resolve, worsen, or ebb and flow depending upon many factors (e.g., cognitive/physical exertion, comorbidities). Referral to a specialist can be particularly valuable to help manage certain aspects of the patient's condition. (Physician/Clinician should also complete the ACE Care Plan included in this tool kit.)

1. **Physician/Clinician serial monitoring** – Particularly appropriate if number and severity of symptoms are steadily decreasing over time and/or fully resolve within 3-5 days. If steady reduction is not evident, referral to a specialist is warranted.
2. **Referral to a specialist** – Appropriate if symptom reduction is not evident in 3-5 days, or sooner if symptom profile is concerning in type/severity.
 - **Neuropsychological Testing** can provide valuable information to help assess a patient's brain function and impairment and assist with treatment planning, such as return to play decisions.
 - **Physician Evaluation** is particularly relevant for medical evaluation and management of concussion. It is also critical for evaluating and managing focal neurologic, sensory, vestibular, and motor concerns. It may be useful for medication management (e.g., headaches, sleep disturbance, depression) if post-concussive problems persist.

* Taken with permission from the authors. Gioia GA, Collins M, Isquith PK. Improving identification and diagnosis of mild traumatic brain injury with evidence: psychometric support for the acute concussion evaluation. *Journal of Head Trauma Rehabilitation*. 2008;23(4):230-42.

Appendix 1.2

Abbreviated Westmead Post Traumatic Amnesia Scale (A-WPTAS)

ABBREVIATED WESTMEAD PTA SCALE (A-WPTAS) GCS & PTA testing of patients with MTBI following mild head injury

Abbreviated Westmead PTA Scale (A-WPTAS)
incorporating Glasgow Coma Scale (GCS)

MRN sticker here

Date:		T1	T2	T3	T4	T5
Time						
Motor	Obeys commands	6	6	6	6	6
	Localises	5	5	5	5	5
	Withdraws	4	4	4	4	4
	Abnormal flexion	3	3	3	3	3
	Extension	2	2	2	2	2
	None	1	1	1	1	1
	Eye Opening	4	4	4	4	4
	To speech	3	3	3	3	3
	To pain	2	2	2	2	2
	None	1	1	1	1	1
Verbal	Oriented ** (tick if correct)	5	5	5	5	5
	Name	<input type="checkbox"/>				
	Place	<input type="checkbox"/>				
	Why are you here	<input type="checkbox"/>				
	Month	<input type="checkbox"/>				
	Year	<input type="checkbox"/>				
	Confused	4	4	4	4	4
	Inappropriate words	3	3	3	3	3
	Incomprehensible sounds	2	2	2	2	2
	None	1	1	1	1	1
GCS	Score out of 15	/15	/15	/15	/15	/15
	Picture 1	Show pictures (see over)				
	Picture 2					
	Picture 3					
A-WPTAS	Score out of 18		/18	/18	/18	/18

Use of A-WPTAS and GCS for patients with MTBI

The A-WPTAS combined with a standardised GCS assessment is an objective measure of post traumatic amnesia (PTA).
Only for patients with **current GCS of 13-15 (<24hrs post injury)** with impact to the head resulting in confusion, disorientation, anterograde or retrograde amnesia, or brief LOC. **Administer both tests at hourly intervals** to gauge patient's capacity for full orientation and ability to retain new information. Also, **note the following:** poor motivation, depression, pre-morbid intellectual handicap or possible medication, drug or alcohol effects. **NB: This is a screening device, so exercise clinical judgement. In cases where doubt exists, more thorough assessment may be necessary.**

Admission and Discharge Criteria:

A patient is considered to be out of PTA when they score 18/18.
Both the GCS and A-WPTAS should be used in conjunction with clinical judgement.
Patients scoring 18/18 can be considered for discharge.
For patients who do not obtain 18/18 re-assess after a further hour.
Patients with persistent score <18/18 at 4 hours post time of injury should be considered for admission.
Clinical judgement and consideration of pre-existing conditions should be used where the memory component of A-WPTAS is abnormal but the GCS is normal (15/15).
Referral to GP on discharge if abnormal PTA was present, provide patient advice sheet.

Target set of picture cards



** must have all 5 orientation questions correct to score 5 on verbal score for GCS, otherwise the score is 4 (or less).

PUPIL ASSESSMENT	T1		T2		T3		T4		T5		+	=	REACTS BRISKLY
	R	L	R	L	R	L	R	L	R	L			
Size											SL	=	SLUGGISH
Reaction											-	=	NIL

Comments

.....

.....

.....

.....

Pupil Size (mm)



Shores & Lammel (2007) - further copies of this score sheet can be downloaded from <http://www.psy.mq.edu.au/GCS>

GLASGOW COMA SCALE (GCS) AND ABBREVIATED WESTMEAD PTA SCALE (A-WPTAS)

Administration and Scoring

1. Orientation Questions

Question 1: WHAT IS YOUR NAME?

The patient must provide their full name.

Question 2: WHAT IS THE NAME OF THIS PLACE?

The patient has to be able to give the name of the hospital. For example: Westmead Hospital. (NB: The patient does not get any points for just saying 'hospital'.) If the patient can not name the hospital, give them a choice of 3 options. To do this, pick 2 other similar sized hospitals in your local area or neighbouring region. In Westmead Hospital's case the 3 choices are 'Nepean Hospital, Westmead Hospital or Liverpool Hospital'.

Question 3: WHY ARE YOU HERE?

The patient must know why they were brought into hospital. e.g. they were injured in a car accident, fell, assaulted or injured playing sport. If the patient does not know, give them three options, including the correct reason.

Question 4: WHAT MONTH ARE WE IN?

For emphasis the examiner can ask what month are we in now? The patient must name the month. For example, if the patient answers 'the 6th month', the examiner must ask the further question 'What is the 6th month called?'

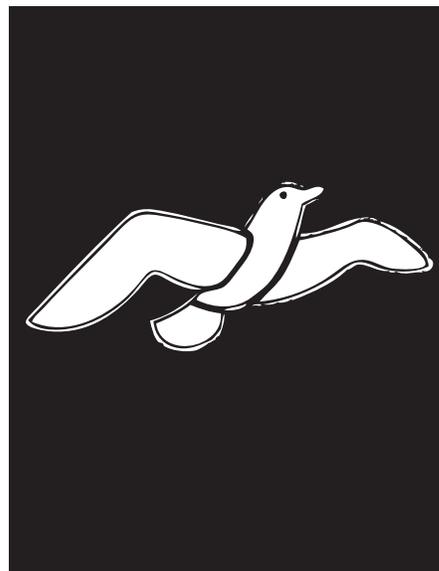
Question 5: WHAT YEAR ARE WE IN?

It is considered correct for patients to answer in the short form '08', instead of '2008'. Also, an acceptable alternative prompt (for the rest of the 2000's) is 'The year is 2000 and what?'

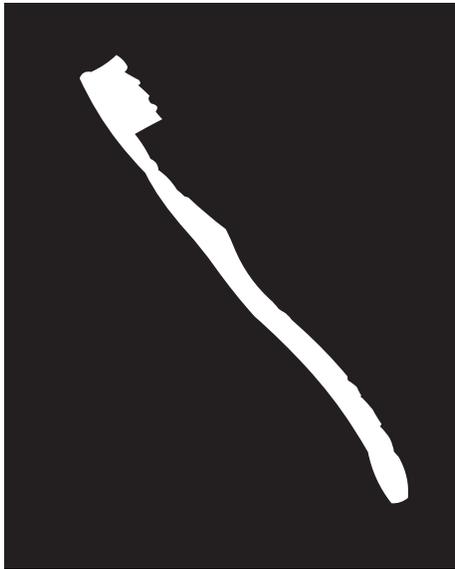
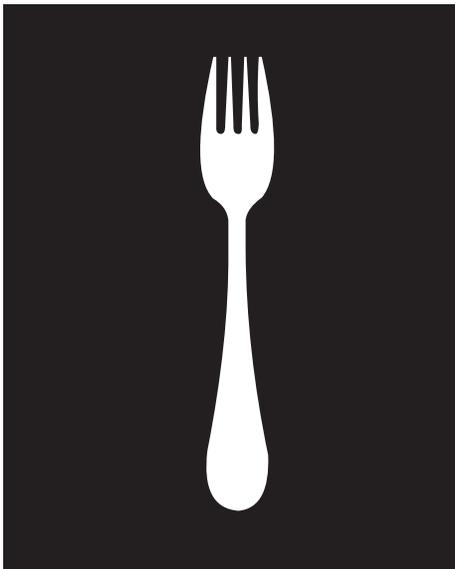
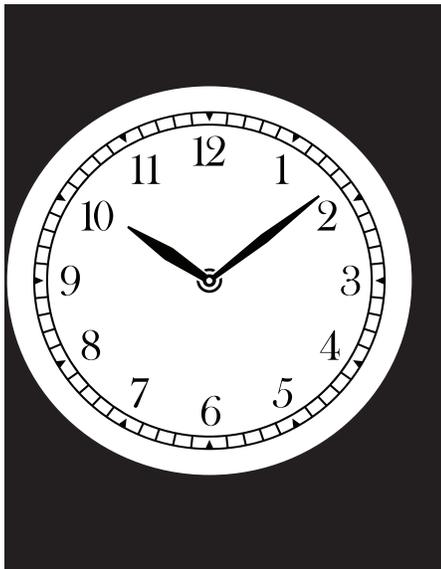
2. Picture recognition

Straight after administering the GCS (standardised questions), administer the A-WPTAS by presenting the 3 Westmead PTA cards. Picture Cards the first time - T1 : Show patients the target set of picture cards for about 5 seconds and ensure that they can repeat the names of each card. Tell the patient to remember the pictures for the next testing in about one hour. Picture Cards at each subsequent time T2-T5: Ask patient, "What were the three pictures that I showed you earlier?" Scoring:

- For patients who free recall all 3 pictures correctly, assign a score of 1 per picture and add up the patient's GCS (out of 15) and A-WPTAS memory component to give the A-WPTAS score (total = 18). Present the 3 target pictures again and re-test in 1 hour.
- For patients who can not free recall, or only partially free recall, the 3 correct pictures, present the 9-object recognition chart. If patient can recognise any correctly, score 1 per correct item and record their GCS and A-WPTAS score (total = 18). Present the target set of pictures again and re-test in 1 hour.
- For patients who neither remember any pictures by free call nor recognition, show the patient the target set of 3 picture cards again for re-test in 1 hour.



Shores & Lammel (2007) - further copies of this score sheet can be downloaded from <http://www.psy.mq.edu.au/GCS>



Shores & Lammell (2007) - further copies of this score sheet can be downloaded from <http://www.psy.mq.edu.au/GCS>

Appendix 1.3

Brain Injury Advice Card - Long Version

Brain Injury Advice Card (Long Version)

Important Points about Mild Brain Injury

- You had a mild brain injury or what is sometimes called a concussion. Most people recover quickly following a concussion/mTBI. A few people may experience symptoms over a longer period.
- There is a small risk of you developing serious complications so you should be watched closely by another adult for 24 hours after the accident.
- Please read the following. It outlines what signs to look for after a brain injury/concussion and what you need to do if you have problems.

Warning Signs

If you show any of these symptoms or signs after your brain injury/concussion, or you get worse, go to the nearest hospital, doctor or call 911 immediately.

- Fainting or blacking out, drowsiness, or can't be woken up
- A constant severe headache or a headache that gets worse
- Vomiting or throwing up more than twice
- Cannot remember new events, recognise people or places (increased confusion)
- Acting strange, saying things that do not make sense (change in behaviour)
- Having a seizure (any jerking of the body or limbs)
- Inability to move parts of your body, weakness in arms or legs, or clumsiness
- Blurred vision or slurred speech
- Being unsteady on your feet or loss of balance
- Continual fluid or bleeding from the ear or nose

The First 24-48 Hours After Injury

- **Warning Signs:** You should be observed and return to hospital if you develop any of the above warning signs.
- **Rest/Sleeping:** Rest (both physical and mental) and avoid strenuous activity for at least 24 hours. It is alright for you to sleep tonight but you should be checked every four hours by someone to make sure you are alright.
- **Driving:** Do not drive for at least 24 hours. You should not drive until you feel much better and can concentrate properly. Talk to your doctor.
- **Drinking/Drugs:** Do not drink alcohol or take sleeping pills or recreational drugs in the next 48 hours. All of these can make you feel worse. They also make it hard for other people to tell whether the injury is affecting you or not.
- **Pain Relief:** Use **acetaminophen** or **acetaminophen/codeine** for headaches (e.g., Tylenol).
- **Sports:** Do not return to sports until you have received medical clearance from a healthcare professional.

See your primary care provider or visit the ED if you are not starting to feel better within a few days of your injury.

The First 4 Weeks After Injury

You may have some common effects from the brain injury/concussion which usually resolve in several weeks to three months. These are called **post-concussion symptoms** (see below). Tiredness can exaggerate the symptoms. Return to your normal activities gradually (not all at once) during the first weeks or months. **You can help yourself get better by:**

- **Rest/Sleeping:** Your brain needs time to recover. It is important to get adequate amounts of sleep as you may feel more tired than normal and you need to get adequate amounts of both physical and mental rest.
- **Driving:** Do not drive or operate machinery until you feel much better and can concentrate properly. Talk to your doctor.
- **Drinking/Drugs:** Do not drink alcohol or use recreational drugs until you are fully recovered. They will make you feel much worse. Do not take medication unless advised by your doctor.
- **Work/Study:** You may need to take time off work or study until you can concentrate better. Most people need a day or two off work but are back full-time in less than 2 weeks. How much time you need off work or study will depend on the type of job you do. See your doctor and let your employer or teachers know if you are having problems at work or with study. You may need to return to study or work gradually.
- **Sport/Lifestyle:** It is dangerous for the brain to be injured again if it has not recovered from the first injury. Talk to your doctor about the steps you need to take to gradually increase sports activity and return to play. If in doubt, sit out.
- **Relationships:** Sometimes your symptoms will affect your relationship with family and friends. You may suffer irritability and mood swings. See your doctor if you or your family are worried.

Recovery

- You should start to feel better within a few days and be 'back to normal' within about 4 weeks. See your local doctor if you are not starting to feel better.
- Your doctor should monitor these symptoms and may refer you to a specialist if you do not improve over 4 weeks up to 3 months.

Post Concussion Symptoms

There are common symptoms after a mild brain injury/ concussion. **They usually go away within a few days or weeks.** Sometimes you may not be aware of them until sometime after your injury like when you return to work.

» Mild headaches (that won't go away)

Headaches are a common problem after a mild brain injury/concussion. They can be made worse by fatigue and stress. Sleeping, resting or taking a break from activities requiring concentration or effort will usually relieve headaches. Pain relievers may help to break a cycle of headaches - use acetaminophen or acetaminophen/codeine, limited to <15 days per month. If your headache gets worse, or cannot be relieved, see your doctor.

» Having more trouble than usual with attention and concentration

No one can concentrate well when they are tired, so it is not surprising that many people have trouble concentrating for a while after they have had a mild brain injury. Maybe you cannot even concentrate well enough to read the newspaper. If you really need to, just read for a short time, and then come back to it when you have had a break. The same thing applies to other areas where concentration is needed. Leave things that need your complete concentration until you are feeling better. If you need to concentrate on something important, do it when you are feeling fresh.

» **Having more trouble than usual with remembering things (memory difficulties/forgetfulness)**

You cannot expect your brain to be as good at remembering things as it usually is. Don't worry if you can't think of a name or a phone number that you ought to know, or if you go to get something, and then can't remember what it is. Your memory is only going to be a problem until you recover. In the meantime, get your family and friends to remind you of important dates and appointments, or write things down.

» **Feeling dizzy or sick without vomiting (nausea)**

Occasionally, people find that they get a sick or uncomfortable feeling if they move or change their position quickly. Usually it is only a problem for a few days. If you find that things seem to spin round if you sit up suddenly after lying down, or if you turn your head sharply, it is best to avoid such sudden movements or changes in position until it clears. If the dizziness persists for more than a week or two, see your doctor.

» **Balance problems**

You may find that you are a bit more clumsy than usual. Don't worry if you do find that you are a bit unsteady on your feet, or bump into furniture, or maybe drop things. Just take everything you do a little more slowly. Your brain is the control centre for your whole body. It has to make sense out of all the messages coming in from your eyes and ears and other senses, and to send the right signals to the right muscles for you to be able to do anything. So give yourself more time to do things.

» **More difficulty than usual with making decisions and solving problems, getting things done or being organized**

You may find you are less able to plan ahead or follow through the steps that are required in carrying out an activity. These kinds of difficulties may cause particular problems during the first few days after a mild brain injury but they are usually temporary in nature. When facing situations that present problems or opportunities to plan, it may help to think things through in a more structured and objective way. For example, you may want to ask yourself a series of questions like:

1. What do I want to achieve?
2. What are the available options?
3. What is the best option?
4. What steps will I need to take to achieve this?

After these questions have been considered and answered, you can then carry out your plan. Writing down a goal, plan or problem also helps to give structure to your thinking and helps to make things clearer. Using a daily and weekly time table, planner, or keeping a diary can provide structure and ensure that plans are made routinely and on an ongoing basis.

» **Feeling vague, slowed or 'foggy' thinking**

Some people who have sustained a mild brain injury find their thinking is a bit slower. This means they might have some difficulty keeping up with conversations or following directions, and things take longer to get done. Encourage others to slow down by asking questions and having them repeat what they have said. Allow yourself extra time to complete tasks and avoid situations where you are under pressure to do things quickly.

» **Feeling more tired than usual and lacking energy (fatigue)**

At first, even a little effort may make you feel very tired. Your brain has less energy to spare than it normally does. If you feel sleepy, go to bed. You will probably find that you need several hours more sleep than you usually do. Let your brain tell you when it needs to sleep, even if it is the middle of the day.

» **Tinnitus. Ringing in the ears.**

Tinnitus is due to damage to the inner ear after brain injury. It is usually described as a whistling, ringing or roaring sound and may be accompanied by some hearing loss. It usually settles on its own within a few weeks after injury. If the ringing in your ears gets worse or does not go away, see your doctor. Reduce your normal intake until you feel fully recovered.

» Irritability/mood swings. Losing your temper and getting annoyed easily

Some people who have had a mild brain injury find that they get annoyed easily by things that normally would not upset them. This does not last very long, but it can be difficult for you and for your family. It happens because the brain controls your emotional system as well as the rest of your body. After a mild brain injury your emotions may not be as well controlled as they usually are. There are several ways to deal with this. Some people find that going out of a room, or away from a situation as soon as it begins to get annoying is enough. Others use relaxation techniques (controlled breathing, progressive muscle relaxation) to help them get back on an even keel. You may find that you can stop the irritability from developing by doing an activity that uses up some physical energy like riding an exercise bicycle, if tiredness permits. Irritability will be worse when you are tired, so rest will also help.

» Anxiety or depression

Feeling anxious, worried, frightened, angry and low in mood are normal emotions after sustaining a mild brain injury. These feelings often pass in the weeks following the injury, as a person gradually resumes their usual activities. Recognise that emotional upset and worry is a normal part of recovery, even though you may have suffered an injury in the past and not felt like this before. Explain any difficulties that you are experiencing to your family and friends, so that they can understand the effect the injury has had on you and support you in managing your difficulties. Recognise if your worry about symptoms intensifies and a vicious circle develops. If that happens remind yourself of the point above. If symptoms nevertheless do not improve, or if you have suffered from anxiety or depression before the injury and the brain injury has intensified those feelings, visit your doctor.

» More sensitive to lights or sounds

You may find that your eyes are sensitive to bright light. Wearing dark glasses in strong light can help to manage this and the need for dark glasses will likely clear up within a few days. When you want to shut out something you don't want to look at, all you have to do is close your eyes. It is much harder to shut your ears. When your brain is fully awake it uses part of its energy to dampen down noises that would interfere with what you are doing. After a mild brain injury your brain may not have enough energy to spare to do this, and you may find that most noises bother you. Explain to your family and friends, and ask them to keep the noise level down if they can.

» Change in sleep patterns. Trouble sleeping or sleeping too much.

Don't worry about the sleep disturbance. This is usually temporary and your normal routine will come back gradually. If you are having trouble falling asleep you may try things like reducing stimulation by not watching TV in bedroom or spending long times on the computer, avoiding a large meal before bed, avoiding caffeine, using relaxation techniques (controlled breathing, progressive muscle relaxation), or getting up for about 30 minutes if you are unable to sleep for long periods. It is best to avoid sleep medications but if your sleeping pattern has become very disrupted, discuss with your doctor if a short course of medication may be helpful in re-establishing your sleeping pattern.

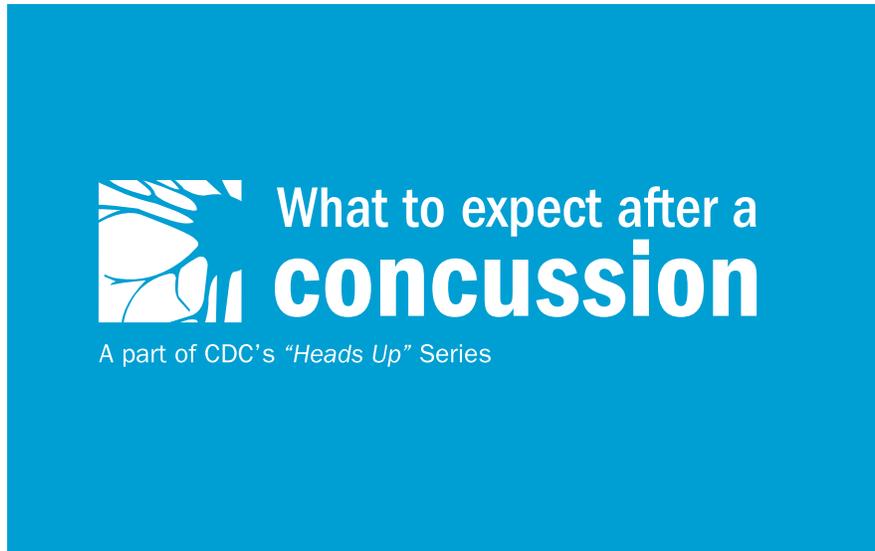
» Reduced tolerance to alcohol.

After a mild brain injury you may be more sensitive to the effects of alcohol. A small amount may worsen the effects of the brain injury. It can cause unsteadiness and dizziness which may lead to a fall and further injury. It is sensible to avoid alcohol for at least one week after injury and then monitor carefully how alcohol affects you. Reduce your normal intake until you feel fully recovered.

Information included on this advice card was adapted from the Motor Accidents Authority of NSW, Guidelines for Mild/Traumatic Brain Injury following Closed Head Injury (MAA NSW, 2008) and the Information about Mild Head Injury or Concussion booklet (Ponsford, Willmott, Nelms & Curran, 2004).

Appendix 1.4

Brain Injury Advice Cards - Short Versions: Example # 1



For more information about concussion, please visit:
www.cdc.gov/Concussion.

PATIENT INSTRUCTIONS

You have been examined at _____
[name of hospital emergency department]
for a head injury and possible concussion. Be sure to let a family member or friend know about your injury. They may notice symptoms before you do and can help you.

Take time off from work or school for _____ days or until you and your doctor think you are able to return to your usual routine.

Your next appointment with _____
[Doctor's name]
is _____
[date and time]

What to Expect Once You're Home from the Hospital

Most people with a concussion recover quickly and fully. During recovery, you may have a range of symptoms that appear right away, while others may not be noticed for hours or even days after the injury. You may not realize you have problems until you try to do your usual activities again. Most symptoms go away over time without any treatment. Below is a list of some of the symptoms you may have:



Thinking/Remembering

- Difficulty thinking clearly ■ Feeling slowed down
- Trouble concentrating ■ Difficulty remembering new information



Physical

- Headache ■ Balance problems ■ Blurred vision ■ Dizziness
- Nausea or vomiting ■ Lack of energy ■ Sensitivity to noise or light



Emotional/Mood

- Irritability ■ Nervousness ■ Sadness ■ More emotional



Sleep

- Sleeping more than usual ■ Sleeping less than usual ■ Trouble falling asleep

How to Feel Better

- Get plenty of rest and sleep.
- Avoid activities that are physically demanding or require a lot of thinking.
- Do not drink alcohol.
- Return slowly and gradually to your routine.
- Ask a doctor when it is safe to drive, ride a bike, or operate heavy equipment.

WHEN TO RETURN TO THE HOSPITAL

Sometimes serious problems develop after a head injury. Return to the emergency department right away if you have any of these symptoms:

- Repeated vomiting
- Worsening or severe headache
- Unable to stay awake during times you would normally be awake
- More confused and restless
- Seizures
- Difficulty walking or difficulty with balance
- Difficulty with your vision
- Any symptom that concerns you, your family members, or friends

Appendix 1.4 (Continued)

Brain Injury Advice Cards - Short Versions: Example # 2

Brain Injury Advice Card (Short Version)

Important Points about Mild Brain Injury

- You had a mild brain injury or what is sometimes called a concussion. Most people recover quickly following a mild brain injury/concussion. A few people may experience symptoms over a longer period.
- There is a small risk of you developing serious complications so you should be watched closely by another adult for 24 hours after the accident.
- Please read the following. It outlines what signs to look for after a brain injury and what you need to do if you have problems.

Warning Signs

If you show any of these symptoms or signs after your brain injury/concussion, or you get worse, go to the nearest hospital, doctor or call 911 immediately.

- Fainting or blacking out, drowsiness, or can't be woken up
- A constant severe headache or a headache that gets worse
- Vomiting or throwing up more than twice
- Cannot remember new events, recognise people or places (increased confusion)
- Acting strange, saying things that do not make sense (change in behaviour)
- Having a seizure (any jerking of the body or limbs)
- Inability to move parts of your body, weakness in arms or legs, or clumsiness
- Blurred vision or slurred speech
- Being unsteady on your feet or loss of balance
- Continual fluid or bleeding from the ear or nose

The First 24-48 Hours After Injury

- **Warning Signs:** You should be observed and return to hospital if you develop any of the above warning signs.
- **Rest/Sleeping:** Rest (both physical and mental) and avoid strenuous activity for at least 24 hours. It is alright for you to sleep tonight but you should be checked every four hours by someone to make sure you are alright.
- **Driving:** Do not drive for at least 24 hours. You should not drive until you feel much better and can concentrate properly. Talk to your doctor.
- **Drinking/Drugs:** Do not drink alcohol or take sleeping pills or recreational drugs in the next 48 hours. All of these can make you feel worse. They also make it hard for other people to tell whether the injury is affecting you or not.
- **Pain Relief:** Use **acetaminophen** or **acetaminophen/codeine** for headaches (e.g., Tylenol).
- **Sports:** Do not return to sports until you have received medical clearance from a healthcare professional.

See your primary care provider or visit the ED if you are not starting to feel better within a few days of your injury.

The First 4 Weeks After Injury

You may have some common effects from the brain injury/concussion which usually resolve in several weeks to three months. These are called **post-concussion symptoms** (see below). Tiredness can exaggerate the symptoms. Return to your normal activities gradually (not all at once) during the first weeks or months. **You can help yourself get better by:**

- **Rest/Sleeping:** Your brain needs time to recover. It is important to get adequate amounts of sleep as you may feel more tired than normal and you need to get adequate amounts of both physical and mental rest.
- **Driving:** Do not drive or operate machinery until you feel much better and can concentrate properly. Talk to your doctor.
- **Drinking/Drugs:** Do not drink alcohol or use recreational drugs until you are fully recovered. They will make you feel much worse. Do not take medication unless advised by your doctor.
- **Work/Study:** You may need to take time off work or study until you can concentrate better. Most people need a day or two off work but are back full-time in less than 2 weeks. How much time you need off work or study will depend on the type of job you do. See your doctor and let your employer or teachers know if you are having problems at work or with study. You may need to return to study or work gradually.
- **Sport/Lifestyle:** It is dangerous for the brain to be injured again if it has not recovered from the first injury. Talk to your doctor about the steps you need to take to gradually increase sports activity and return to play. If in doubt, sit out.
- **Relationships:** Sometimes your symptoms will affect your relationship with family and friends. You may suffer irritability and mood swings. See your doctor if you or your family are worried.

Recovery

- You should start to feel better within a few days and be 'back to normal' within about 4 weeks. See your local doctor if you are not starting to feel better.
- Your doctor will monitor these symptoms and may refer you to a specialist if you do not improve over 4 weeks up to 3 months.

Information included on this advice card was adapted from the Motor Accidents Authority of NSW, Guidelines for Mild Traumatic Brain Injury following Closed Head Injury (MAA NSW, 2008) and the Information about Mild Head Injury or Concussion booklet (Ponsford, Willmott, Nelms & Curran, 2004).

Appendix 1.5

The Rivermead Post Concussion Symptoms Questionnaire*

After a head injury or accident some people experience symptoms which can cause worry or nuisance. We would like to know if you now suffer from any of the symptoms given below. As many of these symptoms occur normally, we would like you to compare yourself now with before the accident. For each one, please circle the number closest to your answer.

- 0 = Not experienced at all
- 1 = No more of a problem
- 2 = A mild problem
- 3 = A moderate problem
- 4 = A severe problem

Compared with before the accident, do you now (i.e., over the last 24 hours) suffer from:

Headaches.....	0	1	2	3	4
Feelings of dizziness.....	0	1	2	3	4
Nausea and/or vomiting.....	0	1	2	3	4
Noise sensitivity, easily upset by loud noise.....	0	1	2	3	4
Sleep disturbance.....	0	1	2	3	4
Fatigue, tiring more easily.....	0	1	2	3	4
Being irritable, easily angered.....	0	1	2	3	4
Feeling depressed or tearful.....	0	1	2	3	4
Feeling frustrated or impatient.....	0	1	2	3	4
Forgetfulness, poor memory.....	0	1	2	3	4
Poor concentration.....	0	1	2	3	4
Taking longer to think.....	0	1	2	3	4
Blurred vision.....	0	1	2	3	4
Light sensitivity, easily upset by bright light.....	0	1	2	3	4
Double vision.....	0	1	2	3	4
Restlessness	0	1	2	3	4

Are you experiencing any other difficulties?

1. _____	0	1	2	3	4
2. _____	0	1	2	3	4

* King N, Crawford S, Wenden F, Moss N, Wade D. The Rivermead Post Concussion Symptoms Questionnaire: A measure of symptoms commonly experienced after head injury and its reliability. *Journal of Neurology*. 1995;242:587-592.

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Appendix 1.6

Post Concussion Symptom Scale

Name: _____ Age/DOB: _____ Date of Injury: _____

Post Concussion Symptom Scale

No symptoms "0"-----Moderate "3"-----Severe"6"

Time after Concussion

SYMPTOMS	Days/Hrs _____	Days/Hrs _____	Days/Hrs _____
Headache	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Nausea	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Vomiting	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Balance problems	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Dizziness	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Fatigue	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Trouble falling to sleep	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Excessive sleep	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Loss of sleep	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Drowsiness	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Light sensitivity	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Noise sensitivity	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Irritability	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Sadness	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Nervousness	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
More emotional	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Numbness	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Feeling "slow"	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Feeling "foggy"	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Difficulty concentrating	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Difficulty remembering	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
Visual problems	0 1 2 3 4 5 6	0 1 2 3 4 5 6	0 1 2 3 4 5 6
TOTAL SCORE	_____	_____	_____

Use of the Post-Concussion Symptom Scale: The athlete should fill out the form, on his or her own, in order to give a subjective value for each symptom. This form can be used with each encounter to track the athlete's progress towards the resolution of symptoms. Many athletes may have some of these reported symptoms at a baseline, such as concentration difficulties in the patient with attention-deficit disorder or sadness in an athlete with underlying depression, and must be taken into consideration when interpreting the score. Athletes do not have to be at a total score of zero to return to play if they already have had some symptoms prior to their concussion.

Appendix 2.1

Specialized Concussion Clinics/Centres in Ontario

Please note that we are not endorsing that these clinics offer benefit beyond what can be expected from other clinics, providing they practice according to evidence based guidelines or in collaboration with physicians and other healthcare providers

LOCATION	INSTITUTION	LOCATION AND CONTACT INFORMATION	SERVICES PROVIDED
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Appendix 2.2

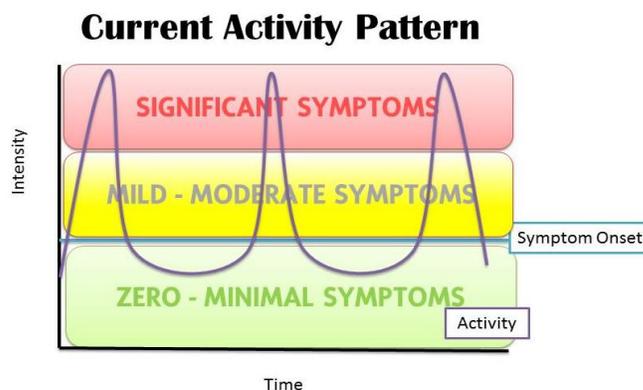
The Parkwood Pacing Graphs



The Pacing Graphs Explained

The green (safe zone) represents when you are symptom-free, or your baseline symptoms. The red (danger zone) represents when your symptoms are increased.

Your Current Activity Pattern may look like this if you continue to work, study, exercise, and in effect push through your symptoms into the 'red zone'. Unfortunately, you end up crashing and may need hours or days to return to baseline. →

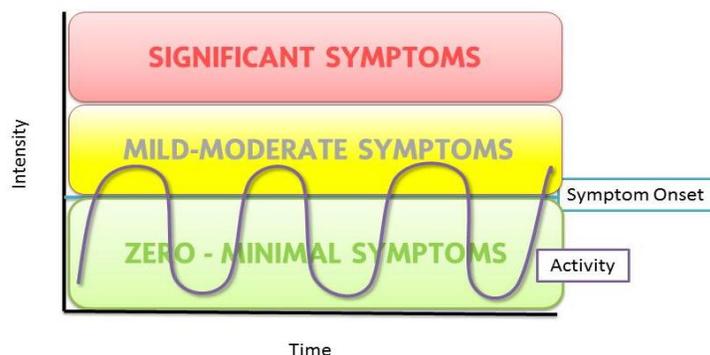


Your Goal: To gradually increase activity tolerance without significantly increasing symptoms or crossing the symptom threshold (into the 'danger zone'). Therefore, planning and pacing of activities is very important. You need to find the right level of activity whereby your symptoms are either eliminated or manageable, and then as your symptoms are better controlled, you can gradually increase your activity level.

You should aim to remain below your significant symptom threshold to promote recovery.

Use your timer to set time restrictions for activities to ensure that a task is stopped soon after symptom onset (i.e. if symptoms increase by 2-3/10 and then return back to baseline within 30-60 min, this is an appropriate amount). This will allow you to monitor your response to activity and teach you how to self-pace and self-monitor. You need to challenge the system in a manageable way in order to change it.

Persistent Symptom Target Activity Pattern



Additional Strategies

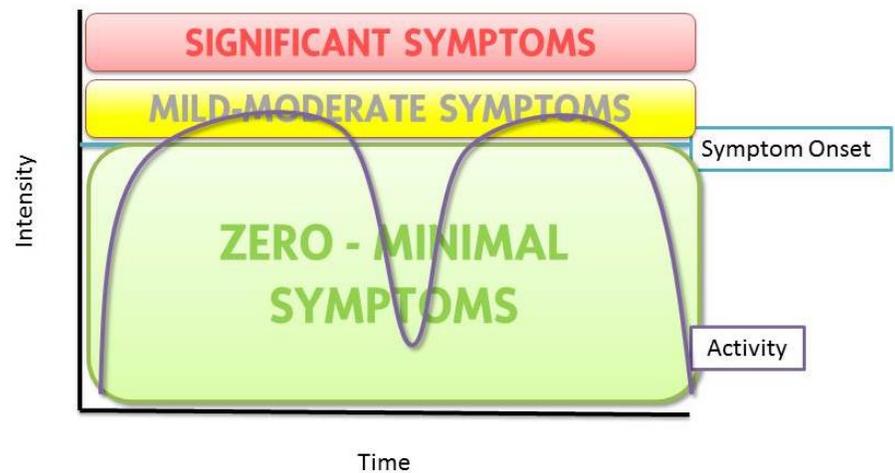
- Start with shorter bouts of exercise or activity with rest in between OR
- Try switching between different types of activities (e.g., switching from reading to walking).
- **Doing nothing at all will not promote recovery, but doing too much each day may cause prolonged symptoms.** Therefore, completing structured, paced activities throughout the day with rest breaks as appropriate is ideal.

- **Use a Planner/Agenda/Technology**

- Plan your day in advance. This promotes scheduling of necessary rest breaks into your day, and activities across a number of days, rather than trying to ‘push through’ and get things all done at once.
- **If you have memory issues**, an agenda or technology aid may assist you, with remembering appointments, upcoming tasks/commitments and sending out reminders (in the case of technology solutions).
- **Track your activities** to help you determine any cause and effect or patterns of setbacks which may occur during your recovery. Tracking activities and symptoms in the notes/journal/agenda can also help with determining if there is a relationship between certain activities and symptom onset.

Long Term Activity Goal

Using strategies to plan and pace your day will help you reach your **long term activity goal** to be able to engage in activities for longer periods of time without making your symptoms significantly worse, and eliminates the need for prolonged recovery time.



Using a Timer for Planning & Pacing

What is it? A timer on your microwave/oven, cellphone, or a digital timer from the dollar store should have an alarm/beep/light that notifies you when the set time has elapsed.

Why? A timer is very important for recovery and for helping you get back doing the day-to-day activities you did before your injury. After brain injury, you have or will experience various symptoms which may be worsened by overstimulation. Overstimulation may include too much “going on” (e.g., sights and sounds) for the brain to process. It is important for you to learn to recognize how much overstimulation it takes to bring on your symptoms (e.g., headache, tremor, fatigue, etc.).

Temporal (time) awareness in brain injured patients may be disrupted as well, resulting in individuals “pushing through” symptoms to finish tasks. Additional challenges may include difficulty starting/stopping activities and over or under-estimation of the passage of time. A timer is a good way to promote pausing, rest, and evaluation of symptoms and to give the brain a break before the symptoms become problematic. It also helps to “reset” your internal clock, as time estimation skills often improve with continued use of a timer.

How to use it: Set a timer for a defined amount of time (e.g., 20 minutes), and then take a break from the task for a defined amount of time (e.g., 10 minutes). Breaks should consist of resting or doing something that encourages focus on something that is not up close. For example, if you read for 20 minutes, then perhaps take a walk for 10 minutes, rest or grab a healthy snack. This will give your brain the break it needs for recovery and to prevent onset of symptoms.

How to progress: Over time, longer work periods (relative to rest), may be established using a timer and increasing the on-task time in increments of 5 minutes every few days. Your goal is to work relatively symptom-free or without a lasting increase in symptoms.

Summary

- Many patients return to activities too quickly, or participate in symptom provoking activities for too long.
- We encourage you to participate in activities below the level of symptom onset in order to gradually build tolerance. As tolerance increases, symptoms may not occur as quickly, and many patients begin to recover and have less symptoms as time progresses.
- Stay conscious of the significant symptoms zone (red), even when symptoms begin to subside, as it is easy to slide into old habits of pushing through symptoms.

Appendix 3.1

Sport Concussion Assessment Tool 5th Edition (SCAT5)

SCAT5[®]

SPORT CONCUSSION ASSESSMENT TOOL – 5TH EDITION

DEVELOPED BY THE CONCUSSION IN SPORT GROUP
FOR USE BY MEDICAL PROFESSIONALS ONLY

supported by



FIFA[®]



FEI

Patient details

Name: _____
DOB: _____
Address: _____
ID number: _____
Examiner: _____
Date of Injury: _____ Time: _____

WHAT IS THE SCAT5?

The SCAT5 is a standardized tool for evaluating concussions designed for use by physicians and licensed healthcare professionals¹. The SCAT5 cannot be performed correctly in less than 10 minutes.

If you are not a physician or licensed healthcare professional, please use the Concussion Recognition Tool 5 (CRT5). The SCAT5 is to be used for evaluating athletes aged 13 years and older. For children aged 12 years or younger, please use the Child SCAT5.

Preseason SCAT5 baseline testing can be useful for interpreting post-injury test scores, but is not required for that purpose. Detailed instructions for use of the SCAT5 are provided on page 7. Please read through these instructions carefully before testing the athlete. Brief verbal instructions for each test are given in italics. The only equipment required for the tester is a watch or timer.

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Recognise and Remove

A head impact by either a direct blow or indirect transmission of force can be associated with a serious and potentially fatal brain injury. If there are significant concerns, including any of the red flags listed in Box 1, then activation of emergency procedures and urgent transport to the nearest hospital should be arranged.

Key points

- Any athlete with suspected concussion should be REMOVED FROM PLAY, medically assessed and monitored for deterioration. No athlete diagnosed with concussion should be returned to play on the day of injury.
- If an athlete is suspected of having a concussion and medical personnel are not immediately available, the athlete should be referred to a medical facility for urgent assessment.
- Athletes with suspected concussion should not drink alcohol, use recreational drugs and should not drive a motor vehicle until cleared to do so by a medical professional.
- Concussion signs and symptoms evolve over time and it is important to consider repeat evaluation in the assessment of concussion.
- The diagnosis of a concussion is a clinical judgment, made by a medical professional. The SCAT5 should NOT be used by itself to make, or exclude, the diagnosis of concussion. An athlete may have a concussion even if their SCAT5 is “normal”.

Remember:

- The basic principles of first aid (danger, response, airway, breathing, circulation) should be followed.
- Do not attempt to move the athlete (other than that required for airway management) unless trained to do so.
- Assessment for a spinal cord injury is a critical part of the initial on-field assessment.
- Do not remove a helmet or any other equipment unless trained to do so safely.

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Sport concussion assessment tool - 5th edition. Br J Sports Med 2017;51:851-858.

1

IMMEDIATE OR ON-FIELD ASSESSMENT

The following elements should be assessed for all athletes who are suspected of having a concussion prior to proceeding to the neurocognitive assessment and ideally should be done on-field after the first first aid / emergency care priorities are completed.

If any of the "Red Flags" or observable signs are noted after a direct or indirect blow to the head, the athlete should be immediately and safely removed from participation and evaluated by a physician or licensed healthcare professional.

Consideration of transportation to a medical facility should be at the discretion of the physician or licensed healthcare professional.

The GCS is important as a standard measure for all patients and can be done serially if necessary in the event of deterioration in conscious state. The Maddocks questions and cervical spine exam are critical steps of the immediate assessment; however, these do not need to be done serially.

STEP 1: RED FLAGS

RED FLAGS:

- Neck pain or tenderness
- Double vision
- Weakness or tingling/burning in arms or legs
- Severe or increasing headache
- Seizure or convulsion
- Loss of consciousness
- Deteriorating conscious state
- Vomiting
- Increasingly restless, agitated or combative

STEP 2: OBSERVABLE SIGNS

Witnessed Observed on Video

	Y	N
Lying motionless on the playing surface	Y	N
Balance / gait difficulties / motor incoordination: stumbling, slow / laboured movements	Y	N
Disorientation or confusion, or an inability to respond appropriately to questions	Y	N
Blank or vacant look	Y	N
Facial injury after head trauma	Y	N

STEP 3: MEMORY ASSESSMENT MADDOCKS QUESTIONS²

"I am going to ask you a few questions, please listen carefully and give your best effort. First, tell me what happened?"

Mark Y for correct answer / N for incorrect

	Y	N
What venue are we at today?	Y	N
Which half is it now?	Y	N
Who scored last in this match?	Y	N
What team did you play last week / game?	Y	N
Did your team win the last game?	Y	N

Note: Appropriate sport-specific questions may be substituted.

Name: _____
 DOB: _____
 Address: _____
 ID number: _____
 Examiner: _____
 Date: _____

STEP 4: EXAMINATION GLASGOW COMA SCALE (GCS)³

Time of assessment			
Date of assessment			

Best eye response (E)

No eye opening	1	1	1
Eye opening in response to pain	2	2	2
Eye opening to speech	3	3	3
Eyes opening spontaneously	4	4	4

Best verbal response (V)

No verbal response	1	1	1
Incomprehensible sounds	2	2	2
Inappropriate words	3	3	3
Confused	4	4	4
Oriented	5	5	5

Best motor response (M)

No motor response	1	1	1
Extension to pain	2	2	2
Abnormal flexion to pain	3	3	3
Flexion / Withdrawal to pain	4	4	4
Localizes to pain	5	5	5
Obeys commands	6	6	6
Glasgow Coma score (E + V + M)			

CERVICAL SPINE ASSESSMENT

Does the athlete report that their neck is pain free at rest?	Y	N
If there is NO neck pain at rest , does the athlete have a full range of ACTIVE pain free movement?	Y	N
Is the limb strength and sensation normal?	Y	N

In a patient who is not lucid or fully conscious, a cervical spine injury should be assumed until proven otherwise.

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OFFICE OR OFF-FIELD ASSESSMENT

Please note that the neurocognitive assessment should be done in a distraction-free environment with the athlete in a resting state.

STEP 1: ATHLETE BACKGROUND

Sport / team / school: _____

Date / time of injury: _____

Years of education completed: _____

Age: _____

Gender: M / F / Other

Dominant hand: left / neither / right

How many diagnosed concussions has the athlete had in the past?: _____

When was the most recent concussion?: _____

How long was the recovery (time to being cleared to play) from the most recent concussion?: _____ (days)

Has the athlete ever been:

	Yes	No
Hospitalized for a head injury?	Yes	No
Diagnosed / treated for headache disorder or migraines?	Yes	No
Diagnosed with a learning disability / dyslexia?	Yes	No
Diagnosed with ADD / ADHD?	Yes	No
Diagnosed with depression, anxiety or other psychiatric disorder?	Yes	No

Current medications? If yes, please list:

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

2

STEP 2: SYMPTOM EVALUATION

The athlete should be given the symptom form and asked to read this instruction paragraph out loud then complete the symptom scale. For the baseline assessment, the athlete should rate his/her symptoms based on how he/she typically feels and for the post injury assessment the athlete should rate their symptoms at this point in time.

Please Check: Baseline Post-Injury

Please hand the form to the athlete

	none	mild	moderate	severe			
Headache	0	1	2	3	4	5	6
"Pressure in head"	0	1	2	3	4	5	6
Neck Pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like "in a fog"	0	1	2	3	4	5	6
"Don't feel right"	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6
Confusion	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervous or Anxious	0	1	2	3	4	5	6
Trouble falling asleep (if applicable)	0	1	2	3	4	5	6

Total number of symptoms: _____ of 22

Symptom severity score: _____ of 132

Do your symptoms get worse with physical activity? Y N

Do your symptoms get worse with mental activity? Y N

If 100% is feeling perfectly normal, what percent of normal do you feel?

If not 100%, why?

Please hand form back to examiner

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3

STEP 3: COGNITIVE SCREENING

Standardised Assessment of Concussion (SAC)⁴

ORIENTATION

What month is it?	0	1
What is the date today?	0	1
What is the day of the week?	0	1
What year is it?	0	1
What time is it right now? (within 1 hour)	0	1
Orientation score	of 5	

IMMEDIATE MEMORY

The Immediate Memory component can be completed using the traditional 5-word per trial list or optionally using 10-words per trial to minimise any ceiling effect. All 3 trials must be administered irrespective of the number correct on the first trial. Administer at the rate of one word per second.

Please choose EITHER the 5 or 10 word list groups and circle the specific word list chosen for this test.

I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order. For Trials 2 & 3: I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before.

List	Alternate 5 word lists					Score (of 5)		
						Trial 1	Trial 2	Trial 3
A	Finger	Penny	Blanket	Lemon	Insect			
B	Candle	Paper	Sugar	Sandwich	Wagon			
C	Baby	Monkey	Perfume	Sunset	Iron			
D	Elbow	Apple	Carpet	Saddle	Bubble			
E	Jacket	Arrow	Pepper	Cotton	Movie			
F	Dollar	Honey	Mirror	Saddle	Anchor			
Immediate Memory Score						of 15		
Time that last trial was completed								

List	Alternate 10 word lists					Score (of 10)		
						Trial 1	Trial 2	Trial 3
G	Finger	Penny	Blanket	Lemon	Insect			
	Candle	Paper	Sugar	Sandwich	Wagon			
H	Baby	Monkey	Perfume	Sunset	Iron			
	Elbow	Apple	Carpet	Saddle	Bubble			
I	Jacket	Arrow	Pepper	Cotton	Movie			
	Dollar	Honey	Mirror	Saddle	Anchor			
Immediate Memory Score						of 30		
Time that last trial was completed								

Name: _____
 DOB: _____
 Address: _____
 ID number: _____
 Examiner: _____
 Date: _____

CONCENTRATION

DIGITS BACKWARDS

Please circle the Digit list chosen (A, B, C, D, E, F). Administer at the rate of one digit per second reading DOWN the selected column.

I am going to read a string of numbers and when I am done, you repeat them back to me in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7.

Concentration Number Lists (circle one)					
List A	List B	List C			
4-9-3	5-2-6	1-4-2	Y	N	0
6-2-9	4-1-5	6-5-8	Y	N	1
3-8-1-4	1-7-9-5	6-8-3-1	Y	N	0
3-2-7-9	4-9-6-8	3-4-8-1	Y	N	1
6-2-9-7-1	4-8-5-2-7	4-9-1-5-3	Y	N	0
1-5-2-8-6	6-1-8-4-3	6-8-2-5-1	Y	N	1
7-1-8-4-6-2	8-3-1-9-6-4	3-7-6-5-1-9	Y	N	0
5-3-9-1-4-8	7-2-4-8-5-6	9-2-6-5-1-4	Y	N	1
List D	List E	List F			
7-8-2	3-8-2	2-7-1	Y	N	0
9-2-6	5-1-8	4-7-9	Y	N	1
4-1-8-3	2-7-9-3	1-6-8-3	Y	N	0
9-7-2-3	2-1-6-9	3-9-2-4	Y	N	1
1-7-9-2-6	4-1-8-6-9	2-4-7-5-8	Y	N	0
4-1-7-5-2	9-4-1-7-5	8-3-9-6-4	Y	N	1
2-6-4-8-1-7	6-9-7-3-8-2	5-8-6-2-4-9	Y	N	0
8-4-1-9-3-5	4-2-7-9-3-8	3-1-7-8-2-6	Y	N	1
Digits Score: of 4					

MONTHS IN REVERSE ORDER

Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November. Go ahead.

Dec - Nov - Oct - Sept - Aug - Jul - Jun - May - Apr - Mar - Feb - Jan	0	1
Months Score	of 1	
Concentration Total Score (Digits + Months)	of 5	

4

STEP 4: NEUROLOGICAL SCREEN

See the instruction sheet (page 7) for details of test administration and scoring of the tests.

Can the patient read aloud (e.g. symptom check-list) and follow instructions without difficulty?	Y	N
Does the patient have a full range of pain-free PASSIVE cervical spine movement?	Y	N
Without moving their head or neck, can the patient look side-to-side and up-and-down without double vision?	Y	N
Can the patient perform the finger nose coordination test normally?	Y	N
Can the patient perform tandem gait normally?	Y	N

BALANCE EXAMINATION

Modified Balance Error Scoring System (mBESS) testing⁵

Which foot was tested (i.e. which is the non-dominant foot) Left Right

Testing surface (hard floor, field, etc.) _____

Footwear (shoes, barefoot, braces, tape, etc.) _____

Condition	Errors
Double leg stance	of 10
Single leg stance (non-dominant foot)	of 10
Tandem stance (non-dominant foot at the back)	of 10
Total Errors	of 30

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

5

STEP 5: DELAYED RECALL:

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section. Score 1 pt. for each correct response.

Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order.

Time Started

Please record each word correctly recalled. Total score equals number of words recalled.

Total number of words recalled accurately: of 5 or of 10

6

STEP 6: DECISION

Domain	Date & time of assessment:		
Symptom number (of 22)			
Symptom severity score (of 132)			
Orientation (of 5)			
Immediate memory	of 15 of 30	of 15 of 30	of 15 of 30
Concentration (of 5)			
Neuro exam	Normal Abnormal	Normal Abnormal	Normal Abnormal
Balance errors (of 30)			
Delayed Recall	of 5 of 10	of 5 of 10	of 5 of 10

Date and time of injury: _____

If the athlete is known to you prior to their injury, are they different from their usual self?
 Yes No Unsure Not Applicable
 (If different, describe why in the clinical notes section)

Concussion Diagnosed?
 Yes No Unsure Not Applicable

If re-testing, has the athlete improved?
 Yes No Unsure Not Applicable

I am a physician or licensed healthcare professional and I have personally administered or supervised the administration of this SCAT5.

Signature: _____

Name: _____

Title: _____

Registration number (if applicable): _____

Date: _____

SCORING ON THE SCAT5 SHOULD NOT BE USED AS A STAND-ALONE METHOD TO DIAGNOSE CONCUSSION, MEASURE RECOVERY OR MAKE DECISIONS ABOUT AN ATHLETE'S READINESS TO RETURN TO COMPETITION AFTER CONCUSSION.

INSTRUCTIONS

Words in *Italics* throughout the SCAT5 are the instructions given to the athlete by the clinician

Symptom Scale

The time frame for symptoms should be based on the type of test being administered. At baseline it is advantageous to assess how an athlete “typically” feels whereas during the acute/post-acute stage it is best to ask how the athlete feels at the time of testing.

The symptom scale should be completed by the athlete, not by the examiner. In situations where the symptom scale is being completed after exercise, it should be done in a resting state, generally by approximating his/her resting heart rate.

For total number of symptoms, maximum possible is 22 except immediately post injury, if sleep item is omitted, which then creates a maximum of 21.

For Symptom severity score, add all scores in table, maximum possible is 22 x 6 = 132, except immediately post injury if sleep item is omitted, which then creates a maximum of 21x6=126.

Immediate Memory

The Immediate Memory component can be completed using the traditional 5-word per trial list or, optionally, using 10-words per trial. The literature suggests that the Immediate Memory has a notable ceiling effect when a 5-word list is used. In settings where this ceiling is prominent, the examiner may wish to make the task more difficult by incorporating two 5-word groups for a total of 10 words per trial. In this case, the maximum score per trial is 10 with a total trial maximum of 30.

Choose one of the word lists (either 5 or 10). Then perform 3 trials of immediate memory using this list.

Complete all 3 trials regardless of score on previous trials.

“I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order.” The words must be read at a rate of one word per second.

Trials 2 & 3 MUST be completed regardless of score on trial 1 & 2.

Trials 2 & 3:

“I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before.”

Score 1 pt. for each correct response. Total score equals sum across all 3 trials. Do NOT inform the athlete that delayed recall will be tested.

Concentration

Digits backward

Choose one column of digits from lists A, B, C, D, E or F and administer those digits as follows:

Say: *“I am going to read a string of numbers and when I am done, you repeat them back to me in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7.”*

Begin with first 3 digit string.

If correct, circle “Y” for correct and go to next string length. If incorrect, circle “N” for the first string length and read trial 2 in the same string length. One point possible for each string length. Stop after incorrect on both trials (2 N’s) in a string length. The digits should be read at the rate of one per second.

Months in reverse order

“Now tell me the months of the year in reverse order. Start with the last month and go backward. So you’ll say December, November ... Go ahead”

1 pt. for entire sequence correct

Delayed Recall

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section.

“Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order.”

Score 1 pt. for each correct response

Modified Balance Error Scoring System (mBESS)⁵ testing

This balance testing is based on a modified version of the Balance Error Scoring System (BESS)⁵. A timing device is required for this testing.

Each of 20-second trial/stance is scored by counting the number of errors. The examiner will begin counting errors only after the athlete has assumed the proper start position. The modified BESS is calculated by adding one error point for each error during the three 20-second tests. The maximum number of errors for any single condition is 10. If the athlete commits multiple errors simultaneously, only

one error is recorded but the athlete should quickly return to the testing position, and counting should resume once the athlete is set. Athletes that are unable to maintain the testing procedure for a minimum of five seconds at the start are assigned the highest possible score, ten, for that testing condition.

OPTION: For further assessment, the same 3 stances can be performed on a surface of medium density foam (e.g., approximately 50cm x 40cm x 6cm).

Balance testing – types of errors

- | | | |
|---------------------------------|---|---|
| 1. Hands lifted off iliac crest | 3. Step, stumble, or fall | 5. Lifting forefoot or heel |
| 2. Opening eyes | 4. Moving hip into > 30 degrees abduction | 6. Remaining out of test position > 5 sec |

“I am now going to test your balance. Please take your shoes off (if applicable), roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable). This test will consist of three twenty second tests with different stances.”

(a) Double leg stance:

“The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes.”

(b) Single leg stance:

“If you were to kick a ball, which foot would you use? [This will be the dominant foot] Now stand on your non-dominant foot. The dominant leg should be held in approximately 30 degrees of hip flexion and 45 degrees of knee flexion. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes.”

(c) Tandem stance:

“Now stand heel-to-toe with your non-dominant foot in back. Your weight should be evenly distributed across both feet. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes.”

Tandem Gait

Participants are instructed to stand with their feet together behind a starting line (the test is best done with footwear removed). Then, they walk in a forward direction as quickly and as accurately as possible along a 38mm wide (sports tape), 3 metre line with an alternate foot heel-to-toe gait ensuring that they approximate their heel and toe on each step. Once they cross the end of the 3m line, they turn 180 degrees and return to the starting point using the same gait. Athletes fail the test if they step off the line, have a separation between their heel and toe, or if they touch or grab the examiner or an object.

Finger to Nose

“I am going to test your coordination now. Please sit comfortably on the chair with your eyes open and your arm (either right or left) outstretched (shoulder flexed to 90 degrees and elbow and fingers extended), pointing in front of you. When I give a start signal, I would like you to perform five successive finger to nose repetitions using your index finger to touch the tip of the nose, and then return to the starting position, as quickly and as accurately as possible.”

References

1. McCrory et al. Consensus Statement On Concussion In Sport – The 5th International Conference On Concussion In Sport Held In Berlin, October 2016. British Journal of Sports Medicine 2017 (available at www.bjsm.bmj.com)
2. Maddocks, DL; Dicker, GD; Saling, MM. The assessment of orientation following concussion in athletes. Clinical Journal of Sport Medicine 1995; 5: 32-33
3. Jennett, B., Bond, M. Assessment of outcome after severe brain damage: a practical scale. Lancet 1975; i: 480-484
4. McCreary M. Standardized mental status testing of acute concussion. Clinical Journal of Sport Medicine. 2001; 11: 176-181
5. Guskiewicz KM. Assessment of postural stability following sport-related concussion. Current Sports Medicine Reports. 2003; 2: 24-30

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CONCUSSION INFORMATION

Any athlete suspected of having a concussion should be removed from play and seek medical evaluation.

Signs to watch for

Problems could arise over the first 24-48 hours. The athlete should not be left alone and must go to a hospital at once if they experience:

- Worsening headache
- Drowsiness or inability to be awakened
- Inability to recognize people or places
- Repeated vomiting
- Unusual behaviour or confusion or irritable
- Seizures (arms and legs jerk uncontrollably)
- Weakness or numbness in arms or legs
- Unsteadiness on their feet.
- Slurred speech

Consult your physician or licensed healthcare professional after a suspected concussion. Remember, it is better to be safe.

Rest & Rehabilitation

After a concussion, the athlete should have physical rest and relative cognitive rest for a few days to allow their symptoms to improve. In most cases, after no more than a few days of rest, the athlete should gradually increase their daily activity level as long as their symptoms do not worsen. Once the athlete is able to complete their usual daily activities without concussion-related symptoms, the second step of the return to play/sport progression can be started. The athlete should not return to play/sport until their concussion-related symptoms have resolved and the athlete has successfully returned to full school/learning activities.

When returning to play/sport, the athlete should follow a stepwise, **medically managed exercise progression, with increasing amounts of exercise.** For example:

Graduated Return to Sport Strategy

Exercise step	Functional exercise at each step	Goal of each step
1. Symptom-limited activity	Daily activities that do not provoke symptoms.	Gradual reintroduction of work/school activities.
2. Light aerobic exercise	Walking or stationary cycling at slow to medium pace. No resistance training.	Increase heart rate.
3. Sport-specific exercise	Running or skating drills. No head impact activities.	Add movement.
4. Non-contact training drills	Harder training drills, e.g., passing drills. May start progressive resistance training.	Exercise, coordination, and increased thinking.
5. Full contact practice	Following medical clearance, participate in normal training activities.	Restore confidence and assess functional skills by coaching staff.
6. Return to play/sport	Normal game play.	

In this example, it would be typical to have 24 hours (or longer) for each step of the progression. If any symptoms worsen while exercising, the athlete should go back to the previous step. Resistance training should be added only in the later stages (Stage 3 or 4 at the earliest).

Written clearance should be provided by a healthcare professional before return to play/sport as directed by local laws and regulations.

Graduated Return to School Strategy

Concussion may affect the ability to learn at school. The athlete may need to miss a few days of school after a concussion. When going back to school, some athletes may need to go back gradually and may need to have some changes made to their schedule so that concussion symptoms do not get worse. If a particular activity makes symptoms worse, then the athlete should stop that activity and rest until symptoms get better. To make sure that the athlete can get back to school without problems, it is important that the healthcare provider, parents, caregivers and teachers talk to each other so that everyone knows what the plan is for the athlete to go back to school.

Note: If mental activity does not cause any symptoms, the athlete may be able to skip step 2 and return to school part-time before doing school activities at home first.

Mental Activity	Activity at each step	Goal of each step
1. Daily activities that do not give the athlete symptoms	Typical activities that the athlete does during the day as long as they do not increase symptoms (e.g. reading, texting, screen time). Start with 5-15 minutes at a time and gradually build up.	Gradual return to typical activities.
2. School activities	Homework, reading or other cognitive activities outside of the classroom.	Increase tolerance to cognitive work.
3. Return to school part-time	Gradual introduction of school-work. May need to start with a partial school day or with increased breaks during the day.	Increase academic activities.
4. Return to school full-time	Gradually progress school activities until a full day can be tolerated.	Return to full academic activities and catch up on missed work.

If the athlete continues to have symptoms with mental activity, some other accommodations that can help with return to school may include:

- Starting school later, only going for half days, or going only to certain classes
- More time to finish assignments/tests
- Quiet room to finish assignments/tests
- Not going to noisy areas like the cafeteria, assembly halls, sporting events, music class, shop class, etc.
- Taking lots of breaks during class, homework, tests
- No more than one exam/day
- Shorter assignments
- Repetition/memory cues
- Use of a student helper/tutor
- Reassurance from teachers that the child will be supported while getting better

The athlete should not go back to sports until they are back to school/learning, without symptoms getting significantly worse and no longer needing any changes to their schedule.

Appendix 3.2

Concussion Recognition Tool 5

CONCUSSION RECOGNITION TOOL 5 ©

To help identify concussion in children, adolescents and adults



RECOGNISE & REMOVE

Head impacts can be associated with serious and potentially fatal brain injuries. The Concussion Recognition Tool 5 (CRT5) is to be used for the identification of suspected concussion. It is not designed to diagnose concussion.

STEP 1: RED FLAGS – CALL AN AMBULANCE

If there is concern after an injury including whether ANY of the following signs are observed or complaints are reported then the player should be safely and immediately removed from play/game/activity. If no licensed healthcare professional is available, call an ambulance for urgent medical assessment:

- Neck pain or tenderness
- Double vision
- Weakness or tingling/ burning in arms or legs
- Severe or increasing headache
- Seizure or convulsion
- Loss of consciousness
- Deteriorating conscious state
- Vomiting
- Increasingly restless, agitated or combative

Remember:

- In all cases, the basic principles of first aid (danger, response, airway, breathing, circulation) should be followed.
- Assessment for a spinal cord injury is critical.
- Do not attempt to move the player (other than required for airway support) unless trained to do so.
- Do not remove a helmet or any other equipment unless trained to do so safely.

If there are no Red Flags, identification of possible concussion should proceed to the following steps:

STEP 2: OBSERVABLE SIGNS

Visual clues that suggest possible concussion include:

- Lying motionless on the playing surface
- Slow to get up after a direct or indirect hit to the head
- Disorientation or confusion, or an inability to respond appropriately to questions
- Balance, gait difficulties, motor incoordination, stumbling, slow laboured movements
- Blank or vacant look
- Facial injury after head trauma

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STEP 3: SYMPTOMS

- Headache
- "Pressure in head"
- Balance problems
- Nausea or vomiting
- Drowsiness
- Dizziness
- Blurred vision
- Sensitivity to light
- Sensitivity to noise
- Fatigue or low energy
- "Don't feel right"
- More emotional
- More irritable
- Sadness
- Nervous or anxious
- Neck Pain
- Difficulty concentrating
- Difficulty remembering
- Feeling slowed down
- Feeling like "in a fog"

STEP 4: MEMORY ASSESSMENT

(IN ATHLETES OLDER THAN 12 YEARS)

- Failure to answer any of these questions (modified appropriately for each sport) correctly may suggest a concussion:
- "What venue are we at today?"
 - "Which half is it now?"
 - "Who scored last in this game?"
 - "What team did you play last week / game?"
 - "Did your team win the last game?"

Athletes with suspected concussion should:

- Not be left alone initially (at least for the first 1-2 hours).
- Not drink alcohol.
- Not use recreational/ prescription drugs.
- Not be sent home by themselves. They need to be with a responsible adult.
- Not drive a motor vehicle until cleared to do so by a healthcare professional.

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ANY ATHLETE WITH A SUSPECTED CONCUSSION SHOULD BE IMMEDIATELY REMOVED FROM PRACTICE OR PLAY AND SHOULD NOT RETURN TO ACTIVITY UNTIL ASSESSED MEDICALLY, EVEN IF THE SYMPTOMS RESOLVE

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Appendix 3.3

Buffalo Concussion Treadmill Test (BCTT)

BUFFALO CONCUSSION TREADMILL TEST (BCTT) – INSTRUCTION MANUAL

Purpose

- To investigate exercise tolerance in patients with post-concussive symptoms (PCS) lasting more than 3 weeks.
- To help establish appropriate levels of exercise to aid in Return to Play for concussed athletes and assist in treatment protocols.
- To aid in differentiating between possible diagnoses for concussive symptoms (Cervicogenic injury, PCS, etc.) and etiology of the concussion.
- To identify physiological variables associated with exacerbation of symptoms, and the patient's level of recovery.

Eligibility

- Before beginning the BCTT, participants should be evaluated for medical and physical ability to exercise. Considerations may include (but are not limited to): cardiovascular illness, respiratory dysfunction, serious vestibular/balance problems, motor dysfunction, and certain orthopedic injuries.
- Do not follow the BCTT if the patient is experiencing such cervical dysfunction that the test could cause considerable pain or harm, is experiencing severe vestibular/balance issues that would impair walking on a treadmill, has a history of unstable cardiac or respiratory disease, or has a lower extremity or spinal orthopedic pathology that compromises safe walking
- The BCTT is not recommended for patients scoring higher than 7/10 for symptom severity.

Absolute
<ul style="list-style-type: none">• Acute myocardial infarction (within 2 d)• High-risk unstable angina*• Uncontrolled cardiac arrhythmias causing symptoms or hemodynamic compromise• Symptomatic severe aortic stenosis• Uncontrolled symptomatic heart failure• Acute pulmonary embolus or pulmonary infarction• Acute myocarditis or pericarditis• Acute aortic dissection
Relative†
<ul style="list-style-type: none">• Left main coronary stenosis• Moderate stenotic valvular heart disease• Electrolyte abnormalities• Severe arterial hypertension‡• Tachyarrhythmias or bradyarrhythmias• Hypertrophic cardiomyopathy and other forms of outflow tract obstruction• Mental or physical impairment leading to inability to exercise adequately• High-degree atrioventricular block
<small>*ACC/AHA Guidelines for the Management of Patients With Unstable Angina/Non-ST-Segment Elevation Myocardial Infarction (350) (see Table 17).</small>
<small>†Relative contraindications can be superseded if the benefits of exercise outweigh the risks.</small>
<small>‡In the absence of definitive evidence, the committee suggests systolic blood pressure of >200 mm Hg and/or diastolic blood pressure of >110 mm Hg. Modified from Fletcher et al.⁷</small>

Safety Considerations

- On testing, participants must be dressed for exercise (comfortable clothing, running shoes), wearing any vision or hearing aids (glasses, etc.), and should be hydrated and well rested.
- It is suggested that two persons assist in conducting the BCTT, in order to assure safety of the participant, with one individual positioned behind the participant (at back of the treadmill) at all times

while test is in progress. It is also recommended that one or more persons with CPR training are present during testing.

- It is important to engage in casual conversation with the patient during the exercise test to assess his/her confidence level as well as any changes in cognitive and communicative functioning. As exercise intensifies, note if patient seems to have difficulty communicating, looks suddenly pale or withdrawn, or otherwise appears to be masking serious discomfort.
- Be aware of postural and structural changes (slouching, rounding the back, leaning head) - noting the patient's thoracic and cervical posture can offer clues on the etiology of the injury.

Preparation

Equipment Requirements

- Treadmill with capacity to reach 15 degrees of elevation
Note: Test can be adapted for treadmills which can reach a minimum of 12 degrees elevation
- Heart rate monitor (Polar brand recommended)
- Borg RPE Scale (Rating of Perceived Exertion) and Concussion Symptom Severity Scale (Likert scale) – *See form attached*
- Test Results form for monitoring heart rate, changes in RPE and symptoms, and relevant observations – *See form attached*
- Chair, water and towel for participant recovery after exercise

Setup

- Attach heart rate monitoring device according to manufacturer's instructions
- Post RPE and Symptom scales within comfortable viewing distance of participant while on treadmill (it is suggested that participant should **not** have to turn head to view scales)

Test Protocol

Starting the Test

1. Inform participant about test procedures and what to expect during the BCTT.
2. Explain and demonstrate the RPE and Likert scales and obtain resting scores. Remind participant that he/she will be asked to rate exertion and symptom severity at each minute during exercise. The RPE scale is a measure of perceived physical activity, and can be explained to participants as a measure of "how hard you feel like your body is working". The scale's numbers (6-20) and descriptors should be pointed out. The Likert symptom scale is a measure of symptom severity ("how good/bad your symptoms are making you feel right now"), and should be distinguished as being distinct from RPE. The scale's numbers (1-10) and pictures (expressions of physical pain) should be pointed out.
3. Patient should begin by standing on the ends of the treadmill while the treadmill is turned on. The experimenter should set treadmill at a speed of **3.6mph** for patients over 5'5", and **3.2mph** for those 5'5" and under. Starting incline is **0 degrees**. Speed can be adjusted depending on athletic status or overall comfort of treadmill speed – patients should be moving at a brisk walking pace.
4. After one minute at this pace, treadmill incline is increased to 1 degree. Participant is asked to rate RPE and symptom severity. Subjective scores and heart rate (bpm) are recorded. This procedure is repeated each minute, with ratings and heart rate being recorded, and treadmill increasing in incline at a rate of 1 degree/minute. Changes to Likert rating should be specifically clarified/noted (for example, if the rating moves from 2 to 3, it should be clarified if this reflects the addition of a new symptom, increased severity of an existing symptom, etc.). Experimenter should also record general observations as the test progresses.
5. Once treadmill reaches maximum incline (15 degrees or 12 degrees in modified test), speed is increased by **0.4mph** each minute in lieu of increased incline.

6. Once test is terminated (see below), speed is reduced to 2.5mph and incline reduced safety back to 0 for a 2 minute cool-down (if participant is safe to continue). During this time, Likert ratings should continue to be reported each minute.

Terminating the Test

Test continues until:

- Maximum exertion (RPE score of 19.5) is reported **or**
- Test is terminated by experimenter due to a symptom exacerbation that causes significant increase in pain or symptom severity (an increase of more than 3 points on the Likert scale from resting score, addition of several new symptoms, or marked increase in severity of symptoms resulting in difficulty continuing test) **or**
- Experimenter notes a rapid progression of complaints (ex. headache to searing focal pain) between symptom reports, patient appears faint or unsteady, or determines that continuing the test constitutes significant health risk for the participant, **or**
- Patient reports an inability to continue the test safely

Outcomes

Diagnosis

- The BCTT can be used in conjunction with balanced error scoring, cervical proprioceptive screening, manual assessment and soft tissue palpation to determine the presence/absence of post-concussion syndrome or cervical/thoracic injuries.

Patients who have symptoms, but do not have a physiologic threshold (can exercise to max) should be evaluated for dysfunction of the cervical spine, vestibular system or temporomandibular region.

Treatment/Return to Play

- On completion of the BCTT, concussion patients may be given an exercise prescription based on 80% of the maximum heart rate reached **without** symptom exacerbation. Patients are instructed to exercise at this level for 20 minutes daily without exceeding the time, or heart rate constraints.

Patients may increase heart rate by swimming, walking or stationary cycling - the athlete should not attempt resistance training.

If any post-concussion symptoms return along the progression, the athlete must return to the previous asymptomatic stage/maximum heart rate.

- If the patient can exercise to voluntary exhaustion on the BCTT without eliciting symptoms, you may begin the process of returning him/her to play by following the fivestep return to play program of the Zurich Consensus Statement.
- Other prescriptions and recommendations will be based on the patient's particular complaints. A patient may be recommended for cervical physical therapy, vestibular physical therapy, infusion therapy or treatment for temporomandibular joint disorders

Appendix 3.4

Core Components to Include in the Neurologic and Musculoskeletal Exam

Physical

- Examine the site(s) of Injury

Cervical Spine

- Range of motion
- Focal areas of tenderness
- Spasm
- Hypertonicity

Temporomandibular Joint

- Range of opening
- Tenderness
- Dislocation

Cognitive

- Cognition
- Language

Vision

- Acuity
- Tracking
- Saccades
- Nystagmus
- Vergence
- Diplopia
- Pupil symmetry and reactivity
- Visual fields to confrontation
- No optic edema

Auditory

- Hearing Screen
- Otoscopic Exam

Sensory

- Sharp
- Light touch
- Proprioception
- No extinction to bilateral tactile stimuli
- Vibration

Motor

- Power
- Pronator drift
- Asymmetrical weakness
- Symmetry of reflexes
- Coordination

Vestibular

- Head Impulse
- Head Shake
- Vestibular Ocular Reflex Suppression (VORS)
- Dynamic Visual Acuity (DVA)
- Positional testing

Functional Activities

- Romberg with eyes open/closed
- Single leg stance

Gait

- Walking
- Tandem walking
- Turning

If any focal abnormalities are observed, refer for appropriate imaging and to an appropriate specialist.

Links for Neck & Neurological Exam Video Demonstrations

<http://www.youtube.com/watch?v=iuegN6P2SAA> (Neck Exam)

<http://www.youtube.com/watch?v=QirMbworS10> (Neck Exam)

<http://www.youtube.com/watch?v=fgwN1P5PDaA> (Neurological Exam)

Appendix 4.1

ICD-10 Definitions for Differential Diagnoses Related to mTBI

<p>Depressive Episode (F32)</p>	<p>In typical mild, moderate, or severe depressive episodes, the patient suffers from lowering of mood, reduction of energy, and decrease in activity. Capacity for enjoyment, interest and concentration is reduced, and marked tiredness after even minimum effort is common. Sleep is usually disturbed and appetite diminished. Self-esteem and self-confidence are almost always reduced and, even in the mild form, some ideas of guilt and worthlessness are often present. The lowered mood varies little from day to day, is unresponsive to circumstances and may be accompanied by so-called “somatic” symptoms, such as loss of interest and pleasurable feelings, waking in the morning several hours before the usual time, depression worst in the morning, marked psychomotor retardation, agitation, loss of appetite, weight loss, and loss of libido. Depending upon the number and severity of symptoms, a depressive episode may be specified as mild, moderate or severe.</p> <p><i>Includes:</i> Single episodes of:</p> <ul style="list-style-type: none"> • Depressive reaction • Psychogenic depression • Reactive depression <p><i>Excludes:</i></p> <ul style="list-style-type: none"> • Adjustment disorder • Recurrent depressive disorder • When associated with conduct
<p>Organic Anxiety Disorder (F06.4)</p>	<p>A disorder characterized by the essential descriptive features of a generalized anxiety disorder (see below), a panic disorder (see below), or a combination of both, but arising as a consequence of an organic disorder.</p> <p><i>Excludes:</i> Anxiety disorders, nonorganic or unspecified</p>
<p>Generalized Anxiety Disorder (F41.1)</p>	<p>Anxiety that is generalized and persistent but not restricted to, or even strongly predominating in, any particular environmental circumstances (i.e., it is “free-floating”). The dominant symptoms are variable but include complaints of persistent nervousness, trembling, muscular tensions, sweating, lightheadedness, palpitations, dizziness, and epigastric discomfort. Fears that the patient or a relative will shortly become ill or have an accident are often expressed.</p> <p><i>Anxiety</i> (Neurosis, Reaction, State)</p> <p><i>Excludes:</i> Neurasthenia</p>
<p>Panic Disorder (F41.0)</p>	<p>The essential feature is recurrent attacks of severe anxiety (panic), which are not restricted to any particular situation or set of circumstances and are therefore unpredictable. As with other anxiety disorders, the dominant symptoms include sudden onset of palpitations, chest pain, choking sensations, dizziness, and feelings of unreality (depersonalization or derealization). There is often also a secondary fear of dying, losing control, or going mad. Panic disorder should not be given as the main diagnosis if the patient has a depressive disorder at the time the attacks start; in these circumstances the panic attacks are probably secondary to depression.</p> <p><i>Panic</i> (Attack, State)</p> <p><i>Excludes:</i> Panic with agoraphobia</p>
<p>Post Traumatic Stress Disorder (F43.1)</p>	<p>Arises as a delayed or protracted response to a stressful event or situation (of either brief or long duration) of an exceptionally threatening or catastrophic nature, which is likely to cause pervasive distress in almost anyone. Predisposing factors, such as personality traits (e.g., compulsive, asthenic) or previous history of neurotic illness, may lower the threshold for the development of the syndrome or aggravate its course, but they are neither necessary nor sufficient to explain its occurrence. Typical features include episodes of repeated reliving of the trauma in intrusive memories (“flashbacks”), dreams or nightmares, occurring against the persisting background of a sense of “numbness” and emotional blunting, detachment from other people, unresponsiveness to surroundings, anhedonia, and avoidance of activities and situations reminiscent of the trauma. There is usually a state of autonomic hyperarousal with hypervigilance, an enhanced startle reaction, and insomnia. Anxiety and depression are commonly associated with the above symptoms and signs, and suicidal ideation is not infrequent. The onset follows the trauma with a latency period that may range from a few weeks to months. The course is fluctuating but recovery can be expected in the majority of cases. In a small proportion of cases the condition may follow a chronic course over many years, with eventual transition to an enduring personality change.</p>

<p>Persistent Somatoform Pain Disorder (F45.4)</p>	<p>The predominant complaint is of persistent, severe, and distressing pain, which cannot be explained fully by a physiological process or a physical disorder, and which occurs in association with emotional conflict or psychosocial problems that are sufficient to allow the conclusion that they are the main causative influences. The result is usually a marked increase in support and attention, either personal or medical. Pain presumed to be of psychogenic origin occurring during the course of depressive disorders or schizophrenia should not be included here.</p> <p>Psychalgia; Psychogenic (Backache, Headache); Somatoform pain disorder</p> <p><i>Excludes:</i></p> <ul style="list-style-type: none"> • Backache NOS • Pain (NOS, Acute, Chronic, Intractable) • Tension headache
<p>Whiplash Associated Disorder (S13.4)</p>	<p>Sprain and Strain of Cervical Spine</p> <p>Anterior longitudinal (ligament), cervical Atlanto-axial (joints) Atlanto-occipital (joints) Whiplash injury</p>
<p>Substance Dependence Syndrome (F19.2)</p>	<p>A cluster of behavioural, cognitive, and physiological phenomena that develop after repeated substance use and that typically include a strong desire to take the drug, difficulties in controlling its use, persisting in its use despite harmful consequences, a higher priority given to drug use than to other activities and obligations, increased tolerance, and sometimes a physical withdrawal state.</p> <p>The dependence syndrome may be present for a specific psychoactive substance (e.g., tobacco, alcohol, diazepam), for a class of substances (e.g., opioid drugs), or for a wider range of pharmacologically different psychoactive substances.</p> <p><i>Excludes:</i></p> <ul style="list-style-type: none"> • Backache NOS • Pain (NOS, Acute, Chronic, Intractable) • Tension headache
<p>Factitious Disorder (F68.1)</p>	<p>The patient feigns symptoms repeatedly for no obvious reason and may even inflict self-harm in order to produce symptoms or signs. The motivation is obscure and presumably internal with the aim of adopting the sick role. The disorder is often combined with marked disorders of personality and relationships.</p> <p>Hospital hopper syndrome; Münchhausen's syndrome; Peregrinating patient</p> <p><i>Excludes:</i></p> <ul style="list-style-type: none"> • Factitial dermatitis • Person feigning illness (with obvious motivation)
<p>Malingering (Z76.5)</p>	<p>Person feigning illness (with obvious motivation).</p> <p><i>Excludes:</i></p> <ul style="list-style-type: none"> • Factitious disorder • Peregrinating patient
<p>Somatoform Disorder (F45.0)</p>	<p>The main feature is repeated presentation of physical symptoms together with persistent requests for medical investigations, in spite of repeated negative findings and reassurances by doctors that the symptoms have no physical basis. If any physical disorders are present, they do not explain the nature and extent of the symptoms or the distress and preoccupation of the patient.</p> <p><i>Excludes:</i></p> <ul style="list-style-type: none"> • Dissociative disorders • Hair-plucking • Lalling • Lipping • Nail-biting • Psychological or behavioural factors associated with disorders or distress classified elsewhere • Sexual dysfunction, not caused by organic disorder or disease • Thumb-sucking • Tic disorders (in childhood and adolescence) • Tourette's syndrome • Trichotillomania

Appendix 6.1

International Classification of Headache Disorders, 3rd Edition (ICHD-III Beta): Acute Headache Attributed to Traumatic Injury to the Head

5.1.2 Acute headache attributed to mild traumatic injury to the head

Diagnostic criteria:

- A. Headache fulfilling criteria for 5.1 Acute headache attributed to traumatic injury to the head
- B. Injury to the head fulfilling both of the following:

1. associated with none of the following:

- a) loss of consciousness for >30 min
- b) Glasgow Coma Scale (GCS) score <13
- c) post-traumatic amnesia lasting >24 hr
- d) altered level of awareness for >24 hr
- e) imaging evidence of a traumatic head injury such as intracranial haemorrhage and/or brain contusion

2. associated, immediately following the head injury, with one or more of the following symptoms and/or signs:

- a) transient confusion, disorientation or impaired consciousness
- b) loss of memory for events immediately before or after the head injury
- c) two or more other symptoms suggestive of mild traumatic brain injury: nausea, vomiting, visual disturbances, dizziness and/or vertigo, impaired memory and/or concentration.

Comment:

The diagnostic criteria for mild traumatic injury to the head and for moderate or severe traumatic injury to the head allow for substantial variability in the severity of head injury classified in each category. This has led some experts to suggest inclusion of additional categories: headache attributed to very mild traumatic injury to the head and headache attributed to very severe traumatic injury to the head. Although there is insufficient evidence for adding these categories at present, future studies should investigate the utility of doing so.

Appendix 6.2

International Classification of Headache Disorders, 3rd Edition (ICHD-III Beta): Persistent Headache Attributed to Traumatic injury to the Head

IHS	Diagnosis	ICD-10
5.2.2	<u>Persistent</u> headache attributed to mild traumatic injury to the head	G44.31

5.2.2 Persistent headache attributed to mild traumatic injury to the head

Diagnostic criteria:

- A. Headache fulfilling criteria for 5.2 Persistent headache attributed to traumatic injury to the head
B. Head injury fulfilling both of the following:

1. associated with none of the following:

- a) loss of consciousness for >30 min
- b) Glasgow Coma Scale (GCS) score <13
- c) post-traumatic amnesia lasting >24 hr
- d) altered level of awareness for >24 hr
- e) imaging evidence of a traumatic head injury such as intracranial haemorrhage and/or brain contusion

2. associated, immediately following the head injury, with one or more of the following symptoms and/or signs:

- a) transient confusion, disorientation or impaired consciousness
- b) loss of memory for events immediately before or after the head injury
- c) two or more other symptoms suggestive of mild traumatic brain injury: nausea, vomiting, visual disturbances, dizziness and/or vertigo, impaired memory and/or concentration.

Comment:

When headache following head injury becomes persistent, the possibility of 8.2 Medication-overuse headache needs to be considered.

Appendix 6.3

Diagnostic Criteria for Selected Primary Headache Types from the International Classification of Headache Disorders, 3rd Edition (ICHD-III Beta)

1.1 Migraine without aura

Previously used terms:

Common migraine; hemicrania simplex.

Description:

Recurrent headache disorder manifesting in attacks lasting 4-72 hours. Typical characteristics of the headache are unilateral location, pulsating quality, moderate or severe intensity, aggravation by routine physical activity and association with nausea and/or photophobia and phonophobia.

Diagnostic criteria:

- A. At least five attacks¹ fulfilling criteria B-D
- B. Headache attacks lasting 4-72 hr (untreated or unsuccessfully treated)^{2,3}
- C. Headache has at least two of the following four characteristics:

- 1. unilateral location
- 2. pulsating quality
- 3. moderate or severe pain intensity
- 4. aggravation by or causing avoidance of routine physical activity (eg, walking or climbing stairs)

- D. During headache at least one of the following:

- 1. nausea and/or vomiting
- 2. photophobia and phonophobia

- E. Not better accounted for by another ICHD-3 diagnosis.

Notes:

- 1. One or a few migraine attacks may be difficult to distinguish from symptomatic migraine-like attacks. Furthermore, the nature of a single or a few attacks may be difficult to understand. Therefore, at least five attacks are required. Individuals who otherwise meet criteria for 1.1 Migraine without aura but have had fewer than five attacks should be coded 1.5.1 Probable migraine without aura.
- 2. When the patient falls asleep during migraine and wakes up without it, duration of the attack is reckoned until the time of awakening.
- 3. In children and adolescents (aged under 18 years), attacks may last 2-72 hours (the evidence for untreated durations of less than two hours in children has not been substantiated).

2.2 Frequent episodic tension-type headache

Description:

Frequent episodes of headache, typically bilateral, pressing or tightening in quality and of mild to moderate intensity, lasting minutes to days. The pain does not worsen with routine physical activity and is not associated with nausea, but photophobia or phonophobia may be present.

Diagnostic criteria:

A. At least 10 episodes of headache occurring on 1-14 days per month on average for >3 months (≥ 12 and < 180 days per year) and fulfilling criteria B-D

B. Lasting from 30 min to 7 days

C. At least two of the following four characteristics:

1. bilateral location
2. pressing or tightening (non-pulsating) quality
3. mild or moderate intensity
4. not aggravated by routine physical activity such as walking or climbing stairs

D. Both of the following:

1. no nausea or vomiting
2. no more than one of photophobia or phonophobia

E. Not better accounted for by another ICHD-3 diagnosis.

Comments:

2.2 Frequent episodic tension-type headache often coexists with 1.1 Migraine without aura. Coexisting tension-type headache in migraineurs should preferably be identified through use of a diagnostic headache diary. The treatment of migraine differs considerably from that of tension-type headache, and it is important to educate patients to distinguish between these headache types if they are to select the right treatment for each whilst avoiding medication overuse and its adverse consequence of 8.2 Medication-overuse headache.

When headache fulfils criteria for both 1.5 Probable migraine and 2. Tension-type headache, code as 2. Tension-type headache (or as any subtype of it for which the criteria are fulfilled) under the general rule that definite diagnoses always trump probable diagnoses. When headache fulfils criteria for both 1.5 Probable migraine and 2.4 Probable tension-type headache, code as the former under the general rule of hierarchy, which puts 1. Migraine and its subtypes before 2. Tension-type headache and its subtypes.

4.7 Primary stabbing headache

Previously used terms:

Ice-pick pains; jabs and jolts; needle-in-the-eye syndrome; ophthalmodynia periodica; sharp short-lived head pain.

Description:

Transient and localized stabs of pain in the head that occur spontaneously in the absence of organic disease of underlying structures or of the cranial nerves.

Diagnostic criteria:

A. Head pain occurring spontaneously as a single stab or series of stabs and fulfilling criteria B-D

B. Each stab lasts for up to a few seconds

C. Stabs recur with irregular frequency, from one to many per day

D. No cranial autonomic symptoms

E. Not better accounted for by another ICHD-3 diagnosis.

Comments:

Studies show 80% of stabs last three seconds or less; rarely, stabs last for 10-120 seconds. Attack frequency is generally low, with one or a few per day. In rare cases, stabs occur repetitively over days, and there has been one description of status lasting one week.

4.7 Primary stabbing headache involves extratrigeminal regions in 70% of cases. It may move from one area to another, in either the same or the opposite hemicranium: in only one third of patients it has a fixed location. When stabs are strictly localized to one area, structural changes at this site and in the distribution of the affected cranial nerve must be excluded.

A few patients have accompanying symptoms, but not including cranial autonomic symptoms. The latter help to differentiate 4.7 Primary stabbing headache from 3.3 Short-lasting unilateral neuralgiform headache attacks.

4.7 Primary stabbing headache is more commonly experienced by people with 1. Migraine, in which cases stabs tend to be localized to the site habitually affected by migraine headaches.

13.4 Occipital neuralgia

Description:

Unilateral or bilateral paroxysmal, shooting or stabbing pain in the posterior part of the scalp, in the distribution of the greater, lesser or third occipital nerves, sometimes accompanied by diminished sensation or dysaesthesia in the affected area and commonly associated with tenderness over the involved nerve(s).

Diagnostic criteria:

- A. Unilateral or bilateral pain fulfilling criteria B-E
- B. Pain is located in the distribution of the greater, lesser and/or third occipital nerves
- C. Pain has two of the following three characteristics:
 - 1. recurring in paroxysmal attacks lasting from a few seconds to minutes
 - 2. severe intensity
 - 3. shooting, stabbing or sharp in quality
- D. Pain is associated with both of the following:
 - 1. dysaesthesia and/or allodynia apparent during innocuous stimulation of the scalp and/or hair
 - 2. either or both of the following:
 - a) tenderness over the affected nerve branches
 - b) trigger points at the emergence of the greater occipital nerve or in the area of distribution of C2
- E. Pain is eased temporarily by local anaesthetic block of the affected nerve
- F. Not better accounted for by another ICHD-3 diagnosis.

Comments:

The pain of 13.4 Occipital neuralgia may reach the fronto-orbital area through trigeminocervical interneuronal connections in the trigeminal spinal nuclei.

13.4 Occipital neuralgia must be distinguished from occipital referral of pain arising from the atlantoaxial or upper zygapophyseal joints or from tender trigger points in neck muscles or their insertions.

Appendix 6.5

International Classification of Headache Disorders (ICHD-III Beta): Medication-Overuse Headache

IHS	Diagnosis	ICD-10
8.2.	Medication-overuse headache (MOH)	G44.41 or G44.83

Previously used terms:

Rebound headache; drug-induced headache; medication-misuse headache.

Description:

Headache occurring on 15 or more days per month developing as a consequence of regular overuse of acute or symptomatic headache medication (on 10 or more or 15 or more days per month, depending on the medication) for more than three months. It usually, but not invariably, resolves after the overuse is stopped.

General comment:

In the criteria set out below for the various subtypes, the specified numbers of days of medication use considered to constitute overuse are based on expert opinion rather than on formal evidence.

Diagnostic criteria:

- A. Headache occurring on ≥ 15 days per month in a patient with a pre-existing headache disorder
- B. Regular overuse for >3 months of one or more drugs that can be taken for acute and/or symptomatic treatment of headache¹
- C. Not better accounted for by another ICHD-3 diagnosis.

Note:

1. Patients should be coded for one or more subtypes of 8.2 Medication-overuse headache according to the specific medication(s) overused and the criteria for each below. For example, a patient who fulfils the criteria for 8.2.2 Triptan-overuse headache and the criteria for one of the subforms of 8.2.3 Simple analgesic-overuse headache should receive both these codes. The exception occurs when patients overuse combination-analgesic medications, who are coded 8.2.5 Combination-analgesic-overuse headache and not according to each constituent of the combination-analgesic medication.

Patients who use multiple drugs for acute or symptomatic treatment of headache may do so in a manner that constitutes overuse even though no individual drug or class of drug is overused; such patients should be coded 8.2.6 Medication-overuse headache attributed to multiple drug classes not individually overused.

Patients who are clearly overusing multiple drugs for acute or symptomatic treatment of headache but cannot give an adequate account of their names and/or quantities are coded 8.2.7 Medication-overuse headache attributed to unverified overuse of multiple drug classes until better information is available. In almost all cases, this necessitates diary follow-up.

Comments:

8.2 Medication-overuse headache is an interaction between a therapeutic agent used excessively and a susceptible patient. Among those with a previous primary headache diagnosis, most have 1. Migraine or 2. Tension-type headache (or both); only a small minority have other primary headache diagnoses such as 3.3 Chronic cluster headache or 4.10 New daily persistent headache.

The diagnosis of 8.2 Medication-overuse headache is extremely important clinically. Approximately half of people with headache on 15 or more days per month for more than three months have 8.2 Medication-overuse headache. Evidence shows that the majority of patients with this disorder improve after discontinuation of the overused medication, as does their responsiveness to preventative treatment. Simple advice on the causes and consequences of 8.2 Medication-overuse headache is an essential part of its management. An explanatory brochure is often all that is necessary to prevent or discontinue medication overuse. Prevention is especially important in patients prone to frequent headache.

However, the behaviour of some patients with 8.2 Medication-overuse headache is similar to that seen with other drug addictions, and the Severity of Dependence Scale (SDS) score is a significant predictor of medication overuse among headache patients.

Appendix 6.6

Self-Regulated Intervention and Lifestyle Strategies to Minimize Headache Occurrence

Simple Self-regulated Intervention Strategies*

- Apply a cold or hot pack to the neck or head
- Tie something tight around the head
- Stretching and self-massaging the head and/or neck and shoulders
- Perform breathing exercises
- Visualization or other mindfulness-based exercises
- Go to a quiet place
- Lie down
- Go outside to get fresh air

* Note. When relevant, there are a variety of allied-health professionals who can guide individuals to perform appropriate home-based neck and shoulder stretching.

Lifestyle Strategies to Minimize Headache Occurrence

- Sleep:** It is well-known that sleep deprivation or inconsistent sleep-wake cycles can precipitate headaches or preclude improvement. Accordingly, it is important to educate individuals with post-traumatic headache (PTH) on the importance of going to bed at the same time each night and waking up at the same time each night and, if possible, avoiding day-time naps. If insomnia continues to be a significant problem, please refer to section 7 for an approach to the management of insomnia
- Regular Meals:** It is well-known that skipping or delaying meals can trigger headaches in some people. As such, it is important to ensure that patients with PTH consume breakfast (ideally a high-protein breakfast), lunch and dinner and avoiding delaying or skipping meals.
- Hydration:** It is thought that dehydration can be a trigger for headaches in some susceptible individuals. As such, it is important to maintain good hydration – this means consuming 4-6 drinks per day of water, juice, milk or other non-caffeinated beverages. Regular daily caffeine-consumption (i.e., coffee, soft-drinks) should be avoided as caffeine consumption and withdrawal can precipitate headaches (when an individual does not consume caffeinated beverages regularly, a caffeinated beverage may be helpful to minimize intermittent bad headaches). Diet soft-drinks should be further avoided as, in some, aspartame may trigger headaches.
- Stress:** It is well-known that in many individuals stress, worry, anxiety or anger can be a significant trigger for headaches. These symptoms are particularly common in individuals who have sustained a traumatic brain injury and, as such, can have a major impact on the frequency and severity of PTH. As such, using relaxation strategies, doing activities such as meditation, yoga, and exercise can assist with coping with stress and avoiding stress-induced worsening of headaches. The assistance of an occupational therapist, psychologist, GP-psychotherapist or psychiatrist may be necessary.
- Exercise:** In the initial period after a traumatic brain injury, physical rest is often endorsed. However, as the weeks go by, inactivity is frequently counter-productive and a sedentary lifestyle without any cardiovascular exercise may, in some, perpetuate the headaches. Accordingly, a brisk walk (particularly a morning walk outside), riding a stationary bicycle, walking or jogging on a treadmill or elliptical machine or swimming can be very helpful in headache management. An exercise program should be undertaken as tolerated with gradually increasing duration and intensity. For some, exercise triggers a headache and in these individuals the intensity and/or duration of the exercise should be reduced or an alternative exercise should be trialed.

Appendix 6.7

Prophylactic Therapy

Note that all therapies utilized for the prophylaxis of post-traumatic headaches are off-label. Prophylactic therapies should be utilized using a “start-low and go slow” approach. Patients should be advised that prophylactic therapies are not a cure and they may not perceive any benefit for weeks and maximal benefit may take up to 12 weeks to be realized. A therapeutic trial of a prophylactic therapy should last 12 weeks unless there are intolerable medication side-effects. The only useful way to evaluate the effectiveness of a prophylactic therapy is review of the patient’s headache and medication calendar. If the prophylactic therapy is efficacious, it should be continued for a minimum of 3-6+ months and then consideration could be given to gradually weaning off, if possible.

Patients must be advised of realistic goals with regards to prophylactic therapy – the goal is not to “cure” the individual’s headaches; rather, the goal is to try to decrease the individual’s headache frequency and/or headache intensity and/or headache duration and/or acute medication requirements. Patients should also be advised that there are no “designer” drugs for headache prophylaxis – all medications utilized were created for other reasons and were subsequently found to be effective in headache prophylaxis in some, but not all, patients. This will pre-empt unnecessary patient confusion and non-compliance.

If the headaches are tension-type in nature or unclassifiable, first-line therapy is Amitriptyline or Nortriptyline (starting at 10 mg po qhs and increasing by 10 mg q1-2 weeks as necessary/tolerated to a maximum of 50- (and occasionally up to 100 mg po qhs). Amitriptyline is more sedating than Nortriptyline so should be utilized if there are concomitant sleep disturbances. Second-line therapy to consider is Gabapentin (starting at 100-300 mg po qhs and increasing by 100-300 mg q5 days as necessary/tolerated on a TID schedule to a maximum of approximately 600 mg po TID)

From the Canadian Headache Society Guideline for Migraine Prophylaxis**

General Principles of Migraine Prophylaxis

When should Migraine Prophylaxis Be Considered? (Expert Consensus)

- i. Migraine Prophylactic therapy should be considered in patients whose migraine attacks have a significant impact on their lives despite appropriate use of acute medications and trigger management/ lifestyle modification strategies.
- ii. Migraine prophylactic therapy should be considered when the frequency of migraine attacks is such that reliance on acute medications alone puts patients at risk for medication overuse (rebound) headache. Medication overuse is defined as use of opioids, combination analgesics, or triptans on ten days a month or more, or use of simple analgesics (acetaminophen, acetylsalicylic acid [ASA], non-steroidal anti-inflammatory drugs [NSAIDs]) on 15 days a month or more.
- iii. Migraine prophylaxis should be considered for patients with greater than three moderate or severe headache days a month when acute medications are not reliably effective, and for patients with greater than eight headache days a month even when acute medications are optimally effective because of the risk of medication overuse headache.
- iv. Migraine prophylaxis may be considered in some patients with relatively infrequent attacks according to patient preference and physician judgement, for example in patients with hemiplegic migraine.
- v. Migraine prophylaxis may be particularly useful for patients with medical contraindications to acute migraine therapies.

When should Migraine Prophylactic Therapy Be Stopped? (Expert Consensus)

- i. A prophylactic medication trial should consist of at least two months at the target or optimal dose (or at the maximum tolerated dose if the usual target dose is not tolerated) before a prophylactic drug is considered ineffective.
- ii. A prophylactic medication is usually considered effective if migraine attack frequency or the number of days with headache per month is reduced by 50% or more, although lesser reductions in migraine frequency may be worthwhile, particularly if the drug is well tolerated.

- iii. In addition to reduction in migraine attack frequency or in the number of days with headache per month, reductions in headache intensity and migraine-related disability need to be considered when judging the effectiveness of prophylactic therapy.
- iv. Patients on migraine prophylaxis require periodic reevaluation both to monitor potential side effects and to assess efficacy.
- v. Because of its utility in assessing the effectiveness of prophylactic therapy, patients should be strongly encouraged to keep a headache diary/calendar.
- vi. After 6 to 12 months of successful prophylactic therapy, consideration should be given to tapering and discontinuing the prophylactic medication in many patients, although others may benefit from a much longer duration of prophylactic therapy. If headache frequency increases as the prophylactic drug dosage is reduced, the dosage can be increased again or the drug restarted if it has been discontinued.**

If the headaches are migrainous in nature:

- a) First-line therapy would be a Tricyclic Antidepressant (i.e. Amitriptyline or Nortriptyline starting at 10 mg po qhs and increasing by 10 mg q1-2 weeks as necessary/tolerated to a maximum of 50-100 mg po qhs) or a beta-blocker (i.e. Nadolol starting at 20 mg po BID and increasing by 20 mg q5days as necessary/tolerated to 40-80 mg po BID or Propranolol 20 mg po TID and increasing by 20 mg q5days as necessary/tolerated to a maximum of 80 mg po TID).
- b) Second-line therapy includes Topiramate (starting at 12.5 mg po qhs and increasing by 12.5 mg po qhs qweekly as necessary/tolerated to a maximum of 100 mg po qhs) or, failing this, Gabapentin (starting at 100-300 mg po qhs and increasing by 100-300 mg q5 days as necessary/tolerated on a TID schedule to a maximum of approximately 600 mg po TID).
- c) Third-line therapies would include Verapamil (starting at 40 mg po TID and titrating to 80 mg po TID as necessary/tolerated), Pizotifen (starting at 0.5 mg po qhs and increasing by 0.5 mg qweekly as necessary/tolerated to 3.0 mg po qhs) and Flunarizine (starting at 5 mg po qhs and increasing to 10 mg po qhs after 10-14 days).
- d) Notably, should trials of a couple oral prophylactic agents prove ineffective, or should oral prophylactic medications be contraindicated by concomitant medical issues or by significant polypharmacy, consideration could certainly be given to interventional therapy. Botulinum Toxin Type A (onabotulinum toxin) up to 200 units q3months using a fixed-dose, follow-the-pain treatment paradigm has proven beneficial in recent phase 3 RCT trials for the prophylaxis of chronic migraine and is an approved treatment for chronic migraine.
- e) Nerve blocks (i.e. occipital nerve blocks) should be restricted to intractable daily post-traumatic headache and should be discontinued if the repetitive nerve blocks are ineffective after weekly treatment for 4-6 weeks.

The choice of prophylactic therapy depends on comorbid symptoms (i.e., consider Amitriptyline if concomitant insomnia, a Beta-blocker if concomitant hypertension, Topiramate if concomitant obesity) and contraindications (avoid Beta-blocker/ Calcium-channel blocker if hypotensive, Tricyclic if excessive fatigue, Topiramate if excessive cognitive symptoms, Flunarizine if depression etc).

**Pringsheim T, Davenport W, Mackie G, Worthington I, Aube M, Christie SN, Gladstone J, Becker WJ, Canadian Headache Society Prophylactic Guidelines Development Group. Canadian Headache Society guideline for migraine prophylaxis. *Can J Neurol Sci.* 2012 Mar;39(2 Suppl 2):S1-59.

Appendix 7.1

Brief Definitions of Sleep Disorders Most Frequently Reported Following mTBI*

Insomnia

<i>Main feature</i>	Dissatisfaction with the quality or quantity of sleep.
<i>Common symptoms</i>	Subjective complaints of difficulty falling asleep, difficulty maintaining sleep (with frequent awakenings and/or difficulty returning to sleep after awakenings), early morning awakenings (with insufficient sleep duration) and/or nonrestorative sleep.
<i>Additional criteria</i>	To be considered as an insomnia disorder, symptoms have to be present at least 3 nights/week, last more than 1 or 6 months (depending on the nosology being used), and cause significant distress or impairment in daytime functioning.

Sleep-related breathing disorders

<i>Main feature</i>	Altered respiration during sleep.
<i>Main subtypes</i>	Obstructive sleep apnea (OSA): breathing alteration associated with complete (apnea) or partial (hypopnea) obstruction of the upper airway during sleep. Central apnea: breathing alteration associated with temporary loss of ventilatory effort.
<i>Common symptoms</i>	Daytime sleepiness, frequent awakenings to restart breathing, restless and nonrestorative sleep, snoring.
<i>Additional criteria</i>	Presence of at least 5 polysomnography-documented apneas or hypopneas per hour of sleep.

Narcolepsy

<i>Main feature</i>	Rare disorder characterized by recurrent unplanned daytime napping or sleep episodes.
<i>Common symptoms</i>	Tetrad of classic symptoms (that are not always all present): daytime sleepiness, cataplexy (i.e., episodic loss of muscle function), hypnagogic hallucinations (i.e. dream-like experiences while falling asleep, dozing or awakening), and sleep paralysis (i.e., transitory, inability to talk, or move upon awakening).

Post-traumatic hypersomnia

<i>Main feature</i>	Hypersomnia because of medical condition (TBI) when other primary sleep disorders have been ruled out.
<i>Common symptoms</i>	Excessive daytime sleepiness, increased sleep duration.

Circadian rhythm sleep disorders

<i>Main feature</i>	Mismatch between one's sleep-wake rhythm and the 24-hour environment. In addition to the sleep-wake cycle, melatonin secretion and body temperature rhythms can be disrupted.
<i>Common symptoms</i>	Delayed sleep phase disorder: prolonged delay in the sleep-wake episodes relative to conventional times; Advanced sleep phase disorder: advance in the sleep-wake episodes relative to conventional times; Irregular sleep-wake rhythm: high day-to-day variability in sleep onset and offset.
<i>Additional criteria</i>	Sleep disturbances when trying to conform with conventional times (inability to fall asleep or remain asleep); normal sleep quality and duration when choosing the preferred schedule.

* Taken with permission from Ouellet MC, Beaulieu-Bonneau S Morin CM. Sleep-Wake Disturbances. In Eds. Zasler ND, Katz DI, Zafonte RD. Brain Injury Medicine: Principles and Practice. New York; Demos Medical Publishing LLC; 2012.

Appendix 7.2

Short Clinical Interview for Sleep after Head Injury*

Short Clinical Interview for Sleep after Head Injury

Adapted with permission from Morin C.M. (1993) by Ouellet M.C., Beaulieu-Bonneau S & Morin C.M. Université Laval, Québec, Canada

<p>IDENTIFICATION: DATE:</p> <p>Notes:</p>	
<p>SCREENING FOR INSOMNIA, EXCESSIVE DAYTIME SLEEPINESS AND SYMPTOMS OF OTHER SLEEP DISORDERS</p> <ul style="list-style-type: none"> • Has your sleep quality or quantity changed since your injury? How so? • Do you have trouble falling asleep? • Do you have trouble staying asleep in the middle of the night? • Do you wake up earlier than desired in the morning? • How many hours of sleep do you usually get? • Do you have any trouble staying awake during the day? • How often do you fall asleep during the day without intending to do so? • Have you or your spouse ever noticed one of the following, and if so, how often on a typical week would you say you experience these symptoms? <ul style="list-style-type: none"> <input type="checkbox"/> Loud snoring <input type="checkbox"/> Gasping, choking, breathing interruptions or holding your breath while sleeping <input type="checkbox"/> Urge to move your legs or inability to keep your legs still <input type="checkbox"/> Leg cramps while sleeping <input type="checkbox"/> Twitches or jerks in your legs or arms while sleeping <input type="checkbox"/> Inability to move while in bed <input type="checkbox"/> Grinding your teeth while sleeping <input type="checkbox"/> Confusion or strange sensory experiences when falling asleep or waking up <input type="checkbox"/> Recurrent nightmares or disturbing dreams. Are these related to the accident? 	
<p>EXPLORE EVOLUTION OF SLEEP-WAKE DISTURBANCE</p> <ul style="list-style-type: none"> • How long have you had this sleep problem (specify if before/after TBI)? • Is any particular event related to the onset of the sleep disturbance? • Was the onset gradual or sudden? • What has been the course of your sleep problems since its onset (e.g., persistent, episodic, seasonal)? 	
<p>ASSESS LIFE HABITS, MEDICATION AND SUBSTANCE USE</p> <ul style="list-style-type: none"> • Is your sleep environment comfortable? (e.g. bed, light, temperature, noise) • How many times per week do you exercise? (frequency and timing) • How many caffeinated beverages do you drink per day? (amount and timing) • Do you smoke ? (amount and timing) • In the past month, have you used prescribed or over-the-counter medication or any other substance to improve your sleep or your daytime alertness (e.g., alcohol, drugs, energy drinks, caffeine)? (if so, specify name of medication, amount, frequency of use (number of nights/week)) • What strategies do you use to cope with your sleep problem or to stay awake during the day? 	

Features and symptoms of sleep disturbances reported following traumatic brain injury
Insomnia. Dissatisfaction with sleep quality or quantity. **Symptoms:** Subjective complaints of difficulty falling asleep, difficulty maintaining sleep, early morning awakenings and/or non-restorative sleep. For an insomnia disorder, symptoms have to be present at least 3 nights per week, last more than 1 month and cause significant distress or impairment in daytime functioning.
Sleep-related breathing disorders. Obstructive sleep apnea (OSA): breathing alteration associated with complete (apnea) or partial (hypopnea) obstruction of the upper airway during sleep. Central apnea: breathing alteration associated with temporary loss of ventilatory effort. **Symptoms:** Daytime sleepiness, frequent awakenings to restart breathing, restless and non-restorative sleep, snoring. To confirm, refer for polysomnography and verify if there is presence of at least 5 documented apneas or hypopneas per hour of sleep.
Narcolepsy. Rare disorder characterized by recurrent daytime napping or sleep episodes. **Symptoms:** Tetrad of classic symptoms (that are not always all present): daytime sleepiness, cataplexy (i.e., episodic loss of muscle function), hypnagogic hallucinations (i.e. dreamlike experiences while falling asleep, dozing or awakening), and sleep paralysis (i.e., transitory inability to talk or move upon awakening).
Post-traumatic hypersomnia. Hypersomnia due to medical condition (TBI) when other primary sleep disorders have been ruled out. **Symptoms:** Excessive daytime sleepiness, increased sleep duration.
Circadian rhythm sleep disorders. Delayed sleep phase disorder: prolonged delay in the sleep-wake episodes relative to conventional times. **Symptoms:** Irregular sleep-wake rhythm: high day-to-day variability in sleep onset and offset. Sleep disturbances when trying to conform with conventional times (inability to fall asleep or remain asleep).
 A more comprehensive clinical interview canvas is available in: N. Zaslter, D. Katz, & R. Zafonte, *Brain Injury Medicine: Principles and Practice* (Second edition). Boston. Brain Injury Medicine., Chapter 43, pp. 707-725.

* Taken with permission from Ouellet MC, Beaulieu-Bonneau S Morin CM. Sleep-Wake Disturbances. In Eds. Zaslter ND, Katz DI, Zafonte RD. Brain Injury Medicine: Principles and Practice. New York; Demos Medical Publishing LLC; 2012.

Appendix 7.3

Sleep and Concussion Questionnaire*

Sleep and Concussion Questionnaire[©]

Name / ID#: _____ Age: _____ Date of Visit: _____ D/M/Y

Date of Injury: _____ D/M/Y Completed by: Self Parent/Other: _____

Have you had more than one brain injury/concussion?

Yes No If yes, how many? _____

Have you completed this questionnaire at our clinic before?

Yes—Begin at Section 2 (see page 2) No—Begin at Section 1

Section 1: Initial Assessment

1. a) In the last 6 months before your injury(s), did you consider yourself to be a good sleeper?

Most of the time Some of the time Rarely Never

b) Have you ever sought medical attention for your sleep problems?

Yes No

c) Have you ever used any sleep interventions?

Yes No

d) If yes, please specify the sleep interventions being used:

Medication Non-medicinal supplements
 Behavioural techniques Other: _____

2. a) Since your injury(s), has your sleep changed?

No (0) Yes, Mild Change (1) Yes, Moderate Change (2) Yes, Significant Change (3)

b) If yes, please indicate the type of change:

Sleep more (1) Sleep less (1) Sleep the same amount but is less restful (1)

c) If you have had more than one injury, when did you first experience changes in sleep?

After first injury After subsequent injury - If so, please describe:

Section 2: Follow-Up

3. a) Since the last time you completed this questionnaire, which sentence best describes your sleep?

- My sleep is now the same as before my injury(s) (0)
 My sleep is returning to the same as before my injury(s) (1)
 My sleep is the same as last time and is still different from before my injury(2)
 My sleep has gotten worse (3)

b) If sleep has gotten worse, please describe the change:

- I sleep more (1) I sleep less (2) I sleep the same amount but it is less restful (3)

Section 3: Changes in Sleep

3. Please rate the severity of the changes to your sleep since the injury(s) or last time you completed this questionnaire:

	Never	Sometimes	Often	Always
a) I fall asleep earlier than usual.	0	1	2	3
c) I have difficulty staying asleep.	0	1	2	3
e) I wake up too early & can't fall back asleep.	0	1	2	3

4. My sleep is affected by: *(check all that apply)*

- Nothing, my sleep is unaffected (0) Pain (1) Feeling Restless (1)
 Breathing Problems/Snoring (1) Mood (1) Unsure (0)
 Bad Dreams/Nightmares (1) Worrying (1)
 Other: (1)

5. Please rate the severity of the changes to your daytime function since the injury(s) OR the last time you completed this questionnaire:

	Never	Sometimes	Often	Always
a) I feel more tired during the day.	0	1	2	3
b) I need to nap more often during the day.	0	1	2	3

Sleep and Concussion Questionnaire[©]

Wiseman-Hakes & Ouellet V13

Guidelines for Administration

The Sleep and Concussion Questionnaire has undergone preliminary evaluation of face validity with children and youth age 12-18. It has been used with children age 12 and above and adults. For children and youth age 12-15, parental or caregiver input may be helpful, particularly in the acute stage of concussion. The questionnaire can be administered to children age 6 and above, however it is suggested that for children age 6-11, it be completed by a parent or caregiver who knows the child's habitual sleep.

Guidelines for Scoring/Interpretation and Suggested Action

Note: This is a preliminary scoring guide that is currently being validated.

The scoring guide was inspired by Dr. Charles Morin ISI 1993.

Add scores for 12 items (2a + 2b) or (3a + 3b) + (4a + 4b + 4c + 4d + 4e + 5 + 6a + 6b) = _____

- Score: 0-7** No clinically significant change: No action required UNLESS there is a pre-existing sleep problem that has not been addressed as this can exacerbate concussion symptoms and slow down recovery.
- Score: 8-15** Subclinical change: Requires monitoring. Reassure individual that complete resolution anticipated with resolution of concussion symptoms.
- Score: 16-22** Clinical changes of moderate severity: Further assessment of precipitating factors recommended and possible intervention required.
- Score: 23-36** Clinically severe changes in sleep or wakefulness: Further assessment of precipitating factors, referral to specialist may be indicated and intervention may be indicated.

Appendix 7.4

Sleep Hygiene Program*

Healthy Habits to Promote Good Sleep

- Maintain the same bed and wake time daily.
- Establish a fixed bed-time routine. A warm bath and/or light massage before bed may be helpful.
- The need for a nap should be evaluated depending on the time post-injury and severity of daytime sleepiness (and not fatigue). In the acute stage post injury (i.e., first few hours/days), naps are a natural part of the recovery process and should not be limited. Consult a doctor or emergency department if you are not easily awoken in the first few hours or days after your injury. Beyond the acute period, naps should be avoided as to promote night-time sleep and should not impede gradual return to activity.
- If sleepiness is significant and naps cannot be avoided, ideally naps should be limited to one per day, shorter than 30 minutes, and be taken before 3:00 PM. When napping, attempt to fall asleep in bed (not in another room, or in front of the tv, etc.).

Nutrition, Exercise and Lifestyle

- Avoid consumption of caffeine within 4-6 hours of bedtime.
- Avoid consumption of alcohol too close to bedtime. When metabolized, alcohol can produce awakenings or lighter sleep.
- Avoid heavy meals late in the evening.
- Consider adding a bedtime snack containing protein. Avoid sugar 4 hours before bedtime.
- Adequate vitamin and mineral intake is important to help the body produce melatonin, which promotes sleep. Make sure there is enough magnesium, iron and B vitamins in the diet.
- When tolerated and medically indicated, encourage 30-60 minutes of vigorous exercise a day, as regular exercise promotes sleep. Avoid exercising within two hours of sleep.
- Expose yourself to natural light during the day.

Sleeping Environment

- The sleeping area should be dark, cool and comfortable.
- Ideally there should be no source of light in the bedroom while sleeping.
- The room should be clean, tidy and quiet (e.g., neutral or natural sounds can be helpful to block out distracting sounds)
- The bed and bedroom should be reserved for sleep. Other activities (reading, watching TV, using internet, playing games) should take place in another room. Ideally there should be no electronic equipment in the bedroom. If this is unavoidable, make sure that all computers, tablets, cell phones etc are either turned off or at the very least in 'sleep' mode.
- Having a digital clock in the bedroom with numbers that 'light up' is not recommended. If there is, it should be turned away from the bed. If the individual awakes in the night, it is recommended not to look at the clock.

Refer to the Canadian Sleep Society website <http://www.canadiansleepsociety.ca/tours> for further information and specific resources, available in both English and French (Publications section).

* Taken with permission from the authors: C. Wiseman-Hakes (U of Toronto, Canada), M-C. Ouellet (U Laval) & S. Beaulieu-Bonneau (U Laval).

Appendix 7.5

Behavioural Recommendations for Optimal Sleep*

Objective A: Restrict the time you spend in bed to the actual time you spend sleeping: spending too much time in bed may actually contribute to your sleep problem. (Appendix 7.7)

- 1- Monitor your sleep with a sleep diary ([Appendix 7.6](#)) for 1 or 2 weeks. Calculate the time spent actually sleeping (Time spent in bed minus time to fall asleep and awakenings).
- 2- Under the supervision of your health-care provider, set up a sleep window with a duration corresponding to the actual sleep time of the past 1-2 weeks, and with fixed bedtime and rising time. The sleep window should not be of less than 5.5 hours.
- 3- Maintain the sleep window for at least one week.
- 4- Set a consistent wake time (even on weekends), and regardless of amount of sleep obtained.
- 5- On a weekly basis, gradually adjust the sleep window based on your sleep quantity and quality:
 - If you sleep more than 85% of time you spend in bed and/or you constantly feel sleepy during the day, increase the sleep window by 15-20 minutes.
 - If you sleep less than 85% of the time you spend in bed, decrease the sleep window by 15-20 minutes.
 - Continue this procedure until you achieve an acceptable sleep quality and duration AND you do not feel sleepy during the day.

NOTE: feeling tired (unenergetic, weary, having difficulty maintaining attention or effort) is different than feeling sleepy (drowsy, yawning, eyelids drooping).

CAUTION: You may feel sleepy or tired in the first days/weeks when following these recommendations. Be cautious with activities which may put you in danger (e.g., driving, operating machinery).

Objective B: Re-associate your bed, bedroom and bedtime with sleep and sleepiness rather than with sleep-incompatible activities or the anxiety of not sleeping. (Appendix 7.8)

- 1- **Get up at the same time every morning, regardless of the amount of sleep you obtained.** Maintaining fixed bedtime and rising time helps regulating the biological and maximizing sleep drive at the optimal time.
- 2- **Allow at least 1 hour before bedtime to unwind.** This is intended to facilitate the transition from wakefulness to sleepiness, and to sleep onset. In this time, you should plan quiet, relaxing, and pleasant activities.
- 3- **Go to bed only when sleepy.** Going to bed when feeling wide awake only leads to prolonged wakefulness and further associates the bed and bedroom with insomnia rather than sleep. Wait until you feel the signs of sleepiness (yawning, eyelids drooping) before trying to sleep.
- 4- **If you are unable to fall asleep or fall back to sleep within 15-20 min, get out of bed and find something else to do in another room.** Again, the rationale is to strengthen the association between your bed and bedroom, and sleep. When applying this strategy, it is important to choose a quiet and relaxing activity, avoid stimulating ones (e.g., computer or TV), and avoid bright light. Go back to bed only when you feel sleepy again. Repeat this procedure as often as necessary.
- 5- **Reserve your bed and bedroom for sleep only.** The bedroom environment should be associated with sleep only, sexual activities being the only exception. All other activities, such as reading, worrying about your personal or health problems, or watching TV, should be done elsewhere.
- 6- **Limit daytime napping.** Beyond the first few days post-injury, it is best to avoid daytime napping. Naps can affect the quantity and quality of sleep the following night. Naps longer than 30 min can be followed by an unpleasant period of sleepiness and difficulty concentrating than can last up to 1 hour upon awakening. If daytime sleepiness is too overwhelming, take a short nap (not exceeding 1 hour and taken before 3:00 PM).

These recommendations should be implemented together with a sleep hygiene program ([Appendix 7.4](#)), under the supervision of a healthcare professional.

* Taken with permission from Ouellet MC, Beaulieu-Bonneau S Morin CM. Sleep-Wake Disturbances. In Eds. Zasler ND, Katz DI, Zafonte RD. Brain Injury Medicine: Principles and Practice. New York; Demos Medical Publishing LLC; 2012.

Appendix 7.6

Sleep Diary*

The **National Sleep Foundation** is dedicated to improving health and well-being through sleep education and advocacy. It is well-known for its annual Sleep in America® poll. The Foundation is a charitable, educational and scientific not-for-profit organization located in Washington, DC. Its membership includes researchers and clinicians focused on sleep medicine, health professionals, patients, families affected by drowsy driving and more than 900 healthcare facilities.

www.sleepfoundation.org

NATIONAL SLEEP FOUNDATION

Sufficient sleep is important for your health, well-being and happiness. When you sleep better, you feel better. The National Sleep Foundation Sleep Diary will help you track your sleep, allowing you to see habits and trends that are helping you sleep or that can be improved.

How to Use the National Sleep Foundation Sleep Diary

- ❖ Our sleep diary only takes a few minutes each day to complete.
- ❖ We've given you diary entries for seven days; you may want to make several copies.
- ❖ Review your completed diary to see if there are any patterns or practices that are helping or hindering your sleep. Is your bedroom a sanctuary for sleep? Or are there too many distractions? Did your nap interfere with a good night's sleep?
- ❖ Make incremental changes. Changing one habit at a time can set you on the path to healthy sleep.

Visit sleepfoundation.org for more sleep tips.

* National Sleep Foundation. Sleep Diary

Sleep Diary: Morning

Complete in Morning							
Start date: ___/___/___	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Day of week:							
I went to bed last night at:	PM / AM						
I got out of bed this morning at:	AM / PM						
Last night I fell asleep:							
Easily	<input type="checkbox"/>						
After some time	<input type="checkbox"/>						
With difficulty	<input type="checkbox"/>						
I woke up during the night:							
# of times							
# of minutes							
Last night I slept a total of:	Hours						
My sleep was disturbed by: List mental or physical factors including noise, lights, pets, allergies, temperature, discomfort, stress, etc.							
When I woke up for the day, I felt:							
Refreshed	<input type="checkbox"/>						
Somewhat refreshed	<input type="checkbox"/>						
Fatigued	<input type="checkbox"/>						
Notes: Record any other factors that may affect your sleep (i.e. hours of work shift, or monthly cycle for women).							

Sleep Diary: End of Day

Complete at the End of Day							
Day of week:	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
I consumed caffeinated drinks in the: (M)morning, (A)fternoon, (E)vening, (N/A)							
M / A / E / NA How many?							
I exercised at least 20 minutes in the: (M)morning, (A)fternoon, (E)vening, (N/A)							
Medications I took today:							
Took a nap? (Circle one)	Yes						
	No						
If Yes, for how long?							
During the day, how likely was I to doze off while performing daily activities: No chance, Slight chance, Moderate chance, High chance							
Throughout the day, my mood was ... Very pleasant, Pleasant, Unpleasant, Very unpleasant							
Approximately 2-3 hours before going to bed, I consumed:							
Alcohol	<input type="checkbox"/>						
A heavy meal	<input type="checkbox"/>						
Caffeine	<input type="checkbox"/>						
Not applicable	<input type="checkbox"/>						
In the hour before going to sleep, my bedtime routine included: List activities including reading a book, using electronics, taking a bath, doing relaxation exercises, etc.							

Appendix 7.7

Limiting the time spent in bed to actual sleep time

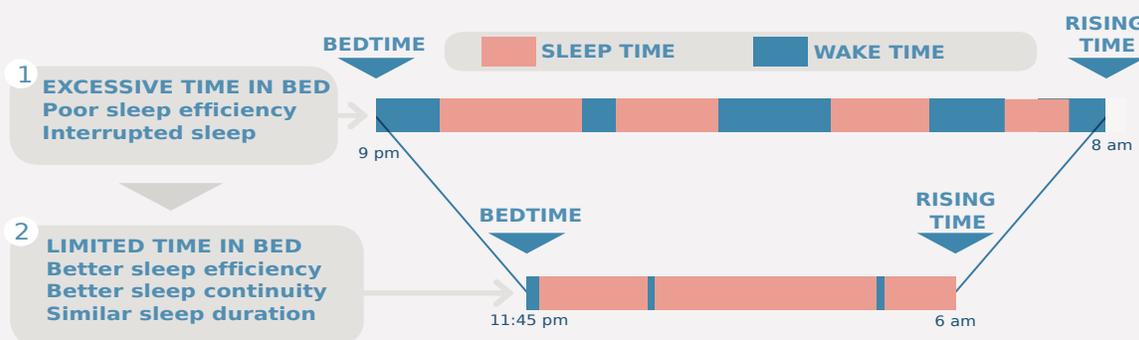


Limiting the time spent in bed to actual sleep time

1/3

One of the strategies most commonly used to try to eliminate insomnia is to spend more time in bed, by going to bed earlier, getting up later, or taking naps. These practices can be beneficial in the short term. However, they can be detrimental in the long term: spending too much time awake in bed tends to fragment sleep and perpetuate insomnia. Indeed, while they are in bed yet not sleeping, many people start worrying or using that time to problem-solve. The solution is to limit the time spent in bed to actual sleeping time.

- This strategy is very effective for decreasing sleep fragmentation and increasing sleep quality;
- The initial effect is to produce a mild state of sleep deprivation, which makes it easier to fall asleep and improves the continuity of sleep through the night;
- In the beginning, the goal is to improve sleep quality and efficiency, but not necessarily to increase sleep duration, which can be achieved subsequently.



How to apply this strategy?

- 1 Determine the duration of your sleep window based on the amount of time slept.
- 2 Choose a set bedtime and rising time to define the sleep window.
- 3 Each week, adjust the sleep window based on your sleep efficiency and the sleepiness you experienced during the day.

Adapted from: Ouellet, M.-C., Beaulieu-Bonneau, S., Savard, J., & Morin, C. M. (2015). *Insomnie et fatigue après un traumatismecraniocérébral* : Manuel d'évaluation et d'intervention.



Limiting the time spent in bed to actual sleep time



2/3

1 Determine the duration of your sleep window based on the amount of time slept

The sleep window is a period of time in which sleep is permitted, and outside of which sleep should be avoided.

The sleep window is defined by a set bedtime and rising time, and **it must be followed each time, whether during the week or on the weekend.**

The duration of the first sleep window is equal to the average number of hours slept each night over the past week or two weeks. You can estimate this duration based on your habits, or using the sleep diary if you have been using it.

For example:

DAYS	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
HOURS OF SLEEP	7:00	6:00	5:30	6:00	6:15	5:45	5:30

Average sleep time = (Total hours of sleep / Number of days) = (42 / 7) = 6 hours.

The first sleep window will be of six hours.



To avoid significant sleepiness during the day, the sleep window should never be less than five or six hours in duration, even if you generally sleep less than this amount.

2 Choose a set bedtime and rising time to define your sleep window.

These times will be set for at least one week: the duration between these two times will be equal to your sleep window duration as defined in Step 1.

For example, for a six-hour sleep window, possible bedtimes and rising times might include the following:

- 11:30 pm to 5:30 am
- 12 am to 6 am
- 12:30 am to 6:30 am

Apply the sleep window each night for one week.
You can subsequently readjust this window based on your sleep efficiency for the week.

Adapted from: Ouellet, M.-C., Beaulieu-Bonneau, S., Savard, J., & Morin, C. M. (2015). *Insomnie et fatigue après un traumatisme craniocérébral : Manuel d'évaluation et d'intervention.*



3 Each week, adjust the sleep window based on your sleep efficiency and the sleepiness you experienced during the day

After maintaining the sleep window for one week, you will need to evaluate it based on the following:

- your sleep efficiency, ideally calculated based on your sleep diary or estimated based on your actual sleep time and time spent in bed over the previous week;
- how you feel during the day (daytime sleepiness).

$$\text{SLEEP EFFICIENCY} = \frac{\text{Total sleep time (in minutes)}}{\text{Time spent in bed at night (in minutes)}} \times 100$$

If your sleep efficiency is **above 85%**
OR
 if you are very sleepy during the day (much sleepier than before you began this strategy).



Extend your sleep window by 15 to 20 minutes for the following week. You may decide to go to bed earlier or to get up later.

If your sleep efficiency is **below 80%**
AND
 you are not too sleepy during the day.



Reduce your sleep window by 15 to 20 minutes for the following week. You may go to bed later or wake up earlier, as long as you reduce the amount of time you spend in bed.

If your sleep efficiency is **between 80% and 85%.**



Maintain the same sleep window for another week.

What to expect?

- The side effect of this strategy of restricting time spent in bed is that you will feel more sleepy during the day. This is normal and temporary. After one or two weeks, you will realize that, in spite of spending less time in bed, you are functioning just as well during the day. Exercise caution if you need to drive or use hazardous machinery.
- Continue to adjust your sleep window each week until you achieve a satisfactory duration of sleep combined with good sleep efficiency (more than 85%). You may need to apply this strategy for several weeks (6 to 10) before achieving this result.

Adapted from: Ouellet, M.-C., Beaulieu-Bonneau, S., Savard, J., & Morin, C. M. (2015). *Insomnie et fatigue après un traumatisme craniocérébral* : Manuel d'évaluation et d'intervention.

Appendix 7.8

Re-creating a Time and Place for Sleep



Re-creating a time and place for sleep



1/3

For good sleepers, the sleep period (nighttime) and sleep environment (the bed and bedroom) are strongly associated with sleep. Insomnia disrupts this association over time, the sleep period and environment that should be associated with sleep become synonymous with wakefulness and insomnia.

Six strategies for reinforcing associations between the bed and bedroom, nighttime, and sleep:

- 1 Set aside at least one hour before bedtime for rest and relaxation.
- 2 Go to bed only when you feel sleepy.
- 3 If unable to fall asleep or fall back asleep in 15 to 20 minutes, get out of bed, engage in a calm activity, and go back to bed when sleepiness returns.
- 4 Get up at the same time each morning (using an alarm clock), regardless of how much you slept.
- 5 Reserve the bed and the bedroom exclusively for sleep.
- 6 Limit naps during the day.



It is important to apply all six strategies, not only those that seem most relevant or require the least effort.

- If you are already applying some of these strategies, it will be easier to focus on the strategies that you are not applying;
- These strategies may require several weeks of steady application before beneficial effects are experienced.

Adapted from: Ouellet, M.-C., Beaulieu-Bonneau, S., Savard, J., & Morin, C. M. (2015). *Insomnie et fatigue après un traumatisme craniocérébral : Manuel d'évaluation et d'intervention.*



1 Set aside at least one hour before bedtime for rest and relaxation.

- In the late evening, avoid sources of cognitive or emotional activation that can delay sleep (e.g., work, video games, physical exercise, and planning out the next day);
- Opt for activities that facilitate the transition between wakefulness, sleepiness, and sleep (e.g., reading, watching TV, listening to music, etc.);
- Reserve a specific time in the early evening (and not the late evening) to address worries or problem-solving;
- Establish a bedtime routine (e.g., taking a bath, brushing your teeth, removing makeup, or getting into your sleepwear).

2 Go to bed only when you feel sleepy.

- Going to bed too early, before you feel sleepy, is likely to delay your sleep and create a stronger association between your bed and bedroom and insomnia;
- If you are not sleepy when going to bed, delay your bedtime until you are - you will fall asleep more quickly;
- Be attentive to signs of sleepiness (associated with the transition from wakefulness to sleep): yawning, heavy eyelids, or itchy or watery eyes. Sleepiness is not the same as fatigue. It is possible to be mentally or physically fatigued without wanting to sleep, i.e., without being sleepy.

3 If unable to fall asleep or fall back asleep in 15 to 20 minutes, get out of bed, engage in a calm activity, and go back to bed when sleepiness returns.

- Getting up at night and changing rooms has two advantages: 1) breaking the association between the bed, bedroom, and insomnia; and 2) disrupting thought processes that linger when you stay in bed for a long time;
- Avoid looking at the time in order to know when you should get out of bed: if you think that 15 to 20 minutes have gone by or you will not be able to fall asleep soon, simply get out of bed;
- Decide in advance which room you will go in, which activity you will do, and what you will need (e.g., in the winter, leave a blanket in the room);
- Maintain a relatively dim environment or use a shaded lamp that will not shine directly into your eyes;
- Avoid falling asleep in the other room. Go back to bed, but only when you feel sleepy;
- Suggested activities: reading, listening to music, writing, or doing crossword puzzles;
- Activities to avoid: household chores, physical exercise, or electronic devices.

Adapted from: Ouellet, M.-C., Beaulieu-Bonneau, S., Savard, J., & Morin, C. M. (2015). *Insomnie et fatigue après un traumatisme craniocérébral : Manuel d'évaluation et d'intervention.*



4 Get up at the same time each morning (using an alarm clock), regardless of how much you slept.

- Use an alarm clock, both during the week and on the weekend, to regulate your sleep cycle and promote sleep on the following night;
- Choose an alarm clock that is loud enough to wake you up, but not too aggressive (e.g., the radio). Put the alarm clock somewhere out of reach, so that you need to get up to turn it off;
- Plan social or family activities early in the morning in order to increase your motivation to get up.

5 Reserve the bed and the bedroom exclusively for sleep.

- Avoid the following in your bedroom (during the day and night): reading, watching TV, listening to music or the radio, using a computer or smartphone, eating, working, planning, or worrying. Sexual activities are an exception, since they can lead to a state of relaxation that is conducive to sleep;
- Falling asleep to the sound of the TV or radio (or other music) is especially detrimental: your brain will continue to pay attention to what you are listening to, causing lighter sleep;
- As much as possible, it is important to always sleep in the same room and the same bed (avoid sleeping or dozing off in another bed, a couch, or a hammock);
- If your room is your living space (e.g., in a hospital, rehabilitation centre, or studio apartment), it is important to set aside a specific space for sleep (the bed) and a space for other activities (other than the bed).

6 Limit naps during the day.

- Avoid or limit naps in order to avoid adverse consequences on your sleep the following night:
 - Nap time:** the early afternoon is conducive to falling asleep quickly, but a late-afternoon or evening nap can disturb your night of sleep;
 - Nap duration:** brief (15 to 30 minutes) naps are more effective than long ones;
 - Nap location:** naps should be taken in the same place as sleep at night, i.e., in your bed.
- Find alternatives to naps in order to deal with sleepiness or fatigue during the day: listening to music, doing physical exercise, walking outside, or doing pleasant or social activities.

Adapted from: Ouellet, M.-C., Beaulieu-Bonneau, S., Savard, J., & Morin, C. M. (2015). *Insomnie et fatigue après un traumatisme craniocérébral* : Manuel d'évaluation et d'intervention.

Appendix 8.1

PHQ-9*

Name: _____

Date: _____

Over the last two weeks, how often have you been bothered by any of the following problems?
(Use "✓" to indicate your answer)

	Not at all (0)	Several days (1)	More than half of the days (2)	Nearly every day (3)
1. Little interest or pleasure in doing things				
2. Feeling down, depressed or hopeless				
3. Trouble falling or staying asleep				
4. Feeling tired or having little energy				
5. Poor appetite or overeating				
6. Feeling bad about yourself - or that you are a failure or have let yourself or your family down				
7. Trouble concentrating on things, such as reading the newspaper or watching television				
8. Moving or speaking so slowly that other people could have noticed. Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual				
9. Thoughts that you would be better off dead, or of hurting yourself				

Add columns:

--	--	--

(Healthcare professional: For interpretation of TOTAL, please refer to accompanying scoring card)

TOTAL:

--

10. If you checked off *any problems*, how *difficult* have these problems made it for you to your work, take care of things at home, or get along with other people?

Not difficult at all _____
Somewhat difficult _____
Very difficult _____
Extremely difficult _____

* May be printed without permission. Available in the public domain.

Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine*. 2001;16(9):606-613.

How to Score the PHQ-9

For initial diagnosis:

1. Patient completes PHQ-9 Quick Depression Assessment.
2. If there are at least 4 ✓s in the shaded section (including Questions #1 and #2), consider a depressive disorder. Add score to determine severity.

Consider Major Depressive Disorder

If there are at least 5 ✓s in the shaded section (one of which corresponds to Question #1 or #2).

Consider Other Depressive Disorder

If there are 2-4 ✓s in the shaded section (one of which corresponds to Question #1 or #2).

Note: Given that the questionnaire relies on patient self-report, all responses should be verified by the clinician, and a definitive diagnosis is made on clinical grounds taking into account how well the patient understood the questionnaire, as well as other relevant information from the patient. Diagnoses of Major Depressive Disorder or Other Depressive Disorder also require impairment of social, occupational, or other important areas of functioning (Question #10) and ruling out normal bereavement, a history of a Manic Episode (Bipolar Disorder), and a physical disorder, medication, or other drug as the biological cause of the depressive symptoms.

Also, PHQ-9 scores can be used to plan and monitor treatment. To score the instrument, tally each response by the number value under the answer headings, (not at all=0, several days=1, more than half the days=2, and nearly every day=3). Add the numbers together to total the score on the bottom of the questionnaire. Interpret the score by using the guide listed below.

Guide for Interpreting PHQ-9 Scores

Score	Action
0 - 4	The score suggests the patient may not need depression treatment.
5 - 14	<u>Mild major depressive disorder.</u> Physician uses clinical judgment about treatment, based on patient's duration of symptoms and functional impairment.
15 - 19	<u>Moderate major depressive disorder.</u> Warrants treatment for depression, using antidepressant, psychotherapy or a combination of treatment.
20 or higher	<u>Severe major depressive disorder.</u> Warrants treatment with antidepressant, with or without psychotherapy, follow frequently.

Functional Health Assessment

The instrument also includes a functional health assessment. This asks the patient how emotional difficulties or problems impact work, things at home, or relationships with other people. Patient responses can be one of four: Not difficult at all, Somewhat difficult, Very difficult, Extremely difficult. The last two responses suggest that the patient's functionality is impaired. After treatment begins, functional status and number score can be measured to assess patient improvement.

* May be printed without permission. Available in the public domain.

Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine.* 2001;16(9):606-613.

Appendix 8.2

GAD-7*

Name: _____

Date: _____

Over the last two weeks, how often have you been bothered by any of the following problems?
(Use "✓" to indicate your answer)

	Not at all (0)	Several days (1)	More than half of the days (2)	Nearly every day (3)
1. Feeling nervous, anxious or on edge				
2. Not being able to stop or control worrying				
3. Worrying too much about different things				
4. Trouble relaxing				
5. Being so restless that it is hard to sit still				
6. Becoming easily annoyed or irritable				
7. Feeling afraid as if something awful might happen				

Add columns:

(Healthcare professional: For interpretation of TOTAL,
please refer to accompanying scoring card)

TOTAL:

10. If you checked off *any problems*, how *difficult* have these problems made it for you to your work, take care of things at home, or get along with other people?

Not difficult at all _____
Somewhat difficult _____
Very difficult _____
Extremely difficult _____

* May be printed without permission. Available in the public domain.

Spitzer RL, Kroenke K, Williams JB, et al. A brief measure for assessing generalised anxiety disorder: the GAD-7. *Archives of Internal Medicine*. 2006;166:1092-1097.

How to Score the GAD-7

Anxiety severity is calculated by assigning scores of 0, 1, 2, and 3, to the response categories of “not at all,” “several days,” “more than half the days,” and “nearly every day,” respectively. GAD-7 total score for the seven items ranges from 0 to 21. Scores of 5, 10, and 15 represent cut points for mild, moderate, and severe anxiety, respectively.

Guide for Interpreting GAD-7 Scores

Score	Interpretation
0 - 4	Normal.
5 - 9	Mild anxiety.
10 - 14	Moderate anxiety.
15 - 21	Severe anxiety.

* When screening for an anxiety disorder, a recommended cut point for further evaluation is a score of 10 or greater.

Using the GAD-7 to Screen for GAD and Other Anxiety Disorders

A score of 10 or greater is the recommended cut point for identifying cases in which a formal diagnosis of GAD may be considered. Elevated GAD-7 scores also raise the possibility that one or more of the other most common anxiety disorders may be present (e.g., panic disorder, PTSD and social phobia).

Functional Health Assessment

The instrument also includes a functional health assessment. This asks the patient how emotional difficulties or problems impact work, things at home, or relationships with other people. Patient responses can be one of four: Not difficult at all, Somewhat difficult, Very difficult, Extremely difficult. The last two responses suggest that the patient’s functionality is impaired. After treatment begins, functional status and number score can be measured to assess patient improvement.

* May be printed without permission. Available in the public domain.

Spitzer RL, Kroenke K, Williams JB, et al. A brief measure for assessing generalised anxiety disorder: the GAD-7. *Archives of Internal Medicine*. 2006;166:1092-1097.

Appendix 8.3

PC-PTSD-5*

ID # _____

PC-PTSD-5

Sometimes things happen to people that are unusually or especially frightening, horrible, or traumatic. For example:

- a serious accident or fire
- a physical or sexual assault or abuse
- an earthquake or flood
- a war
- seeing someone be killed or seriously injured
- having a loved one die through homicide or suicide.

Have you ever experienced this kind of event?

YES

NO

If no, screen total = 0. Please stop here.

If yes, please answer the questions below.

In the past month, have you...

1. had nightmares about the event(s) or thought about the event(s) when you did not want to?

YES

NO

2. tried hard not to think about the event(s) or went out of your way to avoid situations that reminded you of the event(s)?

YES

NO

3. been constantly on guard, watchful, or easily startled?

YES

NO

4. felt numb or detached from people, activities, or your surroundings?

YES

NO

5. felt guilty or unable to stop blaming yourself or others for the event(s) or any problems the event(s) may have caused?

YES

NO

* Adapted from Prins, A., Bovin, M. J., Kimerling, R., Kaloupek, D. G., Marx, B. P., Pless Kaiser, A., & Schnurr, P. P. (2015). The Primary Care PTSD Screen for DSM-5 (PC-PTSD-5) [Measurement instrument]. Available from <http://www.ptsd.va.gov>

Appendix 8.4

PCL-5*

Instructions: Below is a list of problems that people sometimes have in response to a very stressful experience. Please read each problem carefully and then circle one of the numbers to the right to indicate how much you have been bothered by that problem in the past month.

In the past month, how much were you bothered by:	Not at all	A little bit	Moderately	Quite a bit	Extremely
1. Repeated, disturbing, and unwanted memories of the stressful experience?	0	1	2	3	4
2. Repeated, disturbing dreams of the stressful experience?	0	1	2	3	4
3. Suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)?	0	1	2	3	4
4. Feeling very upset when something reminded you of the stressful experience?	0	1	2	3	4
5. Having strong physical reactions when something reminded you of the stressful experience (for example, heart pounding, trouble breathing, sweating)?	0	1	2	3	4
6. Avoiding memories, thoughts, or feelings related to the stressful experience?	0	1	2	3	4
7. Avoiding external reminders of the stressful experience (for example, people, places, conversations, activities, objects, or situations)?	0	1	2	3	4
8. Trouble remembering important parts of the stressful experience?	0	1	2	3	4
9. Having strong negative beliefs about yourself, other people, or the world (for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)?	0	1	2	3	4
10. Blaming yourself or someone else for the stressful experience or what happened after it?	0	1	2	3	4
11. Having strong negative feelings such as fear, horror, anger, guilt, or shame?	0	1	2	3	4
12. Loss of interest in activities that you used to enjoy?	0	1	2	3	4
13. Feeling distant or cut off from other people?	0	1	2	3	4
14. Trouble experiencing positive feelings (for example, being unable to feel happiness or have loving feelings for people close to you)?	0	1	2	3	4
15. Irritable behavior, angry outbursts, or acting aggressively?	0	1	2	3	4
16. Taking too many risks or doing things that could cause you harm?	0	1	2	3	4
17. Being "superalert" or watchful or on guard?	0	1	2	3	4
18. Feeling jumpy or easily startled?	0	1	2	3	4
19. Having difficulty concentrating?	0	1	2	3	4
20. Trouble falling or staying asleep?	0	1	2	3	4

* This is a government document in the public domain. Weathers, F. W., Litz, B. T., Keane, T. M., Palmieri, P. A., Marx, B. P., & Schnurr, P. P. (2013). The PTSD Checklist for DSM-5 (PCL-5) – Standard [Measurement instrument]. Available from <http://www.ptsd.va.gov/>

Appendix 8.5

CAGE and CAGE-AID Questionnaire*

CAGE and CAGE-AID Introduction and Scoring

The CAGE questionnaire is used to test for alcohol abuse and dependence in adults. The CAGE-AID version of the tool has been adapted to include drug use. These tools are not used to diagnose diseases, but only to indicate whether a problem might exist. The questions are most effective when used as part of a general health history and should NOT be preceded by questions about how much or how frequently the patient drinks or uses drugs. The reason for this is that denial is very common among persons abusing alcohol or other drugs; and therefore, the CAGE/CAGE-AID questions focus the discussion toward the behavioral effects of the drinking or drug use rather than toward the number of drinks or drugs used per day.

Item responses on the CAGE and CAGE-AID are scored 0 or 1, with a higher score indicating alcohol or drug use problems. A total score of 2 or greater is considered clinically significant, which then should lead the physician to ask more specific questions about frequency and quantity.

The downside of the CAGE/CAGE-AID approach is that questions do not discriminate well between active and inactive drinkers or drug users, so following positive scores on the CAGE with questions regarding usual consumption patterns (e.g., frequency/quantity/heaviest consumption) will help make this distinction.

Screening Tools

CAGE

1. Have you ever felt you should **cut down** on your drinking?
2. Have people **annoyed** you by criticizing your drinking?
3. Have you ever felt bad or **guilty** about your drinking?
4. **Eye Opener:** Have you ever had a drink first thing in the morning to steady your nerves or to get rid of a hangover?

Scoring: Item responses on the CAGE are scored 0 for "no" and 1 for "yes" answers. A higher score is an indication of alcohol problems. A total score of 2 or greater is considered clinically significant.

CAGE-AID (CAGE Questions Adapted to Include Drugs)

1. Have you ever felt you ought to cut down on your drinking or drug use?
2. Have people annoyed you by criticizing your drinking or drug use?
3. Have you felt bad or guilty about your drinking or drug use?
4. Have you ever had a drink or used drugs first thing in the morning to steady your nerves or to get rid of a hangover?

Scoring: Item responses on the CAGE-AID are scored 0 for "no" and 1 for "yes" answers. A higher score is an indication of alcohol problems. A total score of 2 or greater is considered clinically significant.

Used / reprinted with permission from Brown, R.L., and Rounds, L.A. Conjoint screening questionnaires for alcohol and drug abuse. Wisconsin Medical Journal 94:135-140, 1995.

* May be printed without permission, unless it is used in any profit-making endeavour.

Brown, R.L., and Rounds, L.A. Conjoint screening questionnaires for alcohol and drug abuse. Wisconsin Medical Journal 94:135-140, 1995.

Appendix 10.1

Dizziness Handicap Inventory



Dizziness Handicap Inventory

Instructions: The purpose of this scale is to identify difficulties that you may be experiencing because of your dizziness. Please check “always”, or “no” or “sometimes” to each question. Answer each question only as it pertains to your dizziness problem.

	Questions	Always	Sometimes	No
P1	Does looking up increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E2	Because of your problem, do you feel frustrated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F3	Because of your problem, do you restrict your travel for business or pleasure?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P4	Does walking down the aisle of a supermarket increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F5	Because of your problem, do you have difficulty getting into or out of bed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F6	Does your problem significantly restrict your participation in social activities, such as going out to dinner, going to movies, dancing or to parties?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F7	Because of your problem, do you have difficulty reading?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F8	Does performing more ambitious activities like sports, dancing, and household chores, such as sweeping or putting dishes away; increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E9	Because of your problem, are you afraid to leave your home without having someone accompany you?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E10	Because of your problem, have you been embarrassed in front of others?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P11	Do quick movements of your head increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F12	Because of your problem, do you avoid heights?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P13	Does turning over in bed increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F14	Because of your problem, is it difficult for you to do strenuous housework or yard work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E15	Because of your problem, are you afraid people may think that you are intoxicated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F16	Because of your problem, is it difficult for you to go for a walk by yourself?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P17	Does walking down a sidewalk increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E18	Because of your problem, is it difficult for you to concentrate?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F19	Because of your problem, is it difficult for you to walk around your house in the dark?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E20	Because of your problem, are you afraid to stay home alone?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E21	Because of your problem, do you feel handicapped?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E22	Has your problem placed stress on your relationship with members of your family or friends?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E23	Because of your problem, are you depressed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F24	Does your problem interfere with your job or household responsibilities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
P25	Does bending over increase your problem?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Scoring for Dizziness Handicap Inventory

Eval	Total Functional	Total Emotional	Total Physical	TOTAL SCORE
Reassess #1				
Reassess #2				
Reassess #3				
Reassess #4				

Always = 4

Sometimes = 2

No = 0

P = physical

E = emotional

F = functional

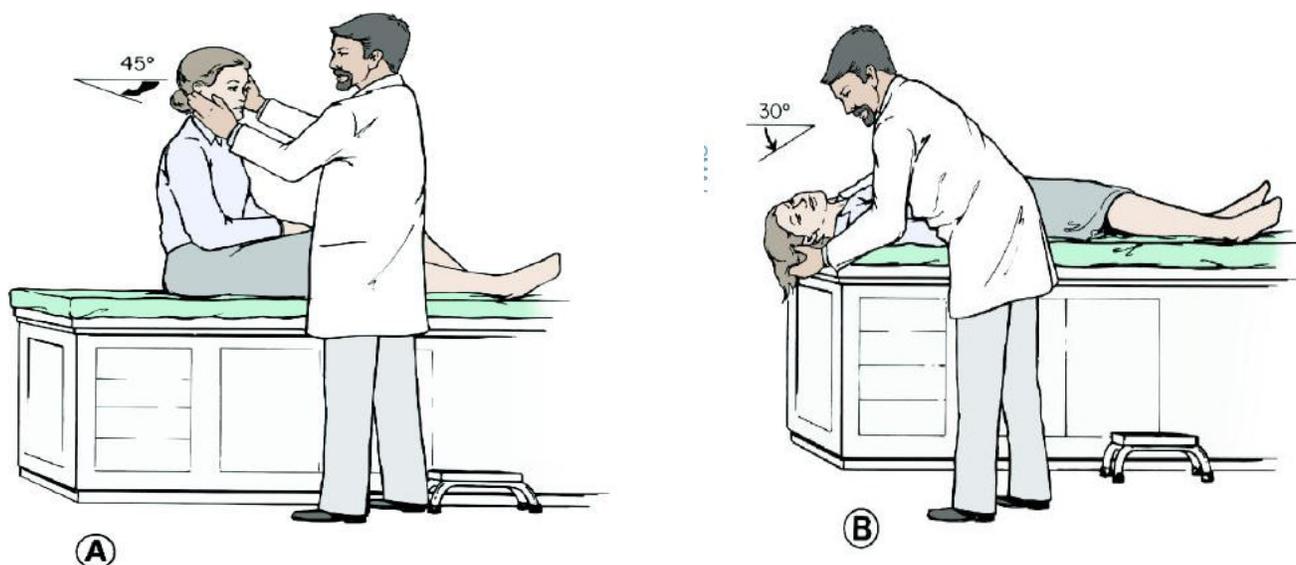
Subscales

Notes:

1. Subjective measure of the patient's perception of handicap due to the dizziness
2. Top score is 100 (maximum perceived disability)
3. Bottom score is 0 (no perceived disability)
4. The following 5 items can be useful in predicting BPPV
 - Does looking up increase your problem?
 - Because of your problem, do you have difficulty getting into or out of bed?
 - Do quick movements of your head increase your problem?
 - Does bending over increase your problem?
5. Can use subscale scores to track change as well

Appendix 10.2

Dix-Hallpike Manoeuvre*

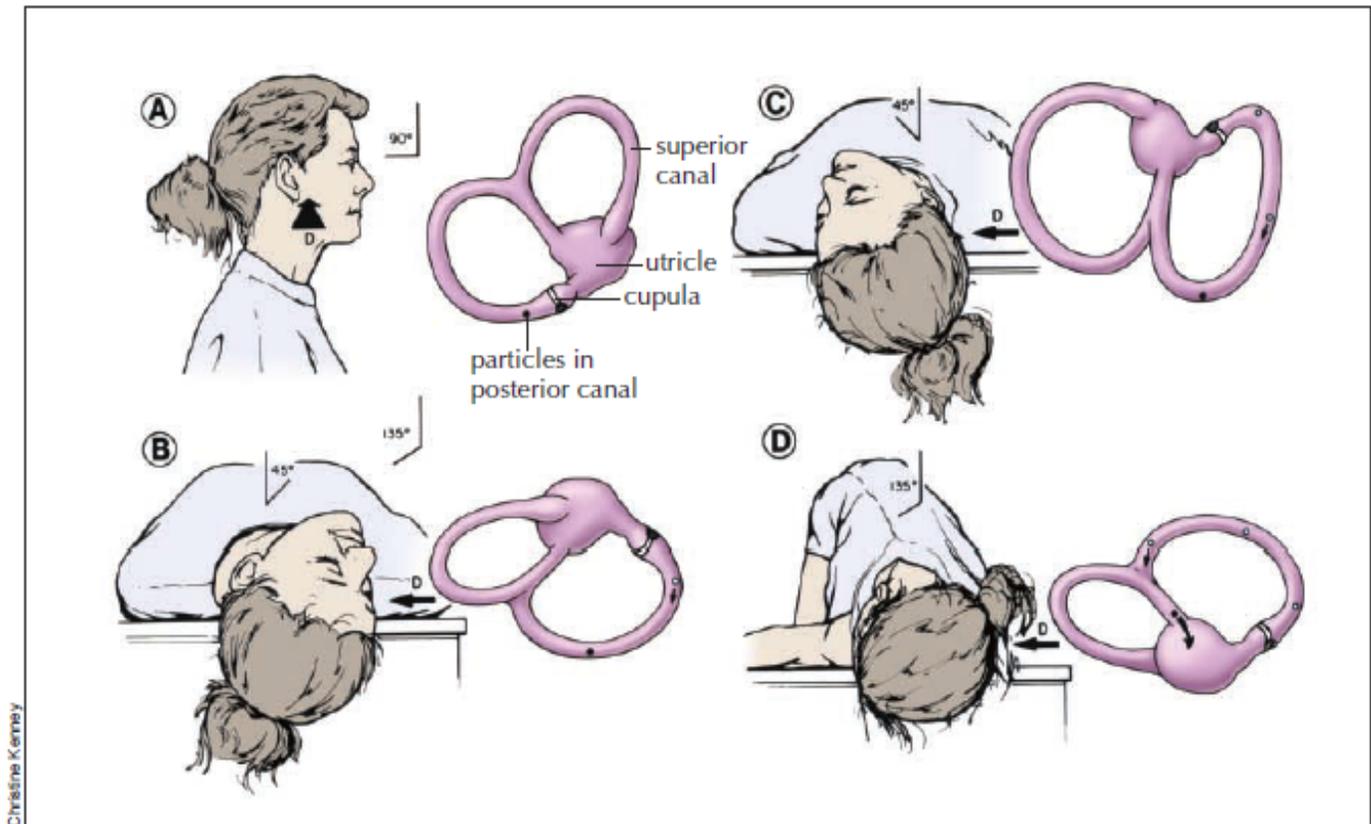


Dix-Hallpike Manoeuvre (right ear). The patient is seated and positioned so that the patient's head will extend over the top edge of the table when supine. The head is turned 45° toward the ear being tested (position A). The patient is quickly lowered into the supine position with the head extending about 30° below the horizontal (position B). The patient's head is held in this position and the examiner observes the patient's eyes for nystagmus. In this case with the right side being tested, the physician should expect to see a fast-phase counter-clockwise nystagmus. To complete the manoeuvre, the patient is returned to the seated positions (position A) and their eyes are observed for reversal nystagmus, in this case a fast-phase clockwise nystagmus. Photo: Christine Kenney

* Taken from Parnes LS, Agrawal SK, Atlas J. Diagnosis and management of benign paroxysmal positional vertigo (BPPV). *Canadian Medical Association Journal*. 2003;169:681-693. For links to video demonstrations of the above manoeuvres, please see [Appendix F](#).

Appendix 10.3

Particle Repositioning Manoeuvre (PRM)/Epley Manoeuvre*



Particle repositioning manoeuvre (right ear). Schema of patient and concurrent movement of posterior/superior semicircular canals and utricle. The patient is seated on a table as viewed from the right side (A). The remaining parts show the sequential head and body positions of a patient lying down as viewed from the top. Before moving the patient into position B, turn the head 45° to the side being treated (in this case it would be the right side). Patient in normal Dix–Hallpike head-hanging position (B). Particles gravitate in an ampullofugal direction and induce utriculofugal cupular displacement and subsequent counter-clockwise rotatory nystagmus. This position is maintained for 1–2 minutes. The patient’s head is then rotated toward the opposite side with the neck in full extension through position C and into position D in a steady motion by rolling the patient onto the opposite lateral side. The change from position B to D should take no longer than 3–5 seconds. Particles continue gravitating in an ampullofugal direction through the common crus into the utricle. The patient’s eyes are immediately observed for nystagmus. Position D is maintained for another 1–2 minutes, and then the patient sits back up to position A. ^D = direction of view of labyrinth, dark circle = position of particle conglomerate, open circle = previous position.

*Taken from Parnes LS, Agrawal SK, Atlas J. Diagnosis and management of benign paroxysmal positional vertigo (BPPV). *Canadian Medical Association Journal*.. 2003;169(7):681-693.

Appendix 10.4

Screening Techniques for Vision Dysfunction

Example Questions for Screening:

1. Do you bump into objects and walls more now than before your injury?
Yes___ No___
2. Were your eyes, eyelids, or area around your eyes injured when your TBI event occurred?
Yes___ No___
3. Do you cover or close one eye at times since your injury?
Yes___ No___
4. Have you noticed a change in your vision since your injury?
Yes___ No___
5. Are you more sensitive to light, either indoors or outdoors, since your injury?
Yes___ No___
6. Have you had any double vision since your injury?
Yes___ No___
7. Have you noticed any changes in your peripheral vision since your injury?
Yes___ No___
8. Is your vision blurry at distance or near since your injury?
Yes___ No___
9. Have you noticed a change in your ability to read since your injury?
Yes___ No___
10. Do you lose your place while reading more now than before your injury?
Yes___ No___
11. How long can you read continuously before you need to stop? Why do you stop reading?
Yes___ No___
12. Do you get headaches during/after reading more now than before your injury?
Yes___ No___
13. Do you have more difficulty remembering what you have read now than before your injury?
Yes___ No___

Goodrich GL, Martinsen GL, Flyg HM, et al. Development of a mild traumatic brain injury-specific vision screening protocol: a Delphi study. *J Rehabil Res Dev.* 2013;50(6):757-768.

Tests to conduct for visual screening

Visual Acuity	Visual acuity should be performed at both distance and near with each eye, with their current prescription (if applicable).
Extra-ocular Motility	The “Broad H” Test is designed to assess the action of all 6 extraocular muscles around each eye. Have the patient follow a penlight as it is moved into the patient’s right and left field, as well as upwards and downwards in both right and left gaze, making a large “H” pattern out to at least 30-40 degrees (shoulder width as a rule of thumb). The movements should be full and smooth, without diplopia or eyestrain.
Vergence	The ability for the eyes to converge as a team should also be assessed via the Near Point of Convergence test. As a penlight is slowly brought inward towards the patient’s nose, the patient is asked to report when the light “breaks into two” (diplopia). The normal point of convergence is approximately 8cm or less from the nose. If one eye turns outwards, or the patient report diplopia is greater than 8 cm, further investigation is warranted.
Pupils	Pupils should be equal, round and reactive to light without afferent pupillary defect.
Fundoscopy	The internal retinal examination should reveal healthy, distinct optic nerves, maculae and retinal tissue.

Appendix 11.1

Barrow Neurological Institute (BNI) Fatigue Scale*

Name: _____

Date: _____

Please rate the extent to which each of the items below has been a problem for you since your injury. You should choose only ONE number from 0–7 on the scale below when making your response.

0	1	2	3	4	5	6	7
<i>Rarely a problem</i>		<i>Occasional problem but not frequent</i>		<i>A frequent problem</i>		<i>A problem most of the time</i>	

1. How difficult is it for me to maintain my energy throughout the day? _____
2. How difficult is it for me to participate in activities because of fatigue? _____
3. How difficult is it for me to stay awake during the day? _____
4. How difficult is it for me to complete a task without becoming tired? _____
5. How difficult is it for me to stay alert during activities? _____
6. How difficult is it for me to build my energy level once I wake up in the morning? _____
7. How difficult is it for me to stay out of my bed during the day? _____
8. How difficult is it for me to stay alert when I am not involved in something? _____
9. How difficult is it for me to attend to something without becoming sleepy? _____
10. How difficult is it for me to last the day without taking a nap? _____

TOTAL:

11. Please circle your OVERALL level of fatigue since your injury:

0	1	2	3	4	5	6	7	8	9	10
<i>No problem</i>										<i>Severe problem</i>

* Borgaro SR, Gierok S, Caples H, Kwasnica C. Fatigue after brain injury: Initial reliability study of the BNI Fatigue Scale. *Brain Injury*. 2004;18:685–690. Reproduced with permission from the authors and Informa Healthcare.

Appendix 11.2

List of Medications Associated with Fatigue, Asthenia, Somnolence and Lethargy from the Multiple Sclerosis Council (MSC) Guideline*

MEDICATIONS	RATE OF SYMPTOMS	MEDICATIONS	RATE OF SYMPTOMS
<i>Medications are cited that cause symptoms in > 5% of patients</i>			
Analgesics		Antihypertensive	
Butalbital	■	Acebutolol (Sectral)	●
Butorphanol (Stadol NS)	●	Amiloride (Moduretic)	●
Dihydrocodeine	■	Atenolol (Tenoretic, Tenormin)	●
Fentanyl (Duragesic transdermal)	●	Benazepril (Lotensin)	●
Hydrocodone (Vicoprofen)	●	Betaxolol (Kerlone)	●
Morphine	■	Carteolol (Cartrol)	●
Oxycodone (Oxycontin)	●	Clonidine (Catapres, Combipress)	●
Tramadol (Ultram)	●	Diltiazem (Tiazac)	●
		Doxazosin (Cardura)	●
Anticonvulsants		Guanadrel (Hylorel)	●
Carbamazepine (Tegretol)	◆	Guanfacine (Tenex)	●
Clorazepate (Tranxene)	■	Labetalol (Normodyne, Trandate)	●
Divalproex (Depakote)	●	Metoprolol (Lopressor, Toprol)	●
Felbamate (Felbatol)	●	Nifedipine (Adalat)	●
Gabapentin (Neurontin)	●	Perindopril (Aceon)	●
Lamotrigine (Lamictal)	●	Prazosin (Minipress, Minizide)	●
Phenobarbital	▲		
Primidone (Mysoline)	▲	Anti-Inflammatory	
		Fenoprofen (Nalfon)	●
Antidepressants		Ketorolac (Toradol)	●
Buspirone (Buspar)	●	Naproxen (Anaprox, Naprelan, Naprosyn)	●
Clomipramine (Anafranil)	●	Tolmetin (Tolectin)	●
Doxepin (Sinequan)	◆		
Fluoxetine (Prozac)	●	Antipsychotic	
Fluvoxamine (Luvox)	●	Clozapine (Clozaril)	●
Mirtazapine (Remeron)	●	Mesoridazine (Serentil)	■
Nefazodone (Serzone)	●	Molindone (Moban)	■
Paroxetine (Paxil)	●	Olanzapine (Zyprexa)	●
Sertraline (Zoloft)	●	Risperidone (Risperdal)	●
Trazodone (Desyrel)	●		
Tricyclic agents	■	Asthma Drugs	
Venlafaxine (Effexor)	●	Fluticasone (Flovent)	●
		Terbutaline	●
Antihistamines			
Astemizole (Hismanal)	●	Carbonic Anhydrase Inhibitors	
Azatadine (Trinalin)	■	Dichlorphenamide (Daranide)	◆
Azelastine (Astelin)	●		
Cetirizine (Zyrtec)	●	Cardiac	
Chlorpheniramine	◆	Bepridil (Vasacor)	●
Diphenhydramine	■	Amiodarone (Cordarone)	●
Loratadine (Claritin)	●	Disopyramide (Norpac)	●
Phenylephrine	◆	Flecainide (Tambocor)	●
Terfenadine (Seldane)	●	Nifedipine (Procardia)	●
		Quinine (Cardioquin, Quinidex)	●
		Sotalol (Betapace)	●

Legend

- >50%
- Most Frequent
- ◆ Most Common
- 25-50%
- Among Most Frequent
- ◆ Among Most Common
- 10-25%
- Among Frequent
- ▲ Occasional
- 5-10%
- ▲ Can Develop During Therapy

* Adapted from the Multiple Sclerosis Council (MSC) Guideline.

MEDICATIONS	RATE OF SYMPTOMS	MEDICATIONS	RATE OF SYMPTOMS
<i>Medications are cited that cause symptoms in > 5% of patients</i>			
Diabetic Agents		Nicotine Agents	
Glipizide (Glucotrol)	●	Habitrol	●
Troglitazone (Rezulin)	●	Nicotrol nasal spray	●
		Prostep	●
Gastrointestinal		Sedative Hypnotics	
Dicyclomine (Bentyl)	●	Alprazolam (Xanax)	●
Granisetron (Kytril)	●	Clonazepam (Klonopin)	●
Metoclopramide (Reglan)	●	Diazepam (Valium)	◆
		Estazolam (ProSom)	●
Genitourinary		Quazepam (Doral)	●
Terazosin (Hytrin)	●	Secobarbital (Seconal)	◆
		Temazepam (Restoril)	●
Hormone Replacement		Triazolam (Halcion)	●
Depo-Provera (medroxyprogesterone)	●	Zolpidem (Ambien)	●
Progesterone cream (Crinone)	●		
Leuprolide (Lupron)	●	Other	
(Lupron depot preparation)	●	Dexfenfluramine (Redux)	●
		Fenfluramine (Pondimin)	◆
Immune Modulators		Scopolamine (Transderm Scop)	●
Interferon beta-1a (Avonex)	●		
Interferon beta-1b (Betaseron)	●		
Muscle Relaxants			
Carisoprodol (Soma)	■		
Cyclobenzaprine (Flexeril)	●		
Dantrolene (Dantrium)	■		
Diazepam (Valium)	◆		
Tizanidine (Zanaflex)	●		

Legend

- >50%
- Most Frequent
- ◆ Most Common
- 25-50%
- Among Most Frequent
- ◆ Among Most Common
- 10-25%
- Among Frequent
- ▲ Occasional
- 5-10%
- ▲ Can Develop During Therapy

* Adapted from the Multiple Sclerosis Council (MSC) Guideline.

Appendix 11.3

Patient Advice Sheet on Coping Strategies for Fatigue*

FACT SHEET 11

Managing Fatigue

THIS FACT SHEET explains the symptoms and triggers of fatigue and provides some strategies to minimise and manage it.

Fatigue is a common and very disabling symptom experienced by people with acquired brain injury (ABI) or neurological conditions. Some people with multiple sclerosis, for example, describe an overwhelming sense of general fatigue that can occur at any time of the day. It happens without warning and the person needs to rest immediately before the symptoms get worse.

Fatigue is also a problem among carers as they find themselves managing increased workloads and greater responsibilities. Members of the rehabilitation team understand your position and can recommend support services, such as respite care, and coping strategies. Do consult with your GP or a trusted team member before your own health is affected.

What is Fatigue?

The fatigue associated with brain injury or neuromuscular damage often appears more suddenly, lasts longer and takes longer to recover from than ordinary fatigue. Make no mistake, *it is real*, and not a case of mind over matter.

What Causes Fatigue?

Fatigue can occur for no apparent reason or after relatively mild exertion. It may be caused by physical activity, but is just as likely to occur as a result of mental activity.

Planning the week's errands, organising a work schedule, calculating a weekly budget or simply reading, can be very draining. We all experience this to some extent but for the person with brain injury, it happens more easily and much more frequently.

Strategies

Fatigue can be managed with good planning and rest periods, but first carers and the family member affected need to acknowledge that it is *real*.

Symptoms

The following symptoms may all suggest fatigue:

- > Withdrawal.
- > Loss of appetite.
- > Shortness of breath.
- > Slower movement and speech.
- > Short answers, quieter voice, a dull tone of voice.
- > Irritability, anxiety, crying episodes.
- > Increased forgetfulness.
- > Lack of motivation to plan for each day.
- > Lack of interest in things the person normally considers important (e.g. appearance, grooming).

Fatigue also intensifies symptoms experienced because of ABI or a neurological condition, such as:

- > Poor vision.
- > Slurred speech.
- > Difficulty finding words.
- > Poor concentration.
- > Cramps or weak muscles.
- > Poor coordination or balance.

The next step is to work out what triggers it and what factors make the symptoms worse, such as holding a demanding conversation for more than 10 minutes or watching a film with a complicated plot. You can then work together to develop strategies to conserve energy.

* Reproduced with permission from the BrainLink (2006) Carer's Guide (*For Those Who Care: A Practical Guide for Families of People with Neurological Conditions or Acquired Brain Injury*).

Contingency plans: Fatigue may occur at the least convenient times – on public transport or during a meeting. You need to negotiate ways of coping when this happens. You can use specific strategies or call in extra support. Work out contingency plans with your family member. Your neuropsychologist, occupational therapist or physiotherapist can help with suggestions.

Assess your environment: Provide an environment that is easy to move around and work in. Think about how and where things are stored, bench heights, entrances, types of furnishing, lighting. For example, some people may find fluorescent lighting or dim lighting more tiring.

Assess best hours: Some people function best in the mornings, so complete demanding tasks then. Others function better in the afternoon or the evening. Organise your routine accordingly.

Schedule rest periods: Make a daily or weekly schedule and include regular rest periods. “Rest” means *do nothing at all*.

Use aids: Use mechanical aids to conserve energy for when it really counts. One man spared his legs extra effort by using his wheelchair to get from his house to the car, then from the car to the church, before walking his daughter, the bride, down the aisle.

Break it down: Break down activities into a series of smaller tasks. This provides opportunities to rest while allowing the person to complete the task. Encourage sensible shortcuts.

Set priorities: Focus on things that must be done and let the others go.

Medication highs & lows: Be aware of changes throughout the day that relate to medication. Is the person better or worse immediately after their tablets? Plan their activities around these times.

Sleep: Encourage a regular sleeping pattern. Some people may also need a regular nap – or two – during the day.

Fitness: Your family member should maintain fitness within their individual ability, that is,

enough exercise to stay fit, but never to the point of causing tension, overtiredness or cramps.

Weight: Maintaining a healthy weight helps. If your family member’s condition affects their ability to eat, consult a dietician and speech pathologist to ensure they have a nutritious diet that is easy to manage (See Fact Sheet 8: *Eating and Swallowing Problems*).

Weather: Hot weather can also increase fatigue. Plan around this.

Seek support: Ask for advice. In particular, an occupational therapist can visit your home and advise on an energy-conserving plan of action.

Contacts

For more information, talk to your doctor or condition-specific support organisation (See Contacts pg 7).

Appendix 11.4

Gradually Increasing Physical Activity to Better Manage Fatigue



Gradually increasing physical activity to better manage fatigue



- Even if a physical activity can seem tiring, it is important to understand that practicing a regular physical activity adapted to your abilities will increase your energy in the long term;
- Proper supervision (e.g., by a physical trainer or kinesiologist) can help you figure out where to start and periodically adjust your goals;
- A program that is too demanding or moves too fast is much less likely to be successful;
- Any excessive activity beyond your physical capacities is not recommended;
- It is essential to begin with small-scale activities (e.g., 10-minute walk) and only very gradually increase their level while respecting your limits;
- If you are unable to finish a physical activity as planned, then the level is too demanding and it should be decreased. Ideally, you should be able to finish the activity even on a "bad day".

MY STARTING POINT (SET A REALISTIC GOAL FOR EVERY DAY, OR ALMOST EVERY DAY)

WEEK OF: _____

	PLANNED ACTIVITY, DURATION, DETAILS	ACTIVITY COMPLETED? OBSTACLES? SOLUTIONS?
MONDAY	→	→
TUESDAY	→	→
WEDNESDAY	→	→
THURSDAY	→	→
FRIDAY	→	→
SATURDAY	→	→
SUNDAY	→	→

Adapted from: Ouellet, M.-C., Beaulieu-Bonneau, S., Savard, J., & Morin, C. M. (2015). *Insomnie et fatigue après un traumatisme craniocérébral : Manuel d'évaluation et d'intervention.*



Gradually increasing physical activity to better manage fatigue

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- Proper supervision (e.g., by a physical trainer or kinesiologist) can help you figure out where to start and periodically adjust your goals;
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- It is essential to begin with small-scale activities (e.g., 10-minute walk) and only very gradually increase their level while respecting your limits;
- If you are unable to finish a physical activity as planned, then the level is too demanding and it should be decreased. Ideally, you should be able to finish the activity even on a "bad day".

MY STARTING POINT (SET A REALISTIC GOAL FOR EVERY DAY, OR ALMOST EVERY DAY)

WEEK OF: _____

	PLANNED ACTIVITY, DURATION, DETAILS	ACTIVITY COMPLETED? OBSTACLES? SOLUTIONS?
MONDAY	→	→
TUESDAY	→	→
WEDNESDAY	→	→
THURSDAY	→	→
FRIDAY	→	→
SATURDAY	→	→
SUNDAY	→	→

Adapted from: Ouellet, M.-C., Beaulieu-Bonneau, S., Savard, J., & Morin, C. M. (2015). *Insomnie et fatigue après un traumatisme craniocérébral : Manuel d'évaluation et d'intervention.*

Appendix 12.1

Components of the Vocational Evaluation Following mTBI*

Assessment of the Person

1. An **assessment of the person** should begin by gathering background information from the individual being evaluated regarding their educational and work history, work goals, self-perceptions of work performance, strengths, weaknesses and concerns.
2. This should be followed by a thorough assessment of the person in **physical, neuropsychological/cognitive, psychosocial, communication, functional domains**, and **work-related skills** and **behaviours** and consideration of these skills and abilities in relation to work goals and/or work demands. Please see [Table I](#) for a summary of the relevant areas within each personal domain.

Table I. Assessment of Person Domains

Domain	Element(s) Requiring Assessment
Physical	<ul style="list-style-type: none"> • Physical symptoms (e.g., headaches, fatigue, dizziness) • Sensory impairments/sensitivities (e.g., vision, hearing, smell) • Physical abilities and related work restrictions (e.g., *mobility/ambulation, upper extremity gross motor, dexterity and co-ordination, standing, bending, etc.)
Neuropsychological/ Cognitive	<ul style="list-style-type: none"> • Intelligence/pre-morbid functioning; academic achievement (where available) • Visual perception; praxis • Attention and concentration • Information processing • Memory • Insight, awareness and denial • Self-regulation; executive functions
Psychosocial	<ul style="list-style-type: none"> • Presence of mental health diagnoses (e.g., mood disorders, schizophrenia, substance abuse) • Ability to engage in and balance multiple roles and responsibilities, including meaningful non- work roles (e.g., parenting, volunteering) • Psychosocial adjustment and social adaptive skills (e.g., coping style/behaviours, self-esteem, self-confidence and self-efficacy, social appropriateness, ability to develop positive relationships with peers)
Communication	<ul style="list-style-type: none"> • Auditory perception and hearing • Speech production • Auditory and reading comprehension • Verbal and written expression • Conversation and non-verbal communication (e.g., facial expression, tone of voice, body posture) • Social communication and pragmatics (e.g., ability to understand and respond to verbal-social cues, modulate affect)
Functional	<ul style="list-style-type: none"> • Functional status and level of independence during task performance in the areas of self-care, household or community activities (e.g., meal preparation, financial) • Performance in unfamiliar tasks, those that require new learning and dual task performance • Speed, timing and accuracy of performance • Level of independence and need for structure • Monitoring, error detection and avoidance of critical errors • Strategy retrieval and use of feedback

* Adapted from Stergiou-Kita M, Dawson D, Rappolt S. Inter-professional clinical practice guideline for vocational evaluation following traumatic brain injury: a systematic and evidence-based approach. *Journal of Occupational Rehabilitation*. 2012;22(2):166-181.

Domain	Element(s) Requiring Assessment
Work-related Skills and Behaviours	<ul style="list-style-type: none"> How physical, cognitive, psychosocial, behavioural, communication impairments, identified in standardized assessments, affect performance of work-related tasks and duties Productivity (e.g., quality and quantity of work, ability to meet deadlines) Ability to management changes and problems encountered in work situations

Assessment of Occupation and Job Demands

- The evaluator should complete an assessment of the **occupational requirements** through the completion of a **job analysis**. This should include:
 - Identification of the occupational/job title/category/classification (e.g., National Occupational Classification, O'Net; Dictionary of Occupational Titles, DOT)
 - A description of the job
 - A description of job demands (See [Table II](#) below for summary of categories of job demands)

Table II. Job Demand Categories

Category	Examples
Physical	<ul style="list-style-type: none"> Lifting, carrying, pushing, stamina
Neuropsychological/ Cognitive	<ul style="list-style-type: none"> Initiation, problem-solving, decision-making, flexibility, adaptability
Psychological/ Emotional	<ul style="list-style-type: none"> Emotional stability
Behavioural Demands	<ul style="list-style-type: none"> Self-monitoring, changes in behaviours required
Communication	<ul style="list-style-type: none"> Verbal, non-verbal, written
Responsibilities and Expectations	<ul style="list-style-type: none"> Responsibilities related to own job, supervision of others, working with the public, customers, clients, level of independence required to complete job tasks
Work Time	<ul style="list-style-type: none"> Work hours, shifts, breaks, overtime
Safety Requirements	<ul style="list-style-type: none"> Related to equipment use, driving

Assessment of Work Environment and Environmental Supports

An assessment of the **work environment** and **environmental supports** and barriers to work or return to work should be completed. This should include an assessment of the: **a) physical workplace environment; b) workplace culture; c) supports and opportunities within the workplace and the individuals support network.**

- An assessment of the physical workplace environment should be completed.
- An assessment of the workplace culture should be completed.

Please see [Table III](#) for a summary of relevant physical and cultural elements of the workplace.

- An assessment of the **supports** (i.e., formal and informal) available within the workplace and the individual's support network should be completed. This should include: availability of accommodations and/or job modifications (e.g., work activities, hours, workstation modification, adaptive aids, devices and employment of compensatory strategies, supervision and identification of individual(s) able to provide on-going assessment and feedback re: work performance); availability of instrumental support (e.g., housekeeping) from natural community supports (e.g., family, volunteer or hired assistance); availability of vocational rehabilitation supports and services; availability of transportation services, if unable to drive

* Adapted from Stergiou-Kita M, Dawson D, Rappolt S. Inter-professional clinical practice guideline for vocational evaluation following traumatic brain injury: a systematic and evidence-based approach. *Journal of Occupational Rehabilitation*. 2012;22(2):166-181.

Table III. Physical and Cultural Workplace Elements

Physical Elements	<ul style="list-style-type: none"> • Light, noise, level of distractions • Temperature control • Outdoor/indoor work • Proximity to co-workers (e.g., in relation to both supports and possible distractions) • Proximity to supervision • Travel required (e.g., to and from work; associated with work demands) and its effect on work performance • Potential risks (e.g., heights, dangerous machinery, heavy lifting); • Length of working day and flexibility in work hours/schedule
Workplace Cultural Elements	<ul style="list-style-type: none"> • Tolerances for differences amongst employees • Positive attitudes towards individuals with disabilities (e.g., an environment free of harassment and discrimination) • An understanding of or willingness to learn about TBI • A willingness to involve employment specialists in a collaborative work planning process • Opportunities for social participation and team work

* Adapted from Stergiou-Kita M, Dawson D, Rappolt S. Inter-professional clinical practice guideline for vocational evaluation following traumatic brain injury: a systematic and evidence-based approach. *Journal of Occupational Rehabilitation*. 2012;22(2):166-181.

Appendix 12.2

Example Concussion/mTBI Accessibility Intake Package for Student Services/Special Needs Department*

Student Information Form **For Students with Acquired Brain Injury or Concussion**

Last name: _____

First name: _____

University of Toronto Student Number: _____

University of Toronto Email: _____

Telephone:

Home: (____) _____

Mobile: (____) _____

May we leave a message? Please circle below

Yes No Name and Number only

Yes No Name and Number only

1. What is your present status at the University of Toronto? (Check all that apply)

Undergraduate Student

Degree/Program: _____

Professional Faculty: _____

College (if an Arts & Science student): _____

Graduate Student

Degree/Program: _____

Professional Faculty: _____

Access Programs: Academic Bridging Program: _____ Transitional Year Program: _____

Other (e.g., Non-Degree, Visiting) Specify: _____

Income Student starting: _____ (e.g., Fall 2016, Winter 2017, etc.)

2. Have you registered with out service before? Yes No

If yes, who was your Disability Counsellor? _____

3. Are you an International Student? Yes No

If yes, please provide your home country _____

* Adapted from the Accessibility Services: Registration for New Students for the University of Toronto.

4. If you are a Canadian student, please provide your home province. _____

5. Who referred you to Accessibility Services? _____

6. Do you require accommodation of any kind to participate in an intake interview with a Disability Counsellor?

- Yes
- No

If yes, please indicate the type of accommodation:

7. What assistance are you seeking from Accessibility Services?

8. Please indicate the category of disability/ies:

- Chronic Health Issue (e.g., epilepsy, irritable bowel disorders, migraines)
- Head Injury (e.g., concussion, traumatic brain injury)
- Learning Disability or Attention Deficit Hyperactivity Disorder (ADHD)
- Autism Spectrum Disorder (ASD)
- Mental Health Issue (e.g., anxiety, bi-polar, depression, disordered eating, OCD)
- Mobility / Functional Issue (e.g., use of a mobility device, repetitive strain injuries)
- Sensory Issue (e.g., legally blind, low vision, d/Deaf, hard of hearing)
- Temporary (please describe) _____

9. Describe your disability/ies in your own words.

10. Is your disability (please check one):

- Permanent
- Progressive
- Temporary
- In the process of being assessed

11. Do you use an assistive mobility device? Yes No

If yes, please specify: Power/manual wheelchair Walker Cane

12. Do you require any on-campus residence related accommodations? Yes No

If so, please provide more information about your needs:

13. If you're seeking accommodation for any medication-related side effects, please provide information about how your medication impacts you:

* Adapted from the Accessibility Services: Registration for New Students for the University of Toronto.

14. Has anyone ever told you that you may have a learning disability? Yes No

15. Did you recently (within 2 years) complete high school or studies at another educational institution?

Yes No

If yes, please provide name of the educational institution: _____

If yes, please provide any disability-related accommodations you received at that educational institution (if any):

16. How has your disability most recently impacted your academic functioning?

- Difficulty meeting deadlines and/or time management
- Concentration, focus, or attention issues
- Absences
- Difficulty completing required readings and/or understanding course material
- Difficulty with math
- Difficulty with presentations
- Difficulty with writing and/or academic writing and research
- Difficulty writing tests or exams

17. How has your disability most recently impacted your academic functioning? (continued)

Not meeting academic potential

Other (please explain) _____

18. What strategies do you use to manage the impact of your disability/ies on your academic functioning?

- Academic Coach
- Adaptive Technology/Equipment
- Counselling/Therapy
- Exercise/Meditation
- Massage therapy
- Medication
- Physiotherapy
- Tutoring
- Other (Please describe) _____

19. Do you receive or have you applied for provincial financial aid? (For example: Ontario Student Assistance Program – OSAP)? Yes No

If yes, are you eligible to receive provincial financial aid? Yes No

20. What are your reasons for attending the University of Toronto? What are your academic or career goals?

21. Do you have additional comments or questions? (If so, please add them in space below.)

* Adapted from the Accessibility Services: Registration for New Students for the University of Toronto.

Documentation for Students with an Acquired Brain Injury/Concussion

Accessibility/Disability Services provides support for students with documented disabilities, including those with Temporary Disabilities. If you have sustained an injury that limits your ability to attend to your academic responsibilities, you may be eligible to receive alternative accommodations and support from Accessibility Services. In order to determine your eligibility, contact our office as soon as possible and an appointment will be arranged. Accessibility Services requires documentation to verify your injury, which is important to bring to your first appointment.

Please include the documentation completed by a physician, neurologist, neurosurgeon, psychologist or neuropsychologist with the following information:

- Date of Injury
- Diagnosis and/or detailed description of injury
- Treatment plan
- Prescribed and over-the-counter medications with dosages
- Anticipated length of recovery

Please also note:

- If complications arise, or recovery takes longer than anticipated, students will be asked to provide additional documentation. If cognitive related challenges persist after one year post-injury, neuropsychological/cognitive assessment results will be needed to assist with accommodation planning. An adult cognitive assessment will be required for brain injuries sustained in childhood or adolescence with regards to residual cognitive challenges to help guide accommodations at the post-secondary level. Student may be eligible for a bursary/funding to assist with the costs of obtaining this type of assessment. Speak to your disability counsellor for further details.

* Adapted from the Accessibility Services: Registration for New Students for the University of Toronto.

Medical Certificate for Acquired Brain Injury/Concussion-Related Issues

Dear Healthcare Practitioner,

This student is requesting disability-related supports and accommodations while studying at the University. The student is required to provide the University with documentation that is:

- provided by a licensed health-care practitioner, qualified in the appropriate specialty
- thorough enough to support the accommodations being considered or requested

Note: The provision of all reasonable accommodations and services is assessed based on the current impact of the disability on academic performance. A diagnosis is requested but not required for students to receive academic accommodations, however, a confirmation of disability and an understanding of the functional limitations is required.

CONFIDENTIALITY

The collection, use, and disclosure of this information resides under the guidelines of the Freedom of Information and Protection of Privacy Act (FIPPA). Under this legislation information may be shared on a need to know basis if it is required by another staff member in order to fulfill the responsibilities of their position. The documentation will be kept for a period of ten years.

To be completed by a regulated Healthcare Practitioner – Please Print Clearly

Patient's Name: _____

Patient's University Student Number: _____

Date of Birth: ____/____/____ (Year, Month, Day)

How long have you been treating this patient? _____

Last date of Clinical Assessment: _____

Statement of Disability:

Please indicate the appropriate statement for this student in the current academic setting:

Permanent disability with on-going (chronic or episodic) symptoms (that will significantly impact the student over the course of their academic career). This functional limitation is expected to remain with you for the rest of your life.

Temporary with anticipated duration from ____/____/____ to ____/____/____ (Year, Month, Day)
*If unknown, please indicate reasonable duration for which s/he should be accommodated/supported at this time (please specify number of weeks/months or list the next date you will review the symptoms). _____

* Adapted from the Accessibility Services: Registration for New Students for the University of Toronto.

Functional Impacts of Injury and Concurrent Conditions:

Date of Brain Injury/Concussion: _____

Description of Injury: _____

The provision of a diagnosis in the documentation is requested but not required, however, disability documentation must still confirm the student's type of disability and the functional limitations. If the student consents, please provide a clear diagnostic statement; avoiding such terms as "suggests" or "is indicative of". If the diagnostic criteria are not present, this must be stated in the report.

Please note any FUNCTIONAL LIMITATION or concurrent conditions.

Please note all applicable:

Primary:

Secondary:

Additional / Other:

Impacts:

Medication(s):

Potential side effects of medication(s) on academic performance:

Anticipated Date of Recovery: _____

Current treatment: (Check all that apply)

- Physiotherapy
- Chiropractic treatment
- Massage therapy
- Occupational therapy
- Speech language therapy
- Outpatient ABI treatment program
- Counselling
- Neuropsychological Assessment/Counselling
- Other _____

* Adapted from the Accessibility Services: Registration for New Students for the University of Toronto.

Healthcare Practitioner Information

Name of Healthcare Practitioner: (Please Print) _____

Signature: _____

Date:(DD/MM/YY): ____ / ____ / ____

Area of Specialization and License/Registration #: _____

- Physician
- Occupational Therapist
- Psychiatrist
- Sports Medicine Specialist
- Neurologist
- Neuropsychologist
- Psychologist
- Speech Pathologist
- Other

Facility/Clinic/Practice Name and Address: (Please use office stamp)

* Adapted from the Accessibility Services: Registration for New Students for the University of Toronto.

Release of Information

TO BE COMPLETED BY STUDENT

I, _____, hereby authorize _____ to provide
(Student) (Name of Healthcare Practitioner)

the following information to Accessibility/Disability Services at the University and if required, to supply additional information relating to the provision of my academic accommodations and disability-related services. I understand that I am not required to disclose a diagnosis to receive academic accommodations and services. I also understand that documentation to provide a verification of a disability and the functional limitations is required. I authorize Accessibility/Disability Services to contact the Healthcare Practitioner to discuss the provision of accommodations.

I understand that any medical information provided from my healthcare provider resides under the guidelines under the Freedom of Information and Protection of Privacy Act (FIPPA). Under this legislation necessary information may be shared on a need to know basis if it is required by another U of T staff member in order to fulfill the responsibilities of their position.

Student's Signature: _____

University Student Number: _____

Date: _____

* Adapted from the Accessibility Services: Registration for New Students for the University of Toronto.

Appendix 12.3

Greater Accommodations for Students with Persistent Symptoms following mTBI

<p>Activities</p>	<ul style="list-style-type: none"> Students with prolonged symptoms should not participate in any academic activity with physical or safety demands including: attending lectures, participating in lab work, physical activities with other students, clinical placements/ practicums or trades work, until cleared by a physician or a neuropsychologist. <ul style="list-style-type: none"> To decrease social isolation and or anxiety/ depression and to support inclusion and optimism, students should be allowed to audit classes or return to a class as part of a phased return to studies. There should not be an expectation that they will take notes, actively participate or complete any evaluations including tests, exams, written assignments, group projects/presentations or physical tasks. Students should be allowed/encouraged to pace their involvement initially by only attending part of a class or leaving for a period of time to a quiet area outside of class. Students should have limited computer (and tablet) demands initially as screens are often a trigger for cognitive fatigue and headaches.
<p>Curriculum (cn'td on next page)</p>	<ul style="list-style-type: none"> The gradual return should be implemented by the student, the instructor/ professor, student's healthcare team, their Accessibility Advisor and their program of study. The student is still required to demonstrate all the essential learning and evaluations (although the way in which they are administered may differ). A reduced course load may be beneficial and or necessary if the student is experiencing ongoing symptoms. For prolonged periods of absence of classes, students may need to withdraw or seek petitions to defer term work or examinations. Students should be encouraged to catch up on all missed work before enrolling in new/ additional courses. <p>Course Work</p> <ul style="list-style-type: none"> The student should gradually return to course work beginning with reading course material with breaks and cognitive pacing. Initial return to class should include attending lectures (receiving class notes or recording lectures) followed by taking notes in class (potentially with assistance of adaptive technology, e.g., Livescribe or iPad). <ul style="list-style-type: none"> *The student may require hoods, hats or sunglasses to be worn in class. The student may then recommence evaluations with written assignments. A plan should be put in place to help the student catch up on missed assignments (e.g., extensions) with a paced schedule of revised due dates until a student can complete this work. Depending on time remaining in the term, a student may need to petition for extension of term work beyond the semester. Consideration should also be given to the following: <ul style="list-style-type: none"> Amount and complexity of reading required Memory load (e.g., are there expectations for remembering formulas) Sustained and divided attention demands Computer time and expectations Processing of large amounts, and or complex information Speed of processing "Catching up" - attempt to emphasize only vital assignments and course content needed for successful completion of course. Consideration should be given to waiving 'non critical' assignments and tests during the catch-up process where possible

<p>Curriculum (cn'td)</p>	<p>Examinations</p> <ul style="list-style-type: none"> • Mid-terms/final exams may need to be deferred until the student is prepared to take them and precautionary accommodations are put in place for the testing. • Initial tests should be written with accommodations as a safety net until they have had evaluations that demonstrate they have returned to baseline. For prolonged symptoms, a neuropsychological assessment will help identify ongoing accommodations. • Once the student is able to return to examinations, the student may benefit from accommodations for testing such as: <ul style="list-style-type: none"> • Written advanced notice of tests • A review sheet of what will be included on test • The option for oral testing • Writing tests in a quiet private room • Allowing testing in natural light situations, or with a lamp instead of fluorescent lighting (to reduce light sensitivity) • 12 noon start time for tests • Extra time, e.g., 1.5x regular and regular “stopped clock” breaks (not included in examination time) • Chunking of longer tests into short sections written at different times • De-cluttered test format (i.e., not too many questions or information on each page to facilitate easy visual scanning and reduce processing demands, printed in larger font) • Provision of formula and data sheets to reduce memory load (if not being tested on itself) • Use of a computer to type answers with screen shield on computer • Use of reduced contrast coloured (e.g., light blue) paper for exams • Return to class but deferral of examinations to next exam period
<p>Environment</p>	<ul style="list-style-type: none"> • Upon initial return, the student may benefit from having various environmental accommodations to reduce the cognitive burden (e.g., preferential seating, studying/testing in a quiet room, extra time to complete tasks and regular breaks).
<p>Timetable</p>	<ul style="list-style-type: none"> • If the student is experiencing fatigue and or sleep disturbance, the initial return should be tailored to late morning and or early afternoon.

Appendix 12.4

Managing Your Return to Post-Secondary Activities: Package Template and Activity Log

Name of Student: _____ Current Date: _____
Identification Number: _____
Date of Birth: _____

Injury Description

1. Did the injury occur before or after you arrived at your post-secondary institution? Yes No
 - a. Did you sustain a direct blow to the head or indirectly through other forces: Direct Indirect Unknown
 - b. Is there evidence of intracranial injury or skull fracture? Yes No Unknown
 - c. If forces were sustained directly to your head, what was the location:
Frontal Left Temporal Right Temporal Left Parietal Right Parietal Occipital Neck
2. Cause of injury:
Motor Vehicle Collision (MVC), Pedestrian-MVC, Bicycle Fall, Assault, Sports (Specify) _____
Other _____
3. Did you sustain in disruption in your memory for events:
 - a. Do you remember the impact and/or event (i.e., loss of consciousness or conscious awareness)?
 - b. Are there any events from before the injury that you do not remember (i.e., what you were doing just prior to the impact of event)? Yes No
If yes, then duration: _____
 - c. Are there any events from after in the injury that you do not remember, (i.e., what happened after the impact or event)? Yes No
If yes, then duration: _____
 - d. Any immediate symptoms of balance problems, being dazed, confused, unaware of where you were?
Yes No
If yes, then describe: _____
4. Were seizures observed or reported? Yes No

Current Activities

1. What is your academic status? Full Time Part Time Transitional Other _____
2. Do you have co-operative placements? Yes No
3. Do you have practical placements or labs related to your courses? Yes No
 - a. If yes, do you work with equipment, chemicals or other potential hazards? Yes No
4. Do you participate in extra-curricular activities either at post-secondary school or outside of school? Yes No
 - a. If yes, what activities do you participate in? Include clubs, intramural sports, varsity sports, student government, residence staff, residence and faculty representation, employment, and anything else you participate in at or outside of school apart from your classes. Describe your role in each of these commitments.

5. Have you attended class since your injury? Yes No

a. If yes, have you experienced any of the following ***more than usual?***

(Circle any of the items below if they are ***NEW*** symptoms since your injury or worsened since your injury)

a.	Nervousness before tests	Worsened	New
b.	Feeling overwhelmed when studying	Worsened	New
c.	Difficulty paying attention while studying	Worsened	New
d.	Procrastination	Worsened	New
e.	Not understanding assignments	Worsened	New
f.	Forgetting lessons/lectures	Worsened	New
g.	Difficulties with time management	Worsened	New
h.	Unable to manage your regular schedule of events	Worsened	New
i.	Feeling nervous and anxious	Worsened	New
j.	Feeling very sad and sdepressed	Worsened	New
k.	Unusual sense of irritability	Worsened	New
l.	Difficulty being around people	Worsened	New
m.	Problems maintaining regular friendships	Worsened	New
n.	Experiencing strained friendships and/or relationships	Worsened	New
o.	Unusually tired	Worsened	New
p.	Dizzy or light-headed	Worsened	New
q.	Headaches	Worsened	New
r.	Difficulties maintaining physical balance (i.e., feeling unsteady)	Worsened	New
s.	Sensitivity to light	Worsened	New
t.	Sensitivity to noise	Worsened	New

Please follow **Algorithm 12.2** to manage return to school and return to extra-curricular activities.

Use the following symptom/activity monitoring log to monitor your symptoms to facilitate your return-to-school and other activities:

Symptom Intensity: 1 = low intensity; 10 = highest intensity							
Symptomatic? (Yes or no) If yes, list symptoms.							
Alone? (Yes or no) If yes, number of people present?							
Activity: (e.g., class, homework, extra-curricular, work, home, lab, shop, waiting for bus, with friends, etc.)							
Time:							
Date:							

Appendix 12.5

Acute Concussion Evaluation (ACE) Care Plan - Work Version



ACUTE CONCUSSION EVALUATION (ACE) CARE PLAN

Gerard Gioia, PhD¹ & Micky Collins, PhD²
¹Children's National Medical Center
²University of Pittsburgh Medical Center

Patient Name: _____
DOB: _____ Age: _____
Date: _____ ID/MR# _____
Date of Injury: _____

You have been diagnosed with a concussion (also known as a mild traumatic brain injury). This personal plan is based on your symptoms and is designed to help speed your recovery. Your careful attention to it can also prevent further injury.

Rest is the key. You should not participate in any high risk activities (e.g., sports, physical education (PE), riding a bike, etc.) if you still have any of the symptoms below. It is important to limit activities that require a lot of thinking or concentration (homework, job-related activities), as this can also make your symptoms worse. If you no longer have any symptoms and believe that your concentration and thinking are back to normal, you can slowly and carefully return to your daily activities. Children and teenagers will need help from their parents, teachers, coaches, or athletic trainers to help monitor their recovery and return to activities.

Today the following symptoms are present (circle or check).				___ No reported symptoms
Physical		Thinking	Emotional	Sleep
Headaches	Sensitivity to light	Feeling mentally foggy	Irritability	Drowsiness
Nausea	Sensitivity to noise	Problems concentrating	Sadness	Sleeping more than usual
Fatigue	Numbness/Tingling	Problems remembering	Feeling more emotional	Sleeping less than usual
Visual problems	Vomiting	Feeling more slowed down	Nervousness	Trouble falling asleep
Balance Problems	Dizziness			

RED FLAGS: Call your doctor or go to your emergency department if you suddenly experience any of the following			
Headaches that <u>worsen</u>	Look <u>very</u> drowsy, can't be awakened	Can't <u>recognize</u> people or places	Unusual behavior change
Seizures	<u>Repeated</u> vomiting	Increasing confusion	Increasing irritability
Neck pain	Slurred speech	Weakness or numbness in arms or legs	Loss of consciousness

Returning to Daily Activities

1. Get lots of rest. Be sure to get enough sleep at night- no late nights. Keep the same bedtime weekdays and weekends.
2. Take daytime naps or rest breaks when you feel tired or fatigued.
3. **Limit physical activity as well as activities that require a lot of thinking or concentration. These activities can make symptoms worse.**
 - Physical activity includes PE, sports practices, weight-training, running, exercising, heavy lifting, etc.
 - Thinking and concentration activities (e.g., homework, classwork load, job-related activity).
4. Drink lots of fluids and eat carbohydrates or protein to main appropriate blood sugar levels.
5. **As symptoms decrease, you may begin to gradually return to your daily activities. If symptoms worsen or return, lessen your activities, then try again to increase your activities gradually.**
6. During recovery, it is normal to feel frustrated and sad when you do not feel right and you can't be as active as usual.
7. Repeated evaluation of your symptoms is recommended to help guide recovery.

Returning to Work

1. Planning to return to work should be based upon careful attention to symptoms and under the supervision of an appropriate health care professional.
2. Limiting the amount of work you do soon after your injury, may help speed your recovery. It is very important to get a lot of rest. You should also reduce your physical activity as well as activities that require a lot of thinking or concentration.
 - ___ Do not return to work. Return on (date) _____.
 - ___ Return to work with the following supports. Review on (date) _____.

Schedule Considerations

- ___ Shortened work day _____ hours
- ___ Allow for breaks when symptoms worsen
- ___ Reduced task assignments and responsibilities

Safety Considerations

- ___ No driving
- ___ No heavy lifting or working with machinery
- ___ No heights due to possible dizziness, balance problems

This form is part of the "Heads Up: Brain Injury in Your Practice" tool kit developed by the Centers for Disease Control and Prevention (CDC).

WORK VERSION

Returning to Sports

1. **You should NEVER return to play if you still have ANY symptoms** – (Be sure that you do not have any symptoms at rest and while doing any physical activity and/or activities that require a lot of thinking or concentration.)
2. Be sure that the PE teacher, coach, and/or athletic trainer are aware of your injury and symptoms.
3. It is normal to feel frustrated, sad and even angry because you cannot return to sports right away. With any injury, a full recovery will reduce the chances of getting hurt again. It is better to miss one or two games than the whole season.

The following are recommended at the present time:

Do not return to PE class at this time

Return to PE class

Do not return to sports practices/games at this time

Gradual return to sports practices under the supervision of an appropriate health care provider.

- Return to play should occur in gradual steps beginning with aerobic exercise only to increase your heart rate (e.g., stationary cycle); moving to increasing your heart rate with movement (e.g., running); then adding controlled contact if appropriate; and finally return to sports competition.
- Pay careful attention to your symptoms and your thinking and concentration skills at each stage of activity. Move to the next level of activity only if you do not experience any symptoms at the each level. If your symptoms return, stop these activities and let your health care professional know. Once you have not experienced symptoms for a minimum of 24 hours and you receive permission from your health care professional, you should start again at the previous step of the return to play plan.

Gradual Return to Play Plan

1. No physical activity
2. Low levels of physical activity (i.e., *symptoms do not come back during or after the activity*). This includes walking, light jogging, light stationary biking, light weightlifting (lower weight, higher reps, no bench, no squat).
3. Moderate levels of physical activity with body/head movement. This includes moderate jogging, brief running, moderate-intensity stationary biking, moderate-intensity weightlifting (reduced time and/or reduced weight from your typical routine).
4. Heavy non-contact physical activity. This includes sprinting/running, high-intensity stationary biking, regular weightlifting routine, non-contact sport-specific drills (in 3 planes of movement).
5. Full contact in controlled practice.
6. Full contact in game play.

*Neuropsychological testing can provide valuable information to assist physicians with treatment planning, such as return to play decisions.

This referral plan is based on today's evaluation:

Return to this office. Date/Time _____

Refer to: Neurosurgery _____ Neurology _____ Sports Medicine _____ Psychiatrist _____ Other _____

Refer for neuropsychological testing

Other _____

ACE Care Plan Completed by: _____ **MD RN NP PhD ATC**

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Appendix 12.6

Acute Concussion Evaluation (ACE) Care Plan - School Version



ACUTE CONCUSSION EVALUATION (ACE) CARE PLAN

Gerard Gioia, PhD¹ & Micky Collins, PhD²
¹Children's National Medical Center
²University of Pittsburgh Medical Center

Patient Name: _____
 DOB: _____ Age: _____
 Date: _____ ID/MR# _____
 Date of Injury: _____

You have been diagnosed with a concussion (also known as a mild traumatic brain injury). This personal plan is based on your symptoms and is designed to help speed your recovery. Your careful attention to it can also prevent further injury.

You should not participate in any high risk activities (e.g., sports, physical education (PE), riding a bike, etc.) if you still have any of the symptoms below. It is important to limit activities that require a lot of thinking or concentration (homework, job-related activities), as this can also make your symptoms worse. If you no longer have any symptoms and believe that your concentration and thinking are back to normal, you can slowly and carefully return to your daily activities. Children and teenagers will need help from their parents, teachers, coaches, or athletic trainers to help monitor their recovery and return to activities.

Today the following symptoms are present (circle or check).				No reported symptoms
Physical		Thinking	Emotional	Sleep
Headaches	Sensitivity to light	Feeling mentally foggy	Irritability	Drowsiness
Nausea	Sensitivity to noise	Problems concentrating	Sadness	Sleeping more than usual
Fatigue	Numbness/Tingling	Problems remembering	Feeling more emotional	Sleeping less than usual
Visual problems	Vomiting	Feeling more slowed down	Nervousness	Trouble falling asleep
Balance Problems	Dizziness			

RED FLAGS: Call your doctor or go to your emergency department if you suddenly experience any of the following			
Headaches that <u>worsen</u>	Look <u>very</u> drowsy, can't be awakened	Can't <u>recognize</u> people or places	Unusual behavior change
Seizures	<u>Repeated</u> vomiting	Increasing confusion	Increasing irritability
Neck pain	Slurred speech	Weakness or numbness in arms or legs	Loss of consciousness

Returning to Daily Activities

1. Get lots of rest. Be sure to get enough sleep at night- no late nights. Keep the same bedtime weekdays and weekends.
2. Take daytime naps or rest breaks when you feel tired or fatigued.
3. **Limit physical activity as well as activities that require a lot of thinking or concentration. These activities can make symptoms worse.**
 - Physical activity includes PE, sports practices, weight-training, running, exercising, heavy lifting, etc.
 - Thinking and concentration activities (e.g., homework, classwork load, job-related activity).
4. Drink lots of fluids and eat carbohydrates or protein to main appropriate blood sugar levels.
5. **As symptoms decrease, you may begin to gradually return to your daily activities. If symptoms worsen or return, lessen your activities, then try again to increase your activities gradually.**
6. During recovery, it is normal to feel frustrated and sad when you do not feel right and you can't be as active as usual.
7. Repeated evaluation of your symptoms is recommended to help guide recovery.

Returning to School

1. If you (or your child) are still having symptoms of concussion you may need extra help to perform school-related activities. As your (or your child's) symptoms decrease during recovery, the extra help or supports can be removed gradually.
2. Inform the teacher(s), school nurse, school psychologist or counselor, and administrator(s) about your (or your child's) injury and symptoms. School personnel should be instructed to watch for:
 - Increased problems paying attention or concentrating
 - Increased problems remembering or learning new information
 - Longer time needed to complete tasks or assignments
 - Greater irritability, less able to cope with stress
 - Symptoms worsen (e.g., headache, tiredness) when doing schoolwork

~Continued on back page~

This form is part of the "Heads Up: Brain Injury in Your Practice" tool kit developed by the Centers for Disease Control and Prevention (CDC).

Returning to School (Continued)

Until you (or your child) have fully recovered, the following supports are recommended: *(check all that apply)*

- No return to school. Return on (date) _____
- Return to school with following supports. Review on (date) _____
- Shortened day. Recommend _____ hours per day until (date) _____
- Shortened classes (i.e., rest breaks during classes). Maximum class length: _____ minutes.
- Allow extra time to complete coursework/assignments and tests.
- Lessen homework load by _____%. Maximum length of nightly homework: _____ minutes.
- No significant classroom or standardized testing at this time.
- Check for the return of symptoms (use symptom table on front page of this form) when doing activities that require a lot of attention or concentration.
- Take rest breaks during the day as needed.
- Request meeting of 504 or School Management Team to discuss this plan and needed supports.

Returning to Sports

1. **You should NEVER return to play if you still have ANY symptoms** – (Be sure that you do not have any symptoms at rest and while doing any physical activity and/or activities that require a lot of thinking or concentration.)
2. Be sure that the PE teacher, coach, and/or athletic trainer are aware of your injury and symptoms.
3. It is normal to feel frustrated, sad and even angry because you cannot return to sports right away. With any injury, a full recovery will reduce the chances of getting hurt again. It is better to miss one or two games than the whole season.

The following are recommended at the present time:

- Do not return to PE class at this time
- Return to PE class
- Do not return to sports practices/games at this time
- Gradual** return to sports practices under the supervision of an appropriate health care provider.
- Return to play should occur in gradual steps beginning with aerobic exercise only to increase your heart rate (e.g., stationary cycle); moving to increasing your heart rate with movement (e.g., running); then adding controlled contact if appropriate; and finally return to sports competition.
 - Pay careful attention to your symptoms and your thinking and concentration skills at each stage of activity. Move to the next level of activity only if you do not experience any symptoms at the each level. If your symptoms return, stop these activities and let your health care professional know. Once you have not experienced symptoms for a minimum of 24 hours and you receive permission from your health care professional, you should start again at the previous step of the return to play plan.

Gradual Return to Play Plan

1. No physical activity
2. Low levels of physical activity (i.e.,). This includes walking, light jogging, light stationary biking, light weightlifting (lower weight, higher reps, no bench, no squat).
3. Moderate levels of physical activity with body/head movement. This includes moderate jogging, brief running, moderate-intensity stationary biking, moderate-intensity weightlifting (reduced time and/or reduced weight from your typical routine).
4. Heavy non-contact physical activity. This includes sprinting/running, high-intensity stationary biking, regular weightlifting routine, non-contact sport-specific drills (in 3 planes of movement).
5. Full contact in controlled practice.
6. Full contact in game play.

*Neuropsychological testing can provide valuable information to assist physicians with treatment planning, such as return to play decisions.

This referral plan is based on today's evaluation:

- Return to this office. Date/Time _____
- Refer to: Neurosurgery _____ Neurology _____ Sports Medicine _____ Psychiatrist _____ Other _____
- Refer for neuropsychological testing
- Other _____

ACE Care Plan Completed by: _____ **MD RN NP PhD ATC**

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Appendix A

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* The recommendations in this document are those of the Ontario Neurotrauma Foundation, identified by the guideline development team and expert consensus group members, and do not necessarily represent agreement of or endorsement by the Centers for Disease Control and Prevention.

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Abbreviations

ENAO	Emergency Nurses Association of Ontario
INESSS	Institut national d'excellence en santé et en services sociaux
ONF	Ontario Neurotrauma Foundation
OBIA	Ontario Brain Injury Association
WSIB	Workplace Safety and Insurance Board

Appendix C

Conflicts of Interest

At the beginning of the guideline development process, members of the guideline development team and the expert consensus group were asked to declare any possible conflicts of interest.

Eleven members of the expert consensus group reported that within the last five years, they have been employed by a guideline developer or an entity having a commercial interest in the guideline.

Two members of the expert consensus group reported that within the last five years, they have served as a consultant for a guideline developer or an entity having a commercial interest in the guideline.

Three members of the expert consensus group reported that they have ownership interests (including stock options) in an entity having a commercial interest in the guideline.

Two members of the expert consensus group reported that they currently or previously received funding from an entity that has a commercial interest in the guideline.

Two members of the expert consensus group reported that have been paid honouraria or received gifts from a guideline developer or an entity having a commercial interest in the guideline.

One of the expert consensus group members stated that they are a member of the Insurance Bureau of Canada and a member of the Financial Services Commission in Ontario, both of which are working groups focusing on managing various injuries and impairments in the automobile insurance sector in Canada and Ontario, respectively.

Twenty-five members of the expert consensus group reported relevant financial activities outside the guideline of interest.

None of the conflicts of interests stated above were deemed significant to the guideline. All other members declared no research involvement, funding, honoraria or other conflicts of interest.

For more specific information regarding conflicts of interest, please contact the Ontario Neurotrauma Foundation.

POLICY FOR DECLARATION OF AFFILIATIONS AND INTERESTS

Guidelines for the Management of Concussion/Mild Traumatic Brain Injury & Prolonged Symptoms: Third Edition

Updating Guidelines for Concussion/mTBI Study

This Ontario Neurotrauma Foundation funded project includes the formal evaluation of the *Guidelines for the Management of Concussion/Mild Traumatic Brain Injury & Persistent Symptoms: Second Edition* to create newly revised and updated recommendations: *Guidelines for the Management of Concussion/Mild Traumatic Brain Injury & Prolonged Symptoms: Third Edition*. Initially, the methodology will consist of an extensive literature review of appropriate studies pertaining to diagnosing, assessing, managing and treating concussion/mTBI and prolonged symptoms. After completing an assessment of the bias and quality of the literature, the findings will be discussed in a number of online meetings and used as evidence for a guideline development consensus meeting to revise the current ONF guidelines. The proposed guideline updates will then be reviewed for input from a variety of end-users, including individuals and groups likely to benefit from and/or utilize the guidelines. Consensus group members should benefit from each other's knowledge and expertise based on their individual research and/or clinical experience. In addition to updating the current ONF guidelines, recently published literature, relevant discussions and recommendation updates will be used to create a new, first edition patient centered version of the guidelines. Investigators of the study acknowledge that at each step of this process there is potential for conflict of interest (COI), which might bias the recommendations. In theory, at the literature review stage, Investigators might have to review and rate their own studies. Moreover, at the guideline dissemination and end-user review stage, individuals who are highly knowledgeable and involved with concussions/mTBIs might be seen as potentially biased by the constituency and/or specialty they are affiliated with. As a result, the Investigators of the study have concluded that a policy of **complete** disclosure of all **potential** COIs must be implemented to ensure the most unbiased and generalizable guidelines. Thus, end-users of the guidelines can have confidence in the integrity of the steps the research team followed while revising and updating the recommendations. This also protects the reputations of research team members as highly regarded clinicians and researchers.

The general methods to report and deal with potential COIs will follow the recommendations of:

- The Cochrane Collaboration (May 2014): published on the Cochrane Community (beta) website at <http://community.cochrane.org>;
- The ADAPTE Collaboration (2009): published in "Guideline Adaptation: A Resource Toolkit", Version 2.0, available at <http://www.g-i-n.net/document-store/working-groups-documents/adaptation/adapte-resource-toolkit-guideline-adaptation-2-0.pdf>;
- The GIN-McMaster Guideline Development Checklist (Version: June 2, 2014): published by the Guidelines International Network (GIN) and McMaster University, available at <http://cebgrade.mcmaster.ca/guidecheck.html>
- The Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2, 2014), available at <http://www.pre.ethics.gc.ca/eng/policy-politique/initiatives/tcps2-eptc2/chapter7-chapitre7/>
- The Conflict of Interest Policies of:
 - The U.S. Preventive Services Task Force (USPTF, 2014): available at <http://www.uspreventiveservicestaskforce.org/Page/Name/procedure-manual---section-1>
 - The Canadian Task Force on Preventive Health Care (CTFPHC, 2014): available at <http://canadiantaskforce.ca/methods/procedural-manual/>

DEFINITIONS

- **Research Team Member:** An individual who has chosen to participate in the consensus group, involved in the research process, and any persons involved in the evaluation and review.
- **Conflict of Interest Membership:** Dr. Shawn Marshall (Principal Investigator) will be responsible for actions taken by this membership and Chantal Rockwell (Project Coordinator) will be the other member involved.
- **Conflicts of Interest:** We adopt the TCPS 2 definition of a "conflict of interest", which states that:

A conflict of interest may arise when activities or situations place an individual in a real, potential or perceived conflict between the duties or responsibilities related to research, and personal,

institutional or other interests. Research team members' conflicts of interest may arise from interpersonal relationships (e.g., family or community relationships), financial partnerships, other economic interests (e.g., spin-off companies in which researchers have stakes or private contract research outside of the academic realm), academic interests or any other incentives that may compromise integrity or respect for the core principles of this Policy. Conflicts may arise from an individual's involvement in dual and multiple roles within or outside an institution. While it may not be possible to eliminate all conflicts of interest, research team members are expected to identify, minimize or otherwise manage their individual conflicts. (TCPS 2, 2014)

CONFLICT OF INTEREST DECLARATION PROCEDURE FOR RESEARCH TEAM MEMBERS

The determination of conflicts of interest of team members in this study will involve the implementation of two processes:

1. All group members will review this policy and complete a Conflict of Interest Declaration Form; and
2. Review by the COI Project Coordinator and Principal Investigator of the completed Conflict of Interest Declaration Forms and determination of appropriate actions.

Process for the Disclosure of Potential Conflicts of Interest

- All participants will complete the attached Conflict of Interest Declaration Form, in which they are required to provide a full disclosure of information on intellectual, financial or other potential COIs, at two time-points:
 - i. the beginning of their involvement in the project; and
 - ii. just prior to dissemination of the guidelines.
- Furthermore, prior to each meeting, each team member is responsible for informing the projector coordinator of any changes in their situation, since the initial completion of the Declaration Form, which may interfere with their abilities to discuss and/or vote on a specific topic. If a group member presents new information, the Project Coordinator will maintain a record of these changes.
- Each research team member will submit separate Declaration forms to the Project Coordinator in one of two formats:
 - *Physical Form*: submitted in person, by fax; or
 - *Digital Form*: submitted electronically by e-mail.
- Completed Declaration forms will be securely kept on file at The Ottawa Hospital Rehabilitation Center depending on the format of its submission by the members:
 - In-person and faxed submissions will be stored in a locked filing cabinet located within a locked research office within the premises of The Ottawa Hospital Rehabilitation Center; and
 - Electronic submissions will be stored in a password-protected folder on a password-protected computer.

Process for Determining Appropriate Actions

- Authors of original research that might be included as the basis for recommendations should not be involved in data extraction from their research or participate as lead reviewer for the given component of the literature review.
- Similarly, Investigators who have participated in the development of previous guidelines that will be reviewed should not be involved in the process of reviewing those particular guidelines.
- Declaration Forms will be reviewed by the COI Project Coordinator or Principal Investigator to identify potential COIs that might be perceived as biasing the results. Where necessary, the Ottawa Health Science Network Research Ethics Board (OHSN-REB) will be asked to review the potential COI.
- The COI Project Coordinator will retain the right to exclude individuals felt to have serious COIs, or to exclude them from certain aspects of process, by permitting one of the following participatory actions:
 - i. The member may participate as topic lead, and may discuss and vote on the topic;
 - ii. The member may only discuss and vote on the topic; or
 - iii. The member may not participate as topic lead, and may not discuss or vote on the topic. Publicly released recommendations will denote the member's recusal from participation and voting on this topic. (CTFPHC, 2014)
- Following the Declaration Form review meeting, the COI Project Coordinator will notify each consensus group member of the recommended action and the decision will be kept on file.
 - If a group member feels that a more restrictive action is appropriate than that decided upon by the COI Project Coordinator, he or she could withdraw from any part of the process for that topic.

CONFLICT OF INTEREST DECLARATION FORM

Guidelines for the Management of Concussion/Mild Traumatic Brain Injury & Prolonged Symptoms: Third Edition

Updating Guidelines for Concussion/mTBI Study

PERSONAL INFORMATION

Name	Insert Full Name
Credentials	Insert Credentials
Primary Affiliation	Insert Primary Affiliation
Other Affiliations	Insert Other Affiliations
Date	

CONFLICTS OF INTEREST

Please provide a full disclosure of your interests and affiliations, which may potentially influence your involvement in the guideline appraisal, development, and review process, in relation to any of the guideline topics that are under consideration.

Please answer each of the following questions by placing an “x” in the appropriate boxes. For any answered questions, please describe the nature of the interest and/or relationship, and identify the relevant commercial entity.

SECTION A: WORK UNDER CONSIDERATION

1. Participation in Guideline Development (or Endorsement) Related to Concussion/mTBI and Prolonged Symptoms

Please indicate your involvement in the development of any guidelines related to concussion/ mTBI & persisting symptoms under review (e.g. a member of the guideline development committee) or direct participation in any processes to formally endorse any of the guidelines under review, if applicable:

Title of the Guideline	Role					Description of Involvement
	Appraiser or Reviewer of Existing Guideline	Developer of New Guideline	Evaluator of New Guideline	Endorsing Existing or New Guideline	Other	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

2. Participation in Research Related to Concussion/mTBI and Prolonged Symptoms

Please indicate your participation in research related to concussion/mTBI and prolonged symptoms (e.g. as an Investigator, Reviewer, Developer, Evaluator, etc.) and provide a list of citations for the relevant work below, if applicable:

Topic Areas	Relevant Information (e.g. description of involvement)	
Diagnosis/Assessment of Concussion/mTBI	<input type="checkbox"/>	
Management of Concussion/mTBI	<input type="checkbox"/>	
Sports-Related Concussion/mTBI	<input type="checkbox"/>	
General Recommendations Regarding Diagnosis/Assessment of Prolonged Symptoms	<input type="checkbox"/>	
General Recommendations Regarding Management of Prolonged Symptoms	<input type="checkbox"/>	
Post-Traumatic Headache	<input type="checkbox"/>	
Persistent Sleep/Wake Disturbances	<input type="checkbox"/>	
Persistent Mental Health Disorders	<input type="checkbox"/>	
Persistent Cognitive Difficulties	<input type="checkbox"/>	
Persistent Vestibular (Balance/Dizziness) & Vision Dysfunction	<input type="checkbox"/>	
Persistent Fatigue	<input type="checkbox"/>	
Return-To-Activity/Work/School Considerations	<input type="checkbox"/>	
Other Topic Areas Please specify additional topic areas in rows below. If you run out of space, you may add additional rows.		
	<input type="checkbox"/>	
	<input type="checkbox"/>	
	<input type="checkbox"/>	

List of Relevant Citations:

Note: please number the citations and indicate which topic areas they are associated with by including the citation number in the table above.

3. Employment

Please indicate your employment, within the past five years, by a guideline developer or an entity having a commercial interest in the guideline under development, if applicable:

Employer and/or Guideline Developer	Description

4. Consultancy

Please indicate if you have served as a consultant, within the past five years, for a guideline developer or an entity having a commercial interest in the guideline under development, if applicable:

Employer and/or Guideline Developer	Description

5. Ownership Interests

Please indicate your ownership interests (including stock options) in any entity having a commercial interest in the guideline under development, if applicable:

Entity	Description

6. Research Funding

Please indicate if you are currently receiving or have previously received research funding from an entity that has a commercial interest in the guideline under development:

Entity	Description

7. Honouraria

Please indicate if you have been paid honouraria or received gifts from a guideline developer or an entity having a commercial interest in the guideline under development?

Entity	Description

8. Other potential COIs related to guideline under development

Please indicate if you have any other potential COIs related to the guideline under development that have not been addressed above:

SECTION B: RELEVANT FINANCIAL ACTIVITIES OUTSIDE THE CONCUSSION/mTBI & PROLONGED SYMPTOMS GUIDELINE DEVELOPMENT

Please identify whether or not you engage in relevant financial activities outside the concussion/mTBI and prolonged symptoms guideline development by completing each row of the table:

Financial Activities	Selection		Relevant Information (e.g. description of involvement)
	NO	YES	
Board membership	<input type="checkbox"/>	<input type="checkbox"/>	
Consultancy	<input type="checkbox"/>	<input type="checkbox"/>	
Employment	<input type="checkbox"/>	<input type="checkbox"/>	
Expert testimony	<input type="checkbox"/>	<input type="checkbox"/>	
Grants	<input type="checkbox"/>	<input type="checkbox"/>	
Honoraria	<input type="checkbox"/>	<input type="checkbox"/>	
Patents	<input type="checkbox"/>	<input type="checkbox"/>	
Royalties	<input type="checkbox"/>	<input type="checkbox"/>	
Stocks	<input type="checkbox"/>	<input type="checkbox"/>	
Other Topic Areas			
Please specify additional topic areas in rows below. If you run out of space, you may add additional rows.			
	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	

SECTION C: OTHER POTENTIAL COIs

Please indicate if you have any other potential COIs to declare:

As a member of the research team, I affirm the following:

- I have listed all potential conflicts of interest in the work under consideration.
- I have listed all of my relevant financial activities outside the driving guideline development.
- I have declared any other actual or apparent conflicts of interest related to the subject matter of the current and future topics.

Print Name: Insert Full Name

Signature:

Date:

Please submit the signed and dated form to the Project Coordinator, Chantal Rockwell, using one of the following options:

1. E-mail:

Please use your institutional e-mail address and attach either a scanned version of the Declaration Form with your signature inserted by hand or a PDF version containing your digital signature.

2. Fax:

3. In Person:

505 Smyth Rd, Rm 2505A, Ottawa, ON, K1H8M2

Date:

COI Principal Investigator Signature:

Appendix D

Database Search Strategies

MEDLINE (Ovid)

1. brain injuries/ or brain concussion/ or post-concussion syndrome/ or brain injury, chronic/ or diffuse axonal injury/ commotion cerebri
2. craniocerebral trauma/ or head injuries, closed/
3. concussion.tw.
4. commotion cerebri
5. postconcuss\$.tw.
6. post-concuss\$.tw.
7. 1 or 2 or 3 or 4 or 5
8. limit 7 to yr="2013 - 2016"
9. head injur\$.tw.
10. brain injur\$.tw.
11. craniocerebral trauma.tw.
12. 8 or 9 or 10 or 11
13. limit 12 to yr="2013 -Current"
14. 13 not 7

EMBASE (Ovid)

1. *brain concussion/
2. *brain injury/
3. *concussion/
4. *head injury/
5. *postconcussion syndrome/
6. *commotio cerebri/
7. concuss\$.tw.
8. post-concuss\$.tw.
9. brain injur\$.tw.
10. head injur\$.tw.
11. *traumatic brain injury/
12. traumatic brain injury.tw.
13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11
14. limit 12 to yr="2013 -Current"
15. limit 13 to human
16. limit 14 to (adult <18 to 64 years> or aged <65+ years>)
17. limit 15 to english language.

PubMed (*To search for articles that had not been indexed in Medline)

(((((((((((((postconcussion[Title/Abstract])) OR (diffuse axonal injury[Title/Abstract])) OR (mild brain injury[Title/Abstract])) OR (minor brain injury[Title/Abstract])) OR (post concussion[Title/Abstract])) OR (brain injury[Title/Abstract])) OR (head injury[Title/Abstract])) OR (brain injuries[Title/Abstract])) OR (head injuries[Title/Abstract])) OR (brain concussion[Title/Abstract])) OR (concussion[Title/Abstract])) AND (publisher[sb])) AND (("2013/01/01"[PDat] : "2016/12/31"[PDat]))

postconcussion[Title/Abstract] OR
diffuse axonal injury[Title/Abstract] OR
mild brain injury[Title/Abstract] OR
minor brain injury[Title/Abstract] OR
post concussion[Title/Abstract] OR
brain injury[Title/Abstract] OR
head injury[Title/Abstract] OR
brain injuries[Title/Abstract] OR

head injuries[Title/Abstract] OR
brain concussion[Title/Abstract] OR
concussion[Title/Abstract] AND
publisher[sb] AND
"2013/07/01"[PDat] : "2016/12/31"[PDat]

PsycINFO (Ovid)

1. Traumatic Brain Injury/
2. Brain Concussion/
3. Head Injuries/
4. brain injur\$.tw
5. concuss\$.tw
6. head injur\$.tw
7. postconcuss\$.tw
8. post concuss\$.tw
9. minor brain injur\$.tw
10. mild brain injur\$.tw
11. diffuse axonal injur\$.tw
12. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11
13. limit 12 to yr="2013 - current"

CINAHL (EBSCO)

1. MH "Head Injuries") OR
2. MH "Brain Injuries" OR
3. MH "Brain Concussion" OR
4. MH "Postconcussion Syndrome" OR
5. TX concuss* OR
6. TX brain injur* OR
7. TX head injur*

Cochrane Library (Wiley)

1. MeSH descriptor Brain Concussion explode all trees
2. MeSH descriptor Head Injuries, Closed explode all trees
3. MeSH descriptor Post-Concussion Syndrome explode all trees
4. MeSH descriptor Brain Injuries explode all trees
5. (brain injur*):ti,ab,kw
6. (head injur*):ti,ab,kw
7. (concuss*):ti,ab,kw
8. (post-concuss*):ti,ab,kw
9. (mild brain injur*):ti,ab,kw
10. (#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9)
11. (#10), from 2013 to 2016

Appendix E

Example Summary Spreadsheet of New Evidence and Guidance (Provided to the Working Groups at the Expert Consensus Conference)

At the beginning of the recommendation review process recommendations from other existing guidelines, new treatment/ intervention articles and details regarding potential resources from the literature search were extracted and organized into spreadsheets according to their similarity with the guideline recommendations from the Second Edition of the current guideline. These spreadsheets were created to simplify comparison of the specific recommendations, evidence and resources on the same topic in terms of content and the level of evidence. Results of meetings and voting were included in the spreadsheets. All spreadsheets were made available to all experts before, during and after the consensus meeting, see methodology for more information.

Spreadsheet Tab 1- Original Recommendation and Initial Voting

Second Edition Guideline Recommendation	
1.	<p>Diagnosis / Assessment of mTBI</p> <p>Patients with mTBI can be safely discharged for home observation after an initial period of in-hospital observation if they meet the following clinical criteria:</p> <ul style="list-style-type: none"> • Normal mental status (alertness / behaviour / cognition) with clinically improving post concussive symptoms after observation until at least four hours post injury. • No clinical risk factors indicating the need for CT scanning or normal CT scan result if performed due to presence of risk factors. • No clinical indicators for prolonged hospital observation where clinical judgment is required such as: <ul style="list-style-type: none"> • clinical deterioration • persistent abnormal GCS or focal neurological deficit • persistent abnormal mental status • persistent clinical symptoms (vomiting/ severe headache) • presence of known coagulopathy • persistent drug or alcohol intoxication • presence of multi-system injuries • presence of concurrent medical problems • age >65
1.5	

Evidence Cited in 2nd Edition

GRADE	Source of Recommendation (i.e., pre-existing guideline, literature, expert consensus)	Population Addressed by Source (TBI or other)
A	New South Wales Ministry of Health, Adult Trauma Clinical Practice Guidelines: Management of Closed Head Injury	TBI

Results of Voting		
Keep		2
Modify		4
Delete		

Comments

Primary Sources Cited in Pre-Existing Guidelines

Spreadsheet Tab 2- New Guideline Recommendations

New Guideline Recommendations

Second Edition Guideline Recommendation

1. Diagnosis / Assessment of mTBI

Patients with mTBI can be safely discharged for home observation after an initial period of in-hospital observation if they meet the following clinical criteria:

- Normal mental status (alertness / behaviour / cognition) with clinically improving post concussive symptoms after observation until at least four hours post injury.
- No clinical risk factors indicating the need for CT scanning or normal CT scan result if performed due to presence of risk factors.
- No clinical indicators for prolonged hospital observation where clinical judgment is required such as:
 - clinical deterioration
 - persistent abnormal GCS or focal neurological deficit
 - persistent abnormal mental status
 - persistent clinical symptoms (vomiting/ severe headache)
 - presence of known coagulopathy
 - persistent drug or alcohol intoxication
 - presence of multi-system injuries
 - presence of concurrent medical problems
 - age >65

List of New Recommendations:

#	Guideline
1	Patients with an isolated MTBI and a negative brain CT scan result may be discharged from the ED if they have no other injuries or issues requiring hospital admission.
2	Patients with MTBI and a normal neurological examination (including a GCS = 15), no risk factors (in particular a normal coagulation status, no drug or alcohol intoxication, no other injuries, no suspected non-accidental injury, no cerebrospinal fluid leak) and a normal CT could be observed at home and the patient is admitted only if some extracerebral cause occurred.
3	Patients with a new and clinically significant traumatic lesion on CT, GCS <15, focal neurological deficit, restlessness or agitation, intoxication with alcohol or drugs, or other extracranial injuries should be admitted to the hospital.
4	We recommend that adult patients after minimal and mild head injury with GCS 15 and without risk factors (loss of consciousness, repeated (≥2) vomiting, anticoagulation therapy or coagulation disorders, posttraumatic seizures, clinical signs of depressed or basal skull fracture, focal neurological deficits) can be discharged from the hospital without a CT scan.

Detailed Summary

1. Patients with an isolated MTBI and a negative brain CT scan result may be discharged from the ED if they have no other injuries or issues requiring hospital admission.

Level of Evidence	AGREE II Rating	Year	Source of Recommendation	Population Addressed (TBI or)	Comments
Level 3 (from original guideline)		2012	EAST Evaluation and Management of Mild Traumatic Brain Injury, page - S308	mTBI	

Primary Sources Cited

Holmes JF, Borgialli DA, Nadel FM, et al.. Do children with blunt head trauma and normal cranial computed tomography scan results require hospitalization for neurologic observation? *Ann Emerg Med.* 2011; 58: 315–322.
 Livingston DH, Lavery RF, Passannante MR, et al.. Emergency department discharge of patients with a negative cranial computed tomography scan after minimal head injury. *Ann Surg.* 2000; 232: 126–132.
 Geijerstam J-L, Britton M. Mild head injury: reliability of early computed tomographic findings in triage for admission. *Emerg Med J.* 2005; 22: 103–107.

2. Patients with MTBI and a normal neurological examination (including a GCS = 15), no risk factors (in particular a normal coagulation status, no drug or alcohol intoxication, no other injuries, no suspected non-accidental injury, no cerebrospinal fluid leak) and a normal CT could be observed at home and the patient is admitted only if some extracerebral cause occurred.

Level of Evidence	AGREE II Rating	Year	Source of Recommendation	Population Addressed (TBI or)	Comments
Grade A (from original guideline)		2012	EFNS Mild Traumatic Brain Injury Guideline, page - 195	mTBI	

Primary Sources Cited

Teasdale GM, Murray G, Anderson E, et al. Risks of acute traumatic intracranial haematoma in children and adults: implications for managing head injuries. *BMJ* 1990; 300: 363–367.

Spreadsheet Tab 3- New Evidence

New Evidence

#	Title	Author(s)	Year	Summary	PEDro / PRISMA / Downs & Black Rating
1	Acute global outcome in patients with mild uncomplicated and complicated traumatic brain injury.	Dagher J.H.,Richard-De	2013	54% of patients with a median GOS-E score of 2 were discharged home with no need for follow up.Patients with complicated MTBI are associated with a low chance of home discharge without follow-ups and a prolonged LOS. Patients with psychiatric history are a group that have higher odds of lower cognitive scores, eventually necessitating a close psychosocial follow-up.	16/32* *8 sections were not applicable
2	You Cannot Go Home: Routine Concussion Evaluation Is Not Enough	Jennifer L. Hartwell, Chance Spalding, Brian Fletcher, M. Shay O'mara, Chris Karas	2015	27% of the patients who would have met traditional discharge criteria from the ED were found to have persistent deficits after neurocognitive testing and were referred for ongoing therapy. Of all patients who had the diagnosis of MTBI, 46% were discharged without formal evaluation. We should assess these patients with MTBI before discharging them including either a formal cognitive evaluation or planned follow-up. Premature discharge places patients with MTBI at risk for ongoing unrecognized and untreated neurocognitive deficits.	14/32* *7 sections were not applicable

Reference List

1. Dagher J.H.,Richard-Denis A.,Lamoureux J.,De Guise E.,Feyz M.. Acute global outcome in patients with mild uncomplicated and complicated traumatic brain injury. Brain Injury. 2013//. 27:189
 2. Hartwell J.L.,Spalding M.C.,Fletcher B.,O'mara M.S.,Karas C.. You cannot go home: routine concussion evaluation is not enough. The American surgeon. 2015//. 81:395

Spreadsheet Tab 4- Adobconnect Decision Summary

Original Guideline Recommendation

1. Diagnosis / Assessment of mTBI

Patients with mTBI can be safely discharged for home observation after an initial period of in-hospital observation if they meet the following clinical criteria:

- Normal mental status (alertness / behaviour / cognition) with clinically improving post concussive symptoms after observation until at least four hours post injury.
- No clinical risk factors indicating the need for CT scanning or normal CT scan result if performed due to presence of risk factors.
- No clinical indicators for prolonged hospital observation where clinical judgment is required such as:

- clinical deterioration
- 1.5 • persistent abnormal GCS or focal neurological deficit
- persistent abnormal mental status
- persistent clinical symptoms (vomiting/ severe headache)
- presence of known coagulopathy
- persistent drug or alcohol intoxication
- presence of multi-system injuries
- presence of concurrent medical problems
- age >65

Comments

7	X	Keep (edited or unedited)
		Delete
		Review at Conference

NOTES

Spreadsheet Tab 5 - Draft Recommendations

1. Diagnosis / Assessment of mTBI

Poll Everywhere Results

A	
B	
C	

Poll Everywhere: Recommendation 1.5 Voting	DRAFT RECOMMENDATIONS	Comments
A) Original	<p>Patients with mTBI can be safely discharged for home observation after an initial period of in-hospital observation if they meet the following clinical criteria:</p> <ul style="list-style-type: none"> • Normal mental status (alertness / behaviour / cognition) with clinically improving post concussive symptoms after observation until at least four hours post injury. • No clinical risk factors indicating the need for CT scanning or normal CT scan result if performed due to presence of risk factors. • No clinical indicators for prolonged hospital observation where clinical judgment is required such as: <ul style="list-style-type: none"> • clinical deterioration 	
B) Draft	<p>Patients with mTBI can be safely discharged for home observation after an initial period of in-hospital observation (see appendix ###) if they meet the following clinical criteria:</p> <ul style="list-style-type: none"> • Normal mental status (alertness / behaviour / cognition) with clinically improving post concussive symptoms after observation until at least four hours post injury. • No clinical risk factors indicating the need for CT scanning or normal CT scan result if performed due to presence of risk factors. • No clinical indicators for prolonged hospital observation where clinical judgment is required such as: <ul style="list-style-type: none"> • clinical deterioration • persistent abnormal GCS or focal neurological deficit 	NOTES
C) Other		

Spreadsheet Tab 6 - Internal Group Voting

Final Internal Drafted Recommendation	<p>initial period of in-hospital observation if they meet the following clinical criteria (see algorithm ____1.2):</p> <ul style="list-style-type: none"> • Normal mental status (alertness / behaviour / cognition) with clinically improving post concussive symptoms after observation until at least four hours post injury. • No clinical risk factors indicating the need for CT scanning or normal CT scan result if performed due to presence of risk factors. • No clinical indicators for prolonged hospital observation where clinical judgment is required such as: <ul style="list-style-type: none"> • clinical deterioration • persistent abnormal GCS or focal neurological deficit • persistent abnormal mental status • persistent clinical symptoms (vomiting/ severe headache) • presence of known coagulopathy
Internal Voting Edit Results:	Notes
Results of Vote	
Approve:	3
Other:	5
Internal Voting	
Edit 1	
Edit 2	
Edit 3	
Edit 4	
Edit 5	

Spreadsheet Tab 7 - Full Group Voting

Updated Recommendation	<p>Patients with mTBI can be safely discharged for home observation after an initial period of in-hospital observation (See Appendix __) if they meet the following clinical criteria:</p> <ul style="list-style-type: none"> • Normal mental status (alertness / behaviour / cognition) with clinically improving post concussive symptoms after observation until at least four hours post injury. • No clinical risk factors indicating the need for CT scanning or normal CT scan result if performed due to presence of risk factors. <ul style="list-style-type: none"> • No clinical indicators for prolonged hospital observation where clinical judgment is required such as: <ul style="list-style-type: none"> • clinical deterioration • persistent abnormal GCS or focal neurological deficit • persistent abnormal mental status • vomiting/ severe headache • presence of known coagulopathy • persistent drug or alcohol intoxication • presence of multi-system injuries • presence of concurrent medical problems • age >65
-------------------------------	--

Results of Round 1 Voting	# Voted	%
Keep Original	27	
Edit	3	
Skipped	2	

Edit 1	
Edit 2	
Edit 4	
Edit 5	
Edit 6	
Edit 3	

FINAL	<p>Patients presenting to hospital/ clinic acutely with mTBI can be safely discharged for home observation after an initial period of in-hospital observation (See Appendix __) if they meet the following clinical criteria:</p> <ul style="list-style-type: none"> • Normal mental status (alertness / behaviour / cognition) with clinically improving post concussive symptoms after observation until at least four hours post injury. • No clinical risk factors indicating the need for CT scanning or normal CT scan result if performed due to presence of risk factors. <ul style="list-style-type: none"> • No clinical indicators for prolonged hospital observation where clinical judgment is required such as: <ul style="list-style-type: none"> • clinical deterioration • persistent abnormal GCS or focal neurological deficit • persistent abnormal mental status • vomiting/ severe headache • presence of known coagulopathy
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Appendix F

Other Links/References for Resources to Consider

Section 1: Diagnosis/Assessment of Concussion/mTBI

Ohio State University TBI Identification Method - Short Form

This tool is used to assess a patient's lifetime history of any previous TBI. It consists of a series of questions to be administered to the patient by a healthcare professional.

Corrigan JD, Bogner J. Initial reliability and validity of the Ohio State University TBI Identification Method. *Journal of Head Trauma Rehabilitation*. 2007;22(6):318-329.

Section 3: Sport-Related Concussion/mTBI

IMPACT (Immediate Post-Concussion Assessment and Cognitive Testing)

A computerized concussion evaluation system developed to assist qualified practitioners and provide useful information in making sound return-to-play decisions following concussions by measuring one's symptoms and cognition, such as verbal and visual memory, reaction time, processing speed, and impulse control. Also includes a self-report symptom checklist and concussion history questionnaire.

<https://impacttest.com/>

King-Devick Test for Concussions

A saccadic (quick, simultaneous eye movement) test measuring the speed of rapid-number naming, utilizing three test cards with a series of single-digit numbers that are read aloud from left to right.

<http://kingdevicktest.com/for-concussions/>

Recommendations for Assessment/Management of Non-Game High-Risk Sports:

American Association of Cheerleading Coaches and Administrators (AACCA) Concussion Management and Return-to-Play Protocol

<https://www.aacca.org/content.aspx?item=Resources/concussions.xml>

Concussion in Gymnastics

http://usagym.org/pages/home/publications/technique/2009/03/26_concussions.pdf

Baseline Concussion Testing in Figure Skating

<http://skatecoach.wordpress.com/2012/06/07/baseline-concussion-testing-in-figure-skating/>

Section 6: Post-Traumatic Headache

Migraine Disability Assessment Questionnaire (MIDAS)

A 5-item self-report questionnaire which captures information on lost time from work for pay, housework, and leisure activities due to migraines in order to determine how severely migraines affect a patient's life.

Stewart WF, Lipton RB, Dowson AJ, Sawyer J. Development and testing of the Migraine Disability Assessment (MIDAS) Questionnaire to assess headache-related disability. *Neurology*. 2001;56:S20-S28.

Section 7: Persistent Sleep-Wake Disturbances

Insomnia Severity Index

A brief 7-item self-report questionnaire that was designed to assess the severity, nature, and impact of both nighttime and daytime components of insomnia.

Morin CM, Belleville G, Bélanger L, Ivers H. The Insomnia Severity Index: psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep*. 2011;34(5):601-608.

Pittsburgh Sleep Quality Index

A 10-item self-report questionnaire that is designed to measure sleep quality in clinical populations, and assess usual sleep habits during the past month. This scale generates seven “component” scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Items 1-4 inquire about the amount of sleep and responses are recorded in free-text boxes. Items 5-10 inquire about specific sleep behaviors and quality, which are rated on 4-point scale.

Buysse DJ, Reynolds III CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: A New Instrument for Psychiatric Practice and Research. *Journal of Psychiatric Research*. 1989;28(2):193-213.

For detailed information regarding specific classes of medications and their impact on/interactions with sleep, please refer to:

1. Larson EB, Zollman FS. The effect of sleep medications on cognitive recovery from traumatic brain injury. *Journal of Head Trauma Rehabilitation*. 2010;25:61-67.
2. Flanagan SR, Greenwald B & Weiber S. Pharmacological treatment of insomnia. *Journal of Head Trauma Rehabilitation*. 2007;22:67-70.
3. Mollayeva T, Shapiro CM. (2013). Medication Effects. In Kushida C. (ed.) *The Encyclopedia of Sleep V2* p330-337. Academic Press.

Section 8: Persistent Mental Health Disorders

Beck Anxiety Inventory (BAI)

A 21-item multiple-choice self-report inventory that is used for measuring the severity of an individual's anxiety. It can be used for screening, diagnosis, and monitoring of therapeutic progress in both inpatient and outpatient settings.

Beck AT, Epstein N, Brown G, Steer RA. An inventory measuring clinical anxiety: Psychometric properties. *Journal of Consulting and Clinical Psychology*. 1988;56:893–897.

Beck Depression Inventory (BDI-II)

A 21-item multiple-choice self-report inventory that measures characteristic attitudes and symptoms of depression. It can be used for screening, diagnosis, and monitoring of therapeutic progress in both inpatient and outpatient settings. The BDI-II features new items that will bring it in line with current depression criteria of the Diagnostic and Statistical Manual of Mental Disorders - Fourth Edition (DSM-IV).

Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. *Archives of General Psychiatry*. 1961;4(6):561–571.

Beck AT, Steer RA, Brown, GK. (1996). *Manual for the Beck Depression Inventory-II*. San Antonio, TX: Psychological Corporation.

Section 9: Persistent Cognitive Difficulties

Montreal Cognitive Assessment (MOCA)

A screening tool for individuals with mild cognitive dysfunction. It assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuospatial skills, conceptual thinking, calculations, and orientation.

Nasreddine, Z.S., Phillips, N.S., Bédirian, V., Charbonneau, S., Whitehead, V., Collin, I., et al. The Montreal Cognitive Assessment, MoCA: A brief screening tool for mild cognitive impairment. *Journal of the American Geriatrics Society*, 2005: 53(4), 695-699.

Section 10: Persistent Vision and Vestibular (Balance/Dizziness) Dysfunction

Balance Error Scoring System (BESS)

A portable and objective method of assessing static postural stability. More specifically, the BESS can be used to assess the effects of traumatic brain injury on static postural stability. The BESS utilizes a combination of stances (feet in a narrow stance, preferably touching; single leg stance; and tandem stance) and footing surfaces (bare feet on the floor or a medium density foam surface).

Guskiewicz KM. Postural stability assessment following concussion: one piece of the puzzle. *Clinical Journal of Sports Medicine*. 2001;11:182–189.

Links for Dix-Hallpike and Repositioning Manoeuvre Video Demonstrations

<http://www.youtube.com/watch?v=kEM9p4EX1jk>

<http://www.youtube.com/watch?v=1-hsUU7MDqc>

<http://www.youtube.com/watch?v=RQV-oz0baFM>

Brain Injury Vision Symptom Survey (BIVSS)

A 28-item self-report vision symptom questionnaire, on symptoms such as dry eyes, depth perception, peripheral vision. This questionnaire may make it possible to identify different symptom profiles in TBI patients.

Laukkanen H, Scheiman M, Hayes J. Brain Injury Vision Symptom Survey (BIVSS) Questionnaire. *American Journal of Optometry*. 2016; 94(1):43-50.

Section 11: Persistent Fatigue

Fatigue Severity Scale (FSS)

A 9-item self-report questionnaire designed to assess disabling fatigue in all individuals. The scale was designed to look at fatigue/function measures; that is the connection between fatigue intensity and functional disability.

Krupp LB, LaRocca NG, Muir-Nash J, Steinberg AD. The fatigue severity scale. Application to patients with multiple sclerosis and systemic lupus erythematosus. *Archives of Neurology*. 1989 Oct;46(10):1121-1123.

Fatigue Impact Scale (FIS)

A 40-item self report questionnaire that measures functional limitation from fatigue over the past month.

John D. Fisk, Ritvo, P., Lynn Ross, David A. Haase, Marrie, T., & Walter F. Schleich. Measuring the Functional Impact of Fatigue: Initial Validation of the Fatigue Impact Scale. *Clinical Infectious Diseases*, 1994; 18, S79-S83. Retrieved from <http://www.jstor.org/stable/4457604>

Mental Fatigue Scale

A 15-item multidimensional self-report questionnaire to assess persistent fatigue in brain injured patients. The questions concern fatigue in general, lack of initiative, mental fatigue, mental recovery, concentration difficulties, memory problems, slowness of thinking, sensitivity to stress, increased tendency to become emotional, irritability, sensitivity to light and noise, decreased or increased sleep as well as 24-hour symptom variations.

Johansson B, Starmark A, Berglund P, Rödholm M, Rönnbäck L. A self-assessment questionnaire for mental fatigue and related symptoms after neurological disorders and injuries. *Brain Injury*. 2010;24(1):2-12.

Appendix G

Results of the mTBI Systematic Review of the Literature (2012 - May 2017)

Recommendation(s) Supported: 1.2				
Reference	Year	Country	Design	Quality Rating
Miller KJ, Ivins BJ, Schwab KA. Self-reported mild TBI and postconcussive symptoms in a peacetime active duty military population: effect of multiple TBI history versus single mild TBI. <i>J Head Trauma Rehabil.</i> 2013;28(1):31-38.	2013	USA	Cross-Sectional	DOWN'S & BLACK: 18/32*
Abstract				
Objective: To investigate the potential cumulative impact of mild traumatic brain injury (MTBI) on postconcussive symptoms. Participants: A total of 224 active duty soldiers reporting MTBI within 1 year of testing. For 101, this MTBI was their only reported traumatic brain injury (TBI); 123 had sustained at least 1 additional MTBI during their lifetime. A No TBI control group (n = 224) was included for comparison. Main Measure: Self-report symptoms data via questionnaire. Within time since injury subgroups (≤3 months; Post-3 months), symptom endorsement (no symptoms, 1 or 2 symptoms, 3+ symptoms) among soldiers with 1 MTBI was compared with that of soldiers with 2 or more MTBIs. Injured soldiers' symptom endorsement was compared with that of soldiers who had not sustained a TBI. Results: Among the recently injured (≤3 months), those with 2 or more MTBIs endorsed significantly more symptoms than those with 1 MTBI: 67% of soldiers with 2 or more MTBIs reported 3+ symptoms, versus 29% of One MTBI soldiers. Among Post-3 month soldiers, there were no significant differences between MTBI groups. Overall, soldiers with MTBI endorsed significantly more symptoms than those without TBI. Conclusion: Past experience of MTBI may be a risk factor for increased symptom difficulty for several months post injury. Clinicians should ascertain lifetime history of brain injury when evaluating patients for MTBI.				

*7 of the sections were not applicable

Recommendation(s) Supported: 1.2				
Reference	Year	Country	Design	Quality Rating
Carney N, Ghajar J, Jagoda A, et al. Concussion guidelines step 1: systematic review of prevalent indicators. <i>Neurosurgery.</i> 2014;75 Suppl 1:S3-15	2014	USA	Systematic Review	PRISMA: 21/27*
Abstract				
Background: Currently, there is no evidence-based definition for concussion that is being uniformly applied in clinical and research settings. Objective: To conduct a systematic review of the highest-quality literature about concussion and to assemble evidence about the prevalence and associations of key indicators of concussion. The goal was to establish an evidence-based foundation from which to derive, in future work, a definition, diagnostic criteria, and prognostic indicators for concussion. Methods: Key questions were developed, and an electronic literature search from 1980 to 2012 was conducted to acquire evidence about the prevalence of and associations among signs, symptoms, and neurologic and cognitive deficits in samples of individuals exposed to potential concussive events. Included studies were assessed for potential for bias and confound and rated as high, medium, or low potential for bias and confound. Those rated as high were excluded from the analysis. Studies were further triaged on the basis of whether the definition of a case of concussion was exclusive or inclusive; only those with wide, inclusive case definitions were used in the analysis. Finally, only studies reporting data collected at fixed time points were used. For a study to be included in the conclusions, it was required that the presence of any particular sign, symptom, or deficit be reported in at least 2 independent samples. Results: From 5437 abstracts, 1362 full-text publications were reviewed, of which 231 studies were included in the final library. Twenty-six met all criteria required to be used in the analysis, and of those, 11 independent samples from 8 publications directly contributed data to conclusions. Prevalent and consistent indicators of concussion are (1) observed and documented disorientation or confusion immediately after the event, (2) impaired balance within 1 day after injury, (3) slower reaction time within 2 days after injury, and/or (4) impaired verbal learning and memory within 2 days after injury. Conclusion: The results of this systematic review identify the consistent and prevalent indicators of concussion and their associations, derived from the strongest evidence in the published literature. The product is an evidence-based foundation from which to develop diagnostic criteria and prognostic indicators.				

*Additional analyses were not undertaken (i.e., meta-analyses), so 5 of the items were not applicable

Recommendation(s) Supported: 1.2				
Reference	Year	Country	Design	Quality Rating
Fine MS, Lum PS, Brokaw EB, et al. Dynamic motor tracking is sensitive to subacute mTBI. <i>Exp Brain Res</i> . 2016;234(11):3173-3184.	2016	USA	Case-Control	DOWNNS & BLACK: 13/32*
Abstract				
Effective screening for mild traumatic brain injury (mTBI) is critical to accurate diagnosis, intervention, and improving outcomes. However, detecting mTBI using conventional clinical techniques is difficult, time intensive, and subject to observer bias. We examine the use of a simple visuomotor tracking task as a screening tool for mTBI. Thirty participants, 16 with clinically diagnosed mTBI (mean time since injury: 36.4 ± 20.9 days (95 % confidence interval); median = 20 days) were asked to squeeze a hand dynamometer and vary their grip force to match a visual, variable target force for 3 min. We found that controls outperformed individuals with mTBI; participants with mTBI moved with increased variability, as quantified by the standard deviation of the tracking error. We modeled participants' feedback response—how participants changed their grip force in response to errors in position and velocity—and used model parameters to classify mTBI with a sensitivity of 87 % and a specificity of 93 %, higher than several standard clinical scales. Our findings suggest that visuomotor tracking could be an effective supplement to conventional assessment tools to screen for mTBI and track mTBI symptoms during recovery.				

*6 of the sections were not applicable

Recommendation(s) Supported: 1.2				
Reference	Year	Country	Design	Quality Rating
Silverberg ND, Luoto TM, A-hman J, Iverson GL. Assessment of mild traumatic brain injury with the King-Devick Test in an emergency department sample. <i>Brain Inj</i> . 2014;28(12):1590-1593.	2014	USA	Prospective Cohort	DOWNNS & BLACK: 14/32*
Abstract				
Objective: The King-Devick Test (K-D) is a brief measure of cognitive processing speed and rapid gaze shifting that appears sensitive to the effects of sport-related concussion. This study evaluated its diagnostic and incremental validity in civilian patients with mild traumatic brain injury (MTBI). Methods: Participants with MTBI (n=26) and controls with non-head injuries (n=33) were prospectively recruited from an Emergency Department (ED). They underwent a clinical evaluation including the K-D test and the Sport Concussion Assessment Tool 2 (SCAT2). Magnetic resonance imaging (MRI) was conducted within 10 days post-injury. Results: The patients with MTBI differed from those without MTBI on components of the SCAT2, including the Symptom Scale (Cohen's d=1.02–1.15, p<0.001) and Standardized Assessment of Concussion (d=0.81, p=0.004), but not the K-D test (d=0.40, p=0.148). In a logistic regression analysis, the K-D Test did not contribute over and above these two measures in predicting group membership (MTBI vs. control), p=0.191. Low K-D Test scores in the MTBI group (51 SD below controls) were not associated with poor SCAT2 performance, loss of consciousness or traumatic abnormalities on MRI, suggesting these cases may have been false positives. Conclusions: The present findings do not support the K-D Test for the assessment of civilian MTBI in an ED setting.				

*6 of the sections were not applicable

Recommendation(s) Supported: 1.3, 3.3				
Reference	Year	Country	Design	Quality Rating
Ip IK, Raja AS, Gupta A, Andruchow J, Sodickson A, Khorasani R. Impact of clinical decision support on head computed tomography use in patients with mild traumatic brain injury in the ED. <i>Am J Emerg Med</i> . 2015;33(3):320-325.	2015	USA	Prospective Cohort	DOWNNS & BLACK: 14/32*
Abstract				
Background: Reduction of unnecessary head computed tomographies (CTs) in patients with mild traumatic brain injury (MTBI) was recently endorsed by American College of Emergency Physicians (ACEP) in the "Choosing Wisely" campaign. We examined the impact of computerized clinical decision support (CDS) on head CT utilization in MTBI emergency department (ED) visits. Methods: We conducted a 2-year cohort study at a level 1 trauma center and compared our results with the National Hospital Ambulatory Medical Care Survey from 2009 to 2010. All adult patients discharged from the ED with MTBI-associated diagnoses were included. After a baseline observation period at our institution, real-time CDS was implemented. Based upon the clinical history entered, low utility orders triggered an alert to clinicians, suggesting imaging studies might not adhere to evidence-based guidelines. Clinicians could				

cancel the order or ignore the alert. Primary outcome was intensity of head CT use in MTBI ED visits. Secondary outcomes included rates of delayed imaging and delays in diagnosing radiologically significant findings. χ^2 , logistic regression, and process control chart assessed preintervention and postintervention differences. Results: In study patients, 58.1% of MTBI-related visits resulted in head CT preintervention vs 50.3% postintervention (13.4% relative decrease, $P = .005$), a change not detected in controls (73.3% vs 76.9%, $P = .272$). Study cohort patients not receiving a head CT during their index visit were neither more nor less likely to receive one in the subsequent 7 days (6.7% preintervention vs 9.4% postintervention, $P = .231$). Rates of delayed diagnosis of radiologically significant findings were unchanged (0% vs 0%). Conclusions: Evidence-based CDS can reduce low utility imaging for MTBI.

*5 of the sections were not applicable

Recommendation(s) Supported: 1.3, 3.3				
Reference	Year	Country	Design	Quality Rating
Ayaz SI, Thomas C, Kulek A, et al. Comparison of quantitative EEG to current clinical decision rules for head CT use in acute mild traumatic brain injury in the ED. <i>Am J Emerg Med.</i> 2015;33(4):493-496.	2015	USA	Prospective Observational	DOWNES & BLACK: 15/32*
Abstract				
Study objective: We compared the performance of a handheld quantitative electroencephalogram (QEEG) acquisition device to New Orleans Criteria (NOC), Canadian CT Head Rule (CCHR), and National Emergency X-Radiography Utilization Study II (NEXUS II) Rule in predicting intracranial lesions on head computed tomography (CT) in acute mild traumatic brain injury in the emergency department (ED). Methods: Patients between 18 and 80 years of age who presented to the ED with acute blunt head trauma were enrolled in this prospective observational study at 2 urban academic EDs in Detroit, MI. Data were collected for 10 minutes from frontal leads to determine a QEEG discriminant score that could maximally classify intracranial lesions on head CT. Results: One hundred fifty-two patients were enrolled from July 2012 to February 2013. A total 17.1% had acute traumatic intracranial lesions on head CT. Quantitative electroencephalogram discriminant score of greater than or equal to 31 was found to be a good cutoff (area under receiver operating characteristic curve = 0.84; 95% confidence interval [CI], 0.76-0.93) to classify patients with positive head CT. The sensitivity of QEEG discriminant score was 92.3 (95% CI, 73.4-98.6), whereas the specificity was 57.1 (95% CI, 48.0-65.8). The sensitivity and specificity of the decision rules were as follows: NOC 96.1 (95% CI, 78.4-99.7) and 15.8 (95% CI, 10.1-23.6); CCHR 46.1 (95% CI, 27.1-66.2) and 86.5 (95% CI, 78.9-91.7); NEXUS II 96.1 (95% CI, 78.4-99.7) and 31.7 (95% CI, 23.9-40.7). Conclusion: At a sensitivity of greater than 90%, QEEG discriminant score had better specificity than NOC and NEXUS II. Only CCHR had better specificity than QEEG discriminant score but at the cost of low (<50%) sensitivity.				

*6 of the sections were not applicable

Recommendation(s) Supported: 1.3, 3.3				
Reference	Year	Country	Design	Quality Rating
Sharp AL, Nagaraj G, Rippberger EJ, et al. Computed Tomography Use for Adults With Head Injury: Describing Likely Avoidable Emergency Department Imaging Based on the Canadian CT Head Rule. <i>Acad Emerg Med.</i> 2017;24(1):22-30.	2017	USA	Observational Study	DOWNES & BLACK: 15/32*
Abstract				
Background: Millions of head computed tomography (CT) scans are ordered annually, but the extent of avoidable imaging is poorly defined. Objectives: The objective was to determine the prevalence of likely avoidable CT imaging among adults evaluated for head injury in 14 community emergency departments (EDs) in Southern California. Methods: We conducted an electronic health record (EHR) database and chart review of adult ED trauma encounters receiving a head CT from 2008 to 2013. The primary outcome was discordance with the Canadian CT Head Rule (CCHR) high-risk criteria; the secondary outcome was use of a neurosurgical intervention in the discordant cohort. We queried system wide EHRs to identify CCHR discordance using criteria identifiable in discrete data fields. Explicit chart review of a subset of discordant CTs provided estimates of misclassification bias and assessed the low-risk cases who actually received an intervention. Results: Among 27,240 adult trauma head CTs, EHR data classified 11,432 (42.0%) discordant with CCHR recommendation. Subsequent chart review showed that the designation of discordance based on the EHR was inaccurate in 12.2% (95% confidence interval [CI] = 5.6% to 18.8%). Inter-rater reliability for attributing CCHR concordance was 95% ($\kappa = 0.86$). Thus, we estimate that 36.8% of trauma head CTs were truly likely avoidable (95% CI = 34.1% to 39.6%). Among the likely avoidable CT group identified by EHR, only 0.1% ($n = 13$) received a neurosurgical intervention. Chart review showed none of these were actually "missed" by				

the CCHR, as all 13 were misclassified. Conclusion: About one-third of head CTs currently performed on adults with head injury may be avoidable by applying the CCHR. Avoidance of CT in such patients is unlikely to miss any important injuries.

*7 of the sections were not applicable

Recommendation(s) Supported: 1.4				
Reference	Year	Country	Design	Quality Rating
Meares S, Shores EA, Smyth T, Batchelor J, Murphy M, Vukasovic M. Identifying posttraumatic amnesia in individuals with a Glasgow Coma Scale of 15 after mild traumatic brain injury. <i>Arch Phys Med Rehabil.</i> 2015;96(5):956-959.	2015	Australia	Prospective Cohort	DOWNES & Black: 14/32*
Abstract				
Objective: To examine the utility of the Abbreviated Westmead Post-traumatic Amnesia Scale, which includes the Glasgow Coma Scale (GCS) and 3 picture cards used to measure amnesia, in identifying the presence or absence of posttraumatic amnesia in individuals with mild traumatic brain injury (mTBI). Design: Prospective study using data from the Abbreviated Westmead Post-traumatic Amnesia Scale. Setting: Trauma hospital. Participants: Individuals with possible mTBI who presented between April and September 2011 (N=252; age range, 18-65y; mean age, 37.4±3.9y; 77% men). Intervention: Administration of the Abbreviated Westmead Post-traumatic Amnesia Scale. Main Outcome Measures: GCS and Abbreviated Westmead Post-traumatic Amnesia Scale pass/fail rates. Results: Of the individuals, 169 (mean age, 35.1±13.6y; 77% men) received the scale. A pass/fail performance was achieved a median 121 minutes (interquartile range, 89-205min) after triage. Of the 45 who failed, 31 (69%) had a GCS score of 15. The likelihood of failing was associated with being older (odds ratio [OR], 1.03; 95% confidence interval [CI], 1.02-1.06; P<.05), having consumed alcohol (OR, 3.09; 95% CI, 1.42-6.74; P<.01), and the scale being administered closer to the time of the injury (OR, 0.99; 95% CI, 0.99-1.00; P<.05). Nineteen (42%) of those who failed had consumed alcohol, 11 had a GCS score of 15, and 8 had a GCS score of 14. Conclusions: A GCS score of 15 does not always signify return to normative cognitive function. Individuals with a GCS score of 15 who are acutely cognitively impaired are at risk of not being accurately identified. The addition of an amnesia score to the GCS in the Abbreviated Westmead Post-traumatic Amnesia Scale will assist in making a diagnosis of mTBI.				

*7 of the sections were not applicable

Recommendation(s) Supported: 1.5				
Reference	Year	Country	Design	Quality Rating
Hartwell JL, Spalding MC, Fletcher B, O'mara MS, Karas C. You cannot go home: routine concussion evaluation is not enough. <i>Am Surg.</i> 2015;81(4):395-403.	2015	USA	Cross-Sectional	DOWNES & BLACK: 14/32*
Abstract				
Traditional care of mild traumatic brain injury (MTBI) is to discharge patients from the emergency department (ED) if they have a Glasgow Coma Score (GCS) of 15 and a normal head computed tomography (CT) scan. However, this does not address short-term neurocognitive deficits. Our hypothesis is that a notable percentage of patients will need outpatient neurocognitive therapy despite a reassuring initial presentation. This is a retrospective review of patients with MTBI at an urban Level I trauma center. Inclusion criteria were a diagnosis of MTBI in patients 14 years old or older, GCS 15, negative head CT scan, a completed neurocognitive evaluation, blunt mechanism, and no confounding psychiatric comorbidities. Six thousand thirty-two patients were admitted over 18 months. Three hundred ninety-five patients met inclusion criteria. Average age was 38 years (range, 14 to 93 years), 64 per cent were male, and mean Injury Severity Score (ISS) was 8.1. Forty-one per cent were cleared for discharge without follow-up. Twenty-seven per cent required ongoing neurocognitive therapy. Three per cent were deemed unsafe for discharge home. Of the patients cleared for discharge, 88 per cent had positive/questionable loss of consciousness (LOC), whereas 81 per cent who required additional therapy had positive/questionable LOC (P = 0.20). Age, gender, ISS, and alcohol use were compared between the groups and not found to be statistically different rendering them poor predictors for appropriate discharge from the ED. A surprisingly high percentage (27%) of patients who would have met traditional ED discharge criteria were found to have persistent deficits after neurocognitive testing and were referred for ongoing therapy. We provide evidence to suggest that we should take pause before discharging patients with MTBI without a cognitive evaluation.				

*7 of the sections were not applicable

Recommendation(s) Supported: 1.5				
Reference	Year	Country	Design	Quality Rating
Dagher JH, Richard-Denis A, Lamoureux J, de Guise E, Feyz M. Acute global outcome in patients with mild uncomplicated and complicated traumatic brain injury. <i>Brain Inj.</i> 2013;27(2):189-199.	2013	Canada	Retrospective Cohort	DOWNS & BLACK: 16/32*
Abstract				
<p>Primary objective: This study assesses the influence of socio-demographic, psychosocial, clinical and radiological variables on the outcome of patients with mild traumatic brain injury (MTBI) in an acute care inpatient setting. Research design: Retrospective cohort study. Methods and procedure: A total of 2127 inpatients with MTBI were included. Outcomes measured were Extended Glasgow Outcome Scale (GOS-E), the FIM instrument, length of stay (LOS) and discharge destination. Main outcomes and results: Fifty-four per cent of patients with MTBI with a median GOS-E of 2 were discharged home with no need for further follow-up. Age, LOS, lower Glasgow score (GCS) at admission, insurance coverage and positive CT scans were associated with rehabilitation referrals on discharge. Age, LOS, alcohol and drug abuse, motor vehicle collision and lower GCS at admission were associated with greater physical disabilities and functional impairment at discharge. FIM cognitive functional scores were higher in women, younger patients and patients without psychiatric disorders. Brain lesions were correlated with longer LOS. CT scan findings in patients with MTBI may help clinicians predict the final outcome and resources required for patient care during their hospitalization and on discharge. Conclusion: This study can help healthcare professionals in treating and planning future care of patients with MTBI.</p>				

*8 of the sections were not applicable

Recommendation(s) Supported: 1.7				
Reference	Year	Country	Design	Quality Rating
Thorson CM, Van Haren RM, Otero CA, et al. Repeat head computed tomography after minimal brain injury identifies the need for craniotomy in the absence of neurologic change. <i>J Trauma Acute Care Surg.</i> 2013;74(4):967-973 ; discussion 973-965.	2013	USA	Retrospective Cohort	DOWNS & BLACK: 15/32*
Abstract				
<p>Background: In this era of cost containment, the value of routine repeat head computed tomography (CT) in patients with mild TBI (mTBI) and no interval neurologic change has been challenged. The purpose of this study was to test the hypothesis that routine repeat head CT provides critical information after mTBI even with no neurologic change. Methods: From January 1996 to May 2010, records from all patients admitted to our Level I trauma center with an arrival Glasgow Coma Scale (GCS) score of 13 to 15 and at least one head CT were retrospectively reviewed. Results: In 360 patients with mTBI and positive initial head CT finding, the most common abnormalities were subarachnoid hemorrhage (64%), intraparenchymal hemorrhage (57%), and subdural hemorrhage (40%). Scans were repeated in 8 ± 6 hours; 11% were recalled, 59% remained stable, but 30% showed injury progression. Those patients with worsening repeat head CT finding had higher Injury Severity Score (ISS), were more likely to be intubated and require craniotomy, had longer stay, and had higher mortality (all p < 0.001). On multiple logistic regression, altered GCS score (odds ratio, 3.1-4.0), ISS (odds ratio, 1.1), and presence of mass effect (odds ratio, 2.0) were independently associated with worsening repeat head CT finding. In patients receiving a neurosurgical operative intervention, 32% to 59% had no clinical decline before the worsening repeat CT finding. Conclusion: After mTBI, worsening of repeat head CT finding is seen in a third of patients and is associated with worse outcomes. A substantial fraction of patients who require operative intervention will have no clinical changes in the first 8 hours, supporting the value of repeat head CT within this time frame.</p>				

*7 of the sections were not applicable

Recommendation(s) Supported: 1.7				
Reference	Year	Country	Design	Quality Rating
Almenawer SA, Bogza I, Yarascavitch B, et al. The value of scheduled repeat cranial computed tomography after mild head injury: single-center series and meta-analysis. <i>Neurosurgery.</i> 2013;72(1):56-62; discussion 63-54.	2013	Canada	Systematic Review	PRISMA: 15/27*

Abstract

Background: After an initial computed tomography (CT) scan revealing intracranial hemorrhage resulting from traumatic brain injury, a standard of care in many trauma centers is to schedule a repeat CT scan to rule out possible progression of bleed. OBJECTIVE: To evaluate the utility of routine follow-up CT in changing the management of mild head injury patients despite clinical stability, although repeat imaging is indicated to assess a deteriorating patient. Methods: The trauma database at our institution was retrospectively reviewed and the literature was searched to identify patients after mild head injury with positive initial CT finding and scheduled repeat scan. Patients were divided into 2 groups for comparison. Group A included patients who had intervention based on neurological examination changes. Group B comprised patients requiring a change in management according to CT results exclusively. The meta-analysis of the present cohort and included articles was performed with a random-effects model. Results: Overall, 15 studies and 445 patients met our eligibility criteria, totaling 2693 patients. Intervention rates of groups A and B were 2.7% (95% confidence interval, 1.7-3.9; P = .003) and 0.6% (95% confidence interval, 0.3-1; P = .21), respectively. The statistical difference between both intervention rates was clinically significant with P < .001. Conclusion: The available evidence indicates that it is unnecessary to schedule a repeat CT scan after mild head injury when patients are unchanged or improving neurologically. In the absence of supporting data, we question the value of routine follow-up imaging given the associated accumulative increase in cost and risks.

*Additional analyses were not undertaken, so 3 of the items were not applicable

Recommendation(s) Supported: 1.7				
Reference	Year	Country	Design	Quality Rating
Innocenti F, Del Taglia B, Tassinari I, et al. Utility of repeat head computed tomography after mild head trauma: influence on short- and long-term prognosis and health-related quality of life. <i>Intern Emerg Med.</i> 2017;12(1):81-89.	2017	Italy	Retrospective Cohort	DOWNNS & BLACK: 18/32*
Abstract				
The aim of this study was to investigate the utility of repeat head CT in a large population of patients with non-isolated blunt mild head trauma (MTBI), especially in the presence of intracranial injury. This is a study of a cohort of 478 non-isolated MTBI patients admitted to the High Dependency Unit of the Emergency Department of the University-Hospital of Florence from July 2008 to December 2013. Results of initial and subsequent head CT scans, and indications for repeat head CT scan (routine vs. neurologic change) were recorded. The study population was divided into two subgroups: 28 (6 %) patients with neurological change or persistently reduced GCS (group GCS-) and 450 (94 %) patients with normal or improving GCS (group GCS+). After 6 months from the event, a telephone interview using SF12 questionnaire was conducted. Among GCS- patients, the admission CT scan showed intracranial lesions (ICI) in 16 (57 %) patients; only two patients had a TBI-related neurosurgical intervention. Among GCS+ patients, the first CT scan showed an ICI in 133 patients; in a significant proportion of patients with ICI at the first CT scan, the injury worsened (40/133, 30 %, p<0.0001). However, no GCS+ Patient had any neurosurgical intervention. We observed a significant reduction in both MCS and PCS scores after the injury compared with the previous period. The number of repeat CT scan was high in patients who presented ICI at the first CT scan; however, no patient with ICI and normal or improving GCS score needed a neurosurgical intervention.				

*5 of the sections were not applicable

Recommendation(s) Supported: 1.9				
Reference	Year	Country	Design	Quality Rating
Baker A, Unsworth CA, Lannin NA. Fitness-to-drive after mild traumatic brain injury: mapping the time trajectory of recovery in the acute stages post injury. <i>Accid Anal Prev.</i> 2015;79:50-55.	2015	Australia	Case-Control	DOWNNS & BLACK: 18/32*
Abstract				
Introduction: Little is known about the trajectory of recovery in fitness-to-drive after mild traumatic brain injury (mTBI). This means that health-care professionals have limited evidence on which to base recommendations to this cohort about driving. Objective: To determine fitness-to-drive status of patients with a mTBI at 24 h and two weeks post injury, and to summarise issues reported by this cohort about return to driving. Method: Quasi-experimental case-control design. Two groups of participants were recruited: patients with a mTBI (n = 60) and a control group with orthopaedic injuries (n = 60). Both groups were assessed at 24 h post injury on assessments of fitness-to-drive. Follow-up occurred at two weeks post injury to establish driver status. Main Measures: Mini mental state examination, occupational therapy-drive home maze test (OT-DHMT), Road Law Road Craft Test, University of Queensland-Hazard Perception Test, and demographic/interview form collected at 24 h and at two weeks. Results: At the 24 h				

assessment, only the OT–DHMT showed a difference in scores between the two groups, with mTBI participants being significantly slower to complete the test ($p = 0.01$). At the two week follow-up, only 26 of the 60 mTBI participants had returned to driving. Injury severity combined with scores from the 24 h assessment predicted 31% of the variance in time taken to return to driving. Delayed return to driving was reported due to: “not feeling 100% right” ($n = 14$, 23%), headaches and pain ($n = 12$, 20%), and dizziness ($n = 5$, 8%). Conclusion: This research supports existing guidelines which suggest that patients with a mTBI should not to drive for 24 h; however, further research is required to map factors which facilitate timely return to driving.

*4 of the sections were not applicable

Recommendation(s) Supported: 1.9				
Reference	Year	Country	Design	Quality Rating
Baker A, Unsworth CA, Lannin NA. Determining fitness to drive: A systematic review of the methods and assessments used after mild traumatic brain injury. <i>Br J Occup Ther</i> . 2015;78(2):73-84.	2015	Australia	Systematic Review	PRISMA: 19/27*
Abstract				
Introduction: Limited evidence is available to support knowledge of the time-frame and capacity for fitness to drive after mild traumatic brain injury. The aim of this systematic review was to identify what methods and assessments are, or could be used to determine fitness to drive for this population. Method: We undertook a systematic search of six electronic databases. Two authors rated all studies for methodological content and quality, and standardised data were extracted. Narrative analysis was conducted to understand the content of eligible studies. Findings: A total of 2022 articles were retrieved; seven articles met the inclusion criteria. Self-reported questionnaires, non standardised assessments, questionnaires completed by next-of-kin, and simulator tests were the primary methods used to determine fitness to drive. Only one assessment has been used to aid recommendations about fitness to drive in the acute hospital setting. Six additional standardised assessments were identified that have the potential to predict fitness to drive in this population group; however, these assessments require further psychometric testing prior to use. Conclusion: While a variety of methods and assessments are currently used, there is little research evidence to suggest when individuals are able to return to driving after mild traumatic brain injury. Research is urgently required to determine a consistent and standardised approach to assessing fitness to drive following mild traumatic brain injury.				

*Additional analyses were not undertaken (i.e., meta-analyses), so 5 of the items were not applicable

Recommendation(s) Supported: 1.9				
Reference	Year	Country	Design	Quality Rating
Schmidt JD, Hoffman NL, Ranchet M, et al. Driving after Concussion: Is It Safe To Drive after Symptoms Resolve? <i>J Neurotrauma</i> . 2017;34(8):1571-1578.	2017	USA	Case-Control	DOWNS & BLACK: 17/32*
Abstract				
Post-concussion impairments may result in unsafe driving performance, but little research is available to guide consensus on when concussed individuals should return to driving. The purpose of this study was to compare driving performance between individuals with and without a concussion and to explore relationships between neuropsychological and driving performance. Fourteen participants with concussion (age 20.2 – 0.9 years old) and 14 non-concussed age- and driving experience-matched controls (age 20.4 – 1.1 years old) completed a graded symptom checklist, a brief neuropsychological exam, and a 20.5 km driving simulation task. Participants with a concussion completed driving simulation within 48 h of becoming asymptomatic (15.9 – 9.0 days post-concussion). One-way analyses of variance were used to compare total number of crashes, tickets, and lane excursions, as well as standard deviation of lateral position (SDLP) and standard deviation of speed. Pearson’s correlations were conducted to explore the relationship between the neuropsychological and driving performance separately by group ($\alpha = 0.05$). Participants with a concussion committed more frequent lane excursions (concussed 10.9 – 4.5; controls 7.4 – 2.4; $p = 0.017$) and exhibited greater SDLP, compared with controls, during the first curve (concussed 45.7 – 21.3 cm, controls 27.4 – 6.1 cm; $p = 0.030$) and final curve (concussed 39.6 – 24.4 cm; controls 33.5 – 21.3 cm; $p = 0.036$). Poorer performance on symbol digit modalities ($r = -0.54$), Rey Osterrieth Complex Figure ($r = -0.53$), verbal memory ($r = -0.77$), and motor speed ($r = -0.54$) were correlated with more frequent lane excursions in the concussed group, but not in the control group. Despite being asymptomatic, concussed participants exhibited poorer vehicle control, especially when navigating curves. Driving impairments may persist beyond when individuals with a concussion have returned to driving. Our study provides preliminary guidance regarding which neuropsychological functions may best indicate driving impairment following concussion.				

*4 of the sections were not applicable

Recommendation(s) Supported: 2.3, 5.1				
Reference	Year	Country	Design	Quality Rating
Losoi H, Silverberg ND, Waljas M, et al. Recovery from Mild Traumatic Brain Injury in Previously Healthy Adults. <i>J Neurotrauma</i> . 2016;33(8):766-776.	2016	Finland	Retrospective Cohort	DOWNS & BLACK: 20/32*
Abstract				
<p>This prospective longitudinal study reports recovery from mild traumatic brain injury (MTBI) across multiple domains in a carefully selected consecutive sample of 74 previously healthy adults. The patients with MTBI and 40 orthopedic controls (i.e., ankle injuries) completed assessments at 1, 6, and 12 months after injury. Outcome measures included cognition, postconcussion symptoms, depression, traumatic stress, quality of life, satisfaction with life, resilience, and return to work. Patients with MTBI reported more post-concussion symptoms and fatigue than the controls at the beginning of recovery, but by 6 months after injury, did not differ as a group from nonhead injury trauma controls on cognition, fatigue, or mental health, and by 12 months, their level of post-concussion symptoms and quality of life was similar to that of controls. Almost all (96%) patients with MTBI returned to work/normal activities (RTW) within the follow-up of 1 year. A subgroup of those with MTBIs and controls reported mild post-concussion-like symptoms at 1 year. A large percentage of the subgroup who had persistent symptoms had a modifiable psychological risk factor at 1 month (i.e., depression, traumatic stress, and/or low resilience), and at 6 months, they had greater post-concussion symptoms, fatigue, insomnia, traumatic stress, and depression, and worse quality of life. All of the control subjects who had mild post-concussion-like symptoms at 12 months also had a mental health problem (i.e., depression, traumatic stress, or both). This illustrates the importance of providing evidence-supported treatment and rehabilitation services early in the recovery period.</p>				

*4 of the sections were not applicable

Recommendation(s) Supported: 2.3, 5.1, 5.2, 9.3				
Reference	Year	Country	Design	Quality Rating
O'Neil ME, Carlson K, Storzbach D, et al. Complications of Mild Traumatic Brain Injury in Veterans and Military Personnel: A Systematic Review. <i>VA Evidence-based Synthesis Program Reports</i> . 2013.	2013	USA	Systematic Review	PRISMA: 18/27*
Abstract				
<p>Traumatic brain injury (TBI) is a common condition, especially among military members. Twelve to 23 percent of service members returning from Operations Enduring Freedom, Iraqi Freedom, and New Dawn (OEF/OIF/OND) experienced a TBI while deployed. Although various criteria are used to define TBI severity, the majority of documented TBI events among OEF/OIF/OND service members may be classified as mild in severity, or mTBI, according to the definition used by the Veterans Health Administration and Department of Defense (VA/DoD). While some researchers suggest most individuals recover within three months of an mTBI, others estimate that 10 to 20 percent of individuals continue to experience post-concussive symptoms (e.g., headaches, dizziness, balance problems) beyond this time frame. This estimate may be higher among OEF/OIF service members given the frequency of multiple TBI events, concomitant mental health conditions such as depression and posttraumatic stress disorder (PTSD), and other factors unique to combat deployments. As such, deployment-related mTBI is a significant issue for the VA, as patients who report ongoing mTBI symptoms may require the attention from a range of health care professionals. This evidence synthesis review will be used by the VHA TBI Advisory Committee to develop strategies to identify those at-risk for long-term mTBI effects, inform clinical practice, determine resource allocation, and identify future research priorities. The key questions were: Key Question #1. For Veteran/military populations, what is the prevalence of health problems (such as pain, seizure disorders, headaches, migraines, and vertigo), cognitive deficits, functional limitations (such as employment status, changes in marital status/family dynamics), and mental health symptoms (such as PTSD and depression) that develop or persist following mTBI? Key Question #2. What factors affect outcomes for Veteran/military patients with mTBI? Key Question 2A: For Veteran/military populations, are there pre-injury (premorbid) risk/protective factors (e.g., pre-injury mental health factors, genetic factors, or prior concussions) that affect outcomes for mTBI? Key Question 2B: For Veteran/military populations, are there post-injury risk/protective factors (e.g., PTSD) that affect outcomes for mTBI? Key Question #3. What is the resource utilization over time for Veteran/military patients with mTBI?</p>				

*Additional analyses were not undertaken (i.e., meta-analyses), so 5 of the items were not applicable

Recommendation(s) Supported: 2.6, 5.7				
Reference	Year	Country	Design	Quality Rating
Eliyahu L, Kirkland S, Campbell S, Rowe BH. The Effectiveness of Early Educational Interventions in the Emergency Department to Reduce Incidence or Severity of Postconcussion Syndrome Following a Concussion: A Systematic Review. <i>Acad Emerg Med</i> . 2016;23(5):531-542.	2016	Canada	Systematic Review	PRISMA: 21/27*
Abstract				
<p>Objectives: Concussions or mild traumatic brain injury are a major public health concern accounting for 85% of all brain injuries. Postconcussion syndrome (PCS) has been found to affect between 15 and 25% of patients with concussion 1 year after the initial injury. The goal of this review is to assess the effectiveness of early educational information or interventions provided in the emergency department on the onset and/or severity of PCS. Methods: A comprehensive literature search strategy involving seven electronic databases was developed. A grey literature search of Google Scholar, recent conference proceedings in emergency medicine, bibliographies of included studies, and clinical trial registries was also performed. The citation list was reviewed independently by two reviewers; no restrictions on publication status or language of publication were applied. The Cochrane risk-of-bias tool and the Newcastle-Ottawa scale were used to assess quality. Results: From 1,325 citations retrieved, four RCTs and one controlled clinical trial met inclusion criteria. Interventions identified in these studies included: educational information sheets, with or without telephone or in-person follow-up, and one study on bed rest. While rarely requested, one study offered referrals and additional treatment, if needed. None of the studies were deemed to be high quality. Heterogeneity among outcome reporting, follow-up dates and interventions used precluded a pooled analysis. Overall, only two of the five included studies involving adult patients receiving early educational interventions reported a significant improvement in PCS symptoms. No reduction in PCS symptoms was found in the study on bed rest interventions. Conclusion: Limited evidence exists regarding the effectiveness of early educational interventions following concussion. Standardization of the interventions, outcome measures, and follow-up periods would make quantitative comparisons more valid. Moreover, higher-quality research in the field of early interventions for patients in the acute care setting is urgently required.</p>				

*Additional analyses were not undertaken (i.e., meta-analyses), so 5 of the items were not applicable

Recommendation(s) Supported: 2.7, 3.4, 12.2				
Reference	Year	Country	Design	Quality Rating
Nygren-de Boussard C, Holm LW, Cancelliere C, et al. Nonsurgical interventions after mild traumatic brain injury: a systematic review. Results of the International Collaboration on Mild Traumatic Brain Injury Prognosis. <i>Arch Phys Med Rehabil</i> . 2014;95(3 Suppl):S257-264.	2014	Sweden	Systematic Review	PRISMA: 17/27*
Abstract				
<p>Objective: To synthesize the best available evidence regarding the impact of nonsurgical interventions on persistent symptoms after mild traumatic brain injury (MTBI). Data Sources: MEDLINE and other databases were searched (2001-2012) with terms including "rehabilitation." Inclusion criteria were original, peer-reviewed research published in English and other languages. References were also identified from the bibliographies of eligible articles. Study Selection: Controlled trials and cohort and case-control studies were selected according to predefined criteria. Studies had to have a minimum of 30 MTBI cases and assess nonsurgical interventions using clinically relevant outcomes such as self-rated recovery. Data Extraction: Eligible studies were critically appraised using a modification of the Scottish Intercollegiate Guidelines Network (SIGN) criteria. Two reviewers independently reviewed each study and extracted data from the admissible studies into evidence tables. Data Synthesis: The evidence was synthesized qualitatively according to the modified SIGN criteria. Recommendations were linked to the evidence tables using a best-evidence synthesis. After 77,914 records were screened, only 2 of 7 studies related to nonsurgical interventions were found to have a low risk of bias. One studied the effect of a scheduled telephone intervention offering counseling and education on outcome and found a significantly better outcome for symptoms (6.6 difference in adjusted mean symptom score; 95% confidence interval, 1.2-12.0), but no difference in general health outcome at 6 months after MTBI. The other was a randomized controlled trial of the effectiveness of 6 days of bed rest on posttraumatic complaints 6 months post injury, compared with no bed rest, and found no effect. Conclusions: Some evidence suggests that early, reassuring educational information is beneficial after MTBI. Well-designed intervention</p>				

studies are required to develop effective treatments and improve outcomes for adults and children at risk for persistent symptoms after MTBI.

*Additional analyses were not undertaken (i.e., meta-analyses), so 5 of the items were not applicable

Recommendation(s) Supported: 2.7, 2.8				
Reference	Year	Country	Design	Quality Rating
Scheenen ME, Visser-Keizer AC, de Koning ME, et al. Cognitive Behavioral Intervention Compared to Telephone Counseling Early after Mild Traumatic Brain Injury: A Randomized Trial. <i>J Neurotrauma</i> . 2017;34(19):2713-2720.	2017	Netherlands	Randomized Control Trial	PEDro: 6/11*
Abstract				
<p>Many patients do not return to work (RTW) following mild Traumatic Brain Injury (mTBI) due to persistent complaints that are often resistant to therapy in the chronic phase. Recent studies suggest that psychological interventions should be implemented early after injury to prevent patients from developing chronic complaints. This study is a randomized controlled trial which examines the effectiveness of a newly developed CBT intervention (CBTi) compared to telephonic counseling (TC) in at risk mTBI patients (patients with high reports of early complaints). Patients underwent either five sessions of CBT treatment or five phone conversations starting 4-6 weeks after trauma. The main outcome measure was RTW six and twelve months after trauma. Secondary measures comprised functional outcome at six and twelve months, and depression, anxiety and reported posttraumatic complaints at three, six and twelve months after injury. After excluding drop outs, CBTi consisted of 39 patients and TC of 45 patients. No significant differences were found with regard to RTW, with 65% of CBTi patients and 67% of TC patients reporting a RTW at previous level. However, TC patients reported fewer complaints at three (8 vs. 6, $p=.010$) and twelve month post-injury (9 vs. 5, $p=.006$), and more patients in the TC group showed a full recovery twelve months post-injury compared to the CBTi group (62% vs. 39%). The results of this study suggest that early follow-up of at risk patients can have a positive influence on patients' well-being, and that a low-intensive, low-cost telephonic intervention might be more effective than a CBT intervention at improving outcome in at-risk patients.</p>				

*4 of the sections were not indicated in the study

Recommendation(s) Supported: 2.8				
Reference	Year	Country	Design	Quality Rating
Silverberg ND, Hallam BJ, Rose A, et al. Cognitive-behavioral prevention of postconcussion syndrome in at-risk patients: a pilot randomized controlled trial. <i>J Head Trauma Rehabil</i> . 2013;28(4):313-322.	2013	Canada	Randomized Control Trial	PEDro: 9/11
Abstract				
<p>Objective: To examine the tolerability and estimate the treatment effect of cognitive-behavioral therapy (CBT) delivered soon after mild traumatic brain injury to patients at risk for chronic postconcussion syndrome (PCS). Setting: Tertiary rehabilitation center. Participants: Twenty-eight patients with uncomplicated mild traumatic brain injury, determined to be at risk for chronic PCS based on a published algorithm that incorporates subacute post-concussion symptoms and maladaptive illness beliefs (recovery expectations and perceived consequences). They were enrolled within 6 weeks postinjury. Design: Open-label, parallel-group, randomized controlled trial, with masked outcome assessment 3 months after enrolment. Interventions were (1) treatment as usual (education, reassurance, and symptom management strategies) from an occupational therapist, or (2) treatment as usual plus CBT delivered by a psychologist. Main Measures: Rivermead Post concussion Symptoms Questionnaire. Results: Four participants (2:2) withdrew. Treatment credibility and satisfaction ratings were high in the CBT group. Treatment effect sizes were moderate for post-concussion symptoms (Cohen $d = 0.74$) and moderate-large for most secondary outcome measures (Cohen $d = 0.62-1.61$). Fewer participants receiving CBT had a diagnosis of PCS at follow-up (54% vs 91%, $P < .05$). Conclusion: Our preliminary data suggest that CBT delivered soon after mild traumatic brain injury is well tolerated and may facilitate recovery in patients who are at risk for chronic PCS. A definitive clinical trial is warranted.</p>				

Recommendation(s) Supported: 2.8				
Reference	Year	Country	Design	Quality Rating
Silverberg ND, Gardner AJ, Brubacher JR, Panenka WJ, Li JJ, Iverson GL. Systematic review of multivariable prognostic models for mild traumatic brain injury. <i>J Neurotrauma</i> . 2015;32(8):517-526.	2015	Canada	Systematic Review	PRISMA: 15/27*
Abstract				
Prognostic models can guide clinical management and increase statistical power in clinical trials. The availability and adequacy of prognostic models for mild traumatic brain injury (MTBI) is uncertain. The present study aimed to (1) identify and evaluate multivariable prognostic models for MTBI, and (2) determine which pre-, peri-, and early post-injury variables have independent prognostic value in the context of multivariable models. An electronic search of MEDLINE, PsycINFO, PubMed, EMBASE, and CINAHL databases for English-language MTBI cohort studies from 1970–2013 was supplemented by Web of Science citation and hand searching. This search strategy identified 7789 articles after removing duplicates. Of 182 full-text articles reviewed, 26 met eligibility criteria including (1) prospective inception cohort design, (2) prognostic information collected within 1 month post-injury, and (3) 2 + variables combined to predict clinical outcome (e.g., post-concussion syndrome) at least 1 month later. Independent reviewers extracted sample characteristics, study design features, clinical outcome variables, predictor selection methods, and prognostic model discrimination, calibration, and cross-validation. These data elements were synthesized qualitatively. The present review found no multivariable prognostic model that adequately predicts individual patient outcomes from MTBI. Suboptimal methodology limits their reproducibility and clinical usefulness. The most robust prognostic factors in the context of multivariable models were pre-injury mental health and early post-injury neuropsychological functioning. Women and adults with early post-injury anxiety also have worse prognoses. Relative to these factors, the severity of MTBI had little long-term prognostic value. Future prognostic studies should consider a broad range of biopsychosocial predictors in large inception cohorts.				

*Additional analyses were not undertaken (i.e., meta-analyses), so 5 of the items were not applicable

Recommendation(s) Supported: 2.8				
Reference	Year	Country	Design	Quality Rating
Ponsford J, Cameron P, Fitzgerald M, Grant M, Mikocka-Walus A, Schonberger M. Predictors of postconcussive symptoms 3 months after mild traumatic brain injury. <i>Neuropsychology</i> . 2012;26(3):304-313.	2012	Australia	Prospective Cohort	DOWNES & BLACK: 20/32*
Abstract				
Objective: There is continuing controversy regarding predictors of poor outcome following mild traumatic brain injury (mTBI). This study aimed to prospectively examine the influence of preinjury factors, injury-related factors, and postinjury factors on outcome following mTBI. Method: Participants were 123 patients with mTBI and 100 trauma patient controls recruited and assessed in the emergency department and followed up 1 week and 3 months postinjury. Outcome was measured in terms of reported postconcussional symptoms. Measures included the ImPACT Post-Concussional Symptom Scale and cognitive concussion battery, including Attention, Verbal and Visual memory, Processing Speed and Reaction Time modules, pre- and postinjury SF-36 and MINI Psychiatric status ratings, VAS Pain Inventory, Hospital Anxiety and Depression Scale, PTSD Checklist-Specific, and Revised Social Readjustment Scale. Results: Presence of mTBI predicted postconcussional symptoms 1 week postinjury, along with being female and premorbid psychiatric history, with elevated HADS anxiety a concurrent indicator. However, at 3 months, preinjury physical or psychiatric problems but not mTBI most strongly predicted continuing symptoms, with concurrent indicators including HADS anxiety, PTSD symptoms, other life stressors and pain. HADS anxiety and age predicted 3-month PCS in the mTBI group, whereas PTSD symptoms and other life stressors were most significant for the controls. Cognitive measures were not predictive of PCS at 1 week or 3 months. Conclusions: Given the evident influence of both premorbid and concurrent psychiatric problems, especially anxiety, on postinjury symptoms, managing the anxiety response in vulnerable individuals with mTBI may be important to minimize ongoing sequelae.				

*4 of the sections were not applicable

Recommendation(s) Supported: 2.8				
Reference	Year	Country	Design	Quality Rating
Cassidy JD, Boyle E, Carroll LJ. Population-based, inception cohort study of the incidence, course, and prognosis of mild traumatic brain injury after motor vehicle collisions. <i>Arch Phys Med Rehabil.</i> 2014;95(3 Suppl):S278-285.	2014	Canada	Prospective Cohort	DOWNNS & BLACK: 17/32*
Abstract				
Objective: To determine the incidence, course, and prognosis of adult mild traumatic brain injury (MTBI) caused by motor vehicle collisions. Design: Prospective, population-based, inception cohort study. Setting: The province of Saskatchewan, Canada, with a population of about 1,000,000 inhabitants. Participants: All adults (N=1716) incurring an MTBI in a motor vehicle collision between November 1997 and December 1999 in Saskatchewan. Interventions: Not applicable. Main Outcome Measures: Age- and sex-stratified incidence rates, time to self reported recovery, and prognostic factors over a 1-year follow-up. Results: Of 7170 adults injured in a motor vehicle collision over the 2-year inception period, 1716 (24%) met our cohort definition of MTBI. There were more women affected (53%), and MTBI was most common in the 18- to 23-year-old group. Most were not hospitalized (73%), but 28% reported loss of consciousness and 23% reported posttraumatic amnesia. The annual incidence of MTBI per 100,000 adults was 106.1 (95% confidence interval [CI], 98.9-113.6) in the first year and 118.3 (95% CI, 110.8-126.3) in the second year of the study. The 1-year follow-up rate was 84%. The median time to recovery was 100 days (95% CI, 97-103), and about 23% reported not having recovered by 1 year. Factors associated with delayed recovery included being older than 50 years, having less than a high school education, having poor expectations for recovery, having depressive symptoms, having arm numbness, having hearing problems, having headaches, having low back pain, and having thoracic back pain. Loss of consciousness and posttraumatic amnesia were not associated with recovery. Conclusions: MTBI affects almost a quarter of persons reporting an injury after a traffic collision. The median time to recovery is 100 days, but 23% have still not recovered by 1 year. A mix of biopsychosocial factors is associated with recovery, including a strong effect of poor expectations for recovery.				

*5 of the sections were not applicable

Recommendation(s) Supported: 2.8				
Reference	Year	Country	Design	Quality Rating
Snell DL, Hay-Smith EJ, Surgenor LJ, Siegert RJ. Examination of outcome after mild traumatic brain injury: the contribution of injury beliefs and Leventhal's common sense model. <i>Neuropsychol Rehabil.</i> 2013;23(3):333-362.	2013	New Zealand	Prospective Cohort	DOWNNS & BLACK: 15/32*
Abstract				
Associations between components of Leventhal's common sense model of health behaviour (injury beliefs, coping, distress) and outcome after mild traumatic brain injury (MTBI) were examined. Participants (n = 147) were recruited within three months following MTBI and assessed six months later, completing study questionnaires at both visits (Illness Perceptions Questionnaire Revised, Brief COPE, Hospital Anxiety and Depression Scale). Outcome measures included the Rivermead Post-Concussion Symptoms Questionnaire and Rivermead Head Injury Follow-Up Questionnaire. Univariate and multivariate (logistic regression) analyses examined associations between injury beliefs, coping and distress at baseline, and later outcome. Participants endorsing stronger injury identity beliefs ($p < .01$), expectations of lasting severe consequences ($p < .01$), and distress ($p < .01$) at time one, had greater odds of poor outcome at time two. Coping styles were also associated with later outcome although variability in findings limited interpretability. Associations between psychological variables and outcome were examined and 76.5% of cases were correctly classified by the model. Consistent with Leventhal's model, participant beliefs about their injury and recovery had significant associations with outcome over time. Coping also appeared to have important associations with outcome but more research is required to examine these. Current reassurance-based interventions may be improved by targeting variables such as injury beliefs, coping and adjustment soon after injury.				

*5 of the sections were not applicable

Recommendation(s) Supported: 2.8				
Reference	Year	Country	Design	Quality Rating
Scheenen ME, Spikman JM, de Koning ME, et al. Patients "At Risk" of Suffering from Persistent Complaints after Mild Traumatic Brain Injury: The Role of Coping, Mood Disorders, and Post-Traumatic Stress. <i>J Neurotrauma</i> . 2017;34(1):31-37.	2017	Netherlands	Prospective Cohort	DOWNNS & BLACK: 18/32*
Abstract				
<p>Although most patients recover fully following mild traumatic brain injury (mTBI), a minority (15–25%) of all patients develop persistent post-traumatic complaints (PTC) that interfere with the resumption of previous activities. An early identification of patients who are at risk for PTC is currently performed by measuring the number of complaints in the acute phase. However, only part of this group will actually develop persisting complaints, stressing the need for studies on additional risk factors. This study aimed to compare this group of patients with many complaints with patients with few and no complaints to identify potential additional discriminating characteristics and to evaluate which of these factors have the most predictive value for being at risk. We evaluated coping style, presence of psychiatric history, injury characteristics, mood-related symptoms, and posttraumatic stress. We included 820 patients (Glasgow Coma Scale [GCS] score 13–15) admitted to three level-1 trauma centers as part of the UPFRONT-study. At 2 weeks after injury, 60% reported three or more complaints (PTC-high), 25% reported few complaints (PTC-low), and 15% reported no complaints (PTC-zero). Results showed that PTC-high consisted of more females (78% vs. 73% and 52%, $p < 0.001$), were more likely to have a psychiatric history (7% vs. 2% and 5%), and had a higher number of reported depression (22% vs. 6% and 3%, $p < 0.001$), anxiety (25% vs. 7% and 5%), and post-traumatic stress (37% vs. 27% and 19%, $p < 0.001$) than the PTC-low and PTC-zero groups. We conclude that in addition to reported complaints, psychological factors such as coping style, depression, anxiety, and post-traumatic stress symptoms had the highest predictive value and should be taken into account in the identification of at-risk patients for future treatment studies.</p>				

*5 of the sections were not applicable

Recommendation(s) Supported: 2.8				
Reference	Year	Country	Design	Quality Rating
Potter SD, Brown RG, Fleminger S. Randomised, waiting list controlled trial of cognitive-behavioural therapy for persistent postconcussional symptoms after predominantly mild-moderate traumatic brain injury. <i>J Neurol Neurosurg Psychiatry</i> . 2016;87(10):1075-1083.	2017	United Kingdom	Randomized Control Trial	PEPro: 8/11*
Abstract				
<p>Background: Persistent postconcussional symptoms (PCS) can be a source of distress and disability following traumatic brain injury (TBI). Such symptoms have been viewed as difficult to treat but may be amenable to psychological approaches such as cognitive-behavioural therapy (CBT). Objectives: To evaluate the effectiveness of a 12-session individualised, formulation-based CBT programme. Method: Two-centre randomised waiting list controlled trial with 46 adults with persistent PCS after predominantly mild-to-moderate TBI (52% with posttraumatic amnesia (PTA) ≤ 24 hours), but including some with severe TBIs (20% with PTA > 7 days). Results: Improvements associated with CBT were found on the primary outcome measures relating to quality of life (using the Quality of Life Assessment Schedule and the Brain Injury Community Rehabilitation Outcome Scale). Treatment effects after covarying for treatment duration were also found for PCS and several secondary outcomes, including measures of anxiety and fatigue (but not depression or post-traumatic stress disorder (PTSD)). Improvements were more apparent for those completing CBT sessions over a shorter period of time, but were unrelated to medicolegal status, injury severity or length of time since injury. Conclusions: This study suggests that CBT can improve quality of life for adults with persistent PCS and potentially reduce symptoms for some, in the context of outpatient brain injury rehabilitation services.</p>				

*3 of the sections were not indicated in the study

Recommendation(s) Supported: 2.8				
Reference	Year	Country	Design	Quality Rating
Bryant RA, Moulds M, Guthrie R, Nixon RD. Treating acute stress disorder following mild traumatic brain injury. <i>Am J Psychiatry</i> . 2003;160(3):585-587.	2003	Australia	Case-Control	DOWNNS & BLACK: 21/32*
Abstract				
Objective: Acute stress disorder permits early identification of trauma survivors who are at risk of developing chronic posttraumatic stress disorder (PTSD). This study aimed to prevent PTSD in people who developed acute stress disorder after a mild brain injury by early provision of cognitive behavior therapy. Method: Twenty-four civilian trauma survivors with acute stress disorder were given five individually administered sessions of either cognitive behavior therapy or supportive counseling within 2 weeks of their trauma. Results: Fewer patients receiving cognitive behavior therapy than supportive counseling met criteria for PTSD at a posttreatment evaluation (8% versus 58%, respectively). There were also fewer cases of PTSD at a 6-month follow-up evaluation among those receiving cognitive behavior therapy (17%) than among those receiving supportive counseling (58%). Patients in the cognitive behavior therapy condition displayed less re-experiencing and avoidance symptoms at the follow-up evaluation than patients receiving supportive counseling. Conclusions: These findings suggest that PTSD following mild brain injury can be effectively prevented with early provision of cognitive behavior therapy.				
*1 section was not applicable				

Recommendation(s) Supported: 3.2				
Reference	Year	Country	Design	Quality Rating
Asken BM, McCrea MA, Clugston JR, Snyder AR, Houck ZM, Bauer RM. "Playing Through It": Delayed Reporting and Removal From Athletic Activity After Concussion Predicts Prolonged Recovery. <i>J Athl Train</i> . 2016;51(4):329-335.	2016	USA	Cross-Sectional	DOWNNS & BLACK: 12/32*
Abstract				
Context: Preclinical research has demonstrated a window of vulnerability in the immediate aftermath of concussion wherein continued activity and stimulation can impair or prolong neurobehavioral recovery. However, this concept has not been quantified in a human population. Objective: To examine the effect of delayed reporting and removal from athletic activity after concussion on recovery time. Design: Cross-sectional study. Setting: A National Collegiate Athletic Association Division I university. Patients or Other Participants: Ninety-seven athletes who sustained a sport-related concussion between 2008 and 2015 were analyzed (age = 20.4 ± 1.3 years). Athletes were grouped as immediate removal from activity (I-RFA) or delayed removal from activity (D-RFA). Main Outcome Measure(s): Days missed was defined as the number of days between the concussion-causing event and clearance for return to contact. Associations between RFA group and prolonged (8 or more days') versus normal (7 or fewer days') recovery were also analyzed. Results: Fifty (51.5%) of the 97 athletes did not immediately report concussion symptoms. The D-RFA athletes averaged 4.9 more days missed than the I-RFA athletes. Membership in the specific RFA group predicted days missed even after controlling for sex, concussion history, learning disability or attention-deficit/hyperactivity disorder diagnosis, diagnosed psychological disorder, and acute symptom severity (R^2 change = 0.097, β = .319, P = .002). The D-RFA athletes were approximately 2.2 times more likely to have a prolonged recovery (8 or more days) compared with the I-RFA athletes (X^2 = 10.268, P = .001, ϕ = 0.325). Conclusions: Athletes who do not immediately report symptoms of a concussion and continue to participate in athletic activity are at risk for longer recoveries than athletes who immediately report symptoms and are immediately removed from activity. Continuing to participate in athletic activity during the immediate aftermath of a concussion potentially exposes the already injured brain to compounded neuropathophysiologic processes.				
*7 of the sections were not applicable				

Recommendation(s) Supported: 3.2				
Reference	Year	Country	Design	Quality Rating
Thesleff T, Kataja A, A-hman J, Luoto TM. Head injuries and the risk of concurrent cervical spine fractures. <i>Acta Neurochir (Wien)</i> . 2017;159(5):907-914.	2017	Finland	Retrospective Cohort	DOWNNS & BLACK: 16/32*
Abstract				
Background: Cervical spine injuries of variable severity are common among patients with an acute traumatic brain injury (TBI). We hypothesised that TBI patients with positive head computed tomography (CT) scans would have a				

significantly higher risk of having an associated cervical spine fracture compared to patients with negative head CT scans. Method: This widely generalisable retrospective sample was derived from 3,023 consecutive patients, who, due to an acute head injury (HI), underwent head CT at the Emergency Department of Tampere University Hospital (August 2010– July 2012). Medical records were reviewed to identify the individuals whose cervical spine was CT-imaged within 1 week after primary head CT due to a clinical suspicion of a cervical spine injury (CSI) (n = 1,091). Results: Of the whole cranio cervically CT-imaged sample (n = 1,091), 24.7% (n = 269) had an acute CT-positive TBI. Car accidents 22.4% (n = 244) and falls 47.8% (n = 521) were the most frequent injury mechanisms. On cervical CT, any type of fracture was found in 6.6% (n = 72) and dislocation and/or subluxation in 2.8% (n = 31) of the patients. The patients with acute traumatic intracranial lesions had significantly ($p = 0.04$; OR = 1.689) more cervical spine fractures (9.3%, n = 25) compared to head CT-negative patients (5.7%, n = 47). On an individual cervical column level, head CT positivity was especially related to C6 fractures ($p = 0.031$, OR = 2.769). Patients with cervical spine fractures (n = 72) had altogether 101 fractured vertebrae, which were most often C2 (22.8, n = 23), C7 (19.8%, n = 20) and C6 (16.8%, n = 17). Conclusions: Head trauma patients with acute intracranial lesions on CT have a higher risk for cervical spine fractures in comparison to patients with a CT-negative head injury. Although statistically significant, the difference in fracture rate was small. However, based on these results, we suggest that cervical spine fractures should be acknowledged when treating CT-positive TBIs.

*6 of the sections were not applicable

Recommendation(s) Supported: 3.2, 6.4				
Reference	Year	Country	Design	Quality Rating
Kennedy E, Quinn D, Tumilty S, Chapple CM. Clinical characteristics and outcomes of treatment of the cervical spine in patients with persistent post-concussion symptoms: A retrospective analysis. <i>Musculoskelet Sci Pract.</i> 2017;29:91-98.	2017	New Zealand	Retrospective Cohort	DOWNS & BLACK: 16/32*
Abstract				
<p>Background: Concussion is typically defined as a mild brain injury, and yet the brain is unlikely to be the only source of persistent post-concussion symptoms. Concurrent injury to the cervical spine in particular is acknowledged as a potential source of common persistent symptoms such as headache, dizziness and neck pain. Objectives: To describe the cervical spine findings and outcomes of treatment in a series of patients with persistent post-concussion symptoms, and describe the clinical characteristics of a cervicogenic component when it is present. Design: Retrospective chart review of a consecutive series of patients with concussion referred to a physiotherapist for cervical spine assessment. Method: Patient charts for all patients over a calendar year referred by a concussion service provider to a physiotherapist for cervical spine assessment were de-identified and transferred to the research team. Clinical data were independently extracted by two research assistants and analysed using descriptive statistics. Results/findings: Data were analysed from 46 patient charts. Those with a cervicogenic component ($n = 32$) were distinguished from those without a cervicogenic component ($n = 14$) by physical examination findings, particularly pain on manual segmental examination. Physiotherapy treatment of the cervicogenic component ($n = 21$) achieved improvements in function (mean increase of 3.8 in the patient-specific functional scale), and pain (mean decrease of 4.6 in the numeric pain-rating scale). Conclusions: The clinical characteristics described give preliminary support to the idea that the cervical spine may contribute to persistent post-concussion symptoms, and highlight the value of physiotherapy assessment and treatment of the cervical spine following a concussive injury.</p>				
*5 of the sections were not applicable				

Recommendation(s) Supported: 3.4, 12.2				
Reference	Year	Country	Design	Quality Rating
Buckley TA, Munkasy BA, Clouse BP. Acute Cognitive and Physical Rest May Not Improve Concussion Recovery Time. <i>J Head Trauma Rehabil.</i> 2016;31(4):233-241.	2016	USA	Prospective Cohort	DOWNS & BLACK: 15/32*
Abstract				
<p>Objective: To evaluate the effectiveness of an acute period of cognitive and physical rest on concussion. Participants: Fifty consecutive patients with a diagnosis of concussions. Design: Participants were evaluated before ($n = 25$) and after ($n = 25$) a policy change that incorporated cognitive and physical rest. Patients in the rest group were withheld from activities, including classes, for the remainder of the injury day and the following day, whereas patients in the no-rest group were not provided any postinjury accommodations. Main Measures: Patients were evaluated on a graded symptom checklist, Balance Error Scoring System, Standard Assessment of Concussion, and computerized neuropsychological tests. The number of days until each test achieved baseline values was compared between groups with independent-samples t test. Results: The no-rest group achieved asymptomatic status sooner than the rest group (5.2 ± 2.9 days and 3.9 ± 1.9 days, respectively; $P = .047$). There were no differences between groups for time to baseline values on the Balance Error Scoring System, Standard Assessment of Concussion, computerized neuropsychological tests, or time to clinical recovery. Conclusion: A prescribed day of cognitive and physical rest was not effective in reducing postconcussion recovery time. These results agree with a previous study and suggest that light activity postconcussion may not be deleterious to the concussion recovery process.</p>				
*6 of the sections were not applicable				

Recommendation(s) Supported: 3.4, 12.2				
Reference	Year	Country	Design	Quality Rating
Schneider KJ, Leddy JJ, Guskiewicz KM, et al. Rest and treatment/rehabilitation following sport-related concussion: a systematic review. <i>Br J Sports Med.</i> 2017;51(12):930-934.	2017	Canada	Systematic Review	PRISMA: 18/27*
Abstract				
Aim or objective: The objective of this systematic review was to evaluate the evidence regarding rest and active				

treatment/rehabilitation following sport-related concussion (SRC). Design: Systematic review. Data sources: MEDLINE (OVID), CINAHL (EbscoHost), PsycInfo (OVID), Cochrane Central Register of Controlled Trials (OVID), SPORTDiscus (EbscoHost), EMBASE (OVID) and Proquest Dissertations and Theses Global (Proquest) were searched systematically. Eligibility criteria for selecting studies: Studies were included if they met the following criteria: (1) original research; (2) reported SRC as the diagnosis; and (3) evaluated the effect of rest or active treatment/rehabilitation. Review articles were excluded. Results: Twenty-eight studies met the inclusion criteria (9 regarding the effects of rest and 19 evaluating active treatment). The methodological quality of the literature was limited; only five randomised controlled trials (RCTs) met the eligibility criteria. Those RCTs included rest, cervical and vestibular rehabilitation, subsymptom threshold aerobic exercise and multifaceted collaborative care. Summary/conclusions: A brief period (24–48 hours) of cognitive and physical rest is appropriate for most patients. Following this, patients should be encouraged to gradually increase activity. The exact amount and duration of rest are not yet well defined and require further investigation. The data support interventions including cervical and vestibular rehabilitation and multifaceted collaborative care. Closely monitored subsymptom threshold, submaximal exercise may be of benefit.

*Additional analyses were not undertaken (i.e., meta-analyses), so 5 of the items were not applicable

Recommendation(s) Supported: 3.4, 4.5, 5.5, 11.3, 12.2, 12.5				
Reference	Year	Country	Design	Quality Rating
Silverberg ND, Iverson GL. Is rest after concussion "the best medicine?": recommendations for activity resumption following concussion in athletes, civilians, and military service members. <i>J Head Trauma Rehabil.</i> 2013;28(4):250-259.	2013	Canada	Discussion/Review Article	N/A*
Abstract				
Practice guidelines universally recommend an initial period of rest for people who sustain a sports-related concussion or mild traumatic brain injury (MTBI) in daily life or military service. This practice is difficult to reconcile with the compelling evidence that other health conditions can be worsened by inactivity and improved by early mobilization and exercise. We review the scientific basis for the recommendation to rest after MTBI, the challenges and potential unintended negative consequences of implementing it, and how patient management could be improved by refining it. The best available evidence suggests that complete rest exceeding 3 days is probably not helpful, gradual resumption of preinjury activities should begin as soon as tolerated (with the exception of activities that have a high MTBI exposure risk), and supervised exercise may benefit patients with persistent symptoms.				

*No checklists were appropriate to score this article design

Recommendation(s) Supported: 3.4, 4.5, 5.5, 11.3, 12.5				
Reference	Year	Country	Design	Quality Rating
Varner CE, McLeod S, Nahiddi N, Lougheed RE, Dear TE, Borgundvaag B. Cognitive Rest and Graduated Return to Usual Activities Versus Usual Care for Mild Traumatic Brain Injury: A Randomized Controlled Trial of Emergency Department Discharge Instructions. <i>Acad Emerg Med.</i> 2017;24(1):75-82.	2016	Canada	Randomized Control Trial	PE德罗: 8/11
Abstract				
Objectives: It is estimated that 15%–25% of patients with a mild traumatic brain injury (MTBI) diagnosed in the emergency department (ED) will develop postconcussive syndrome. The objective of this study was to determine if patients randomized to graduated return to usual activity discharge instructions had a decrease in their Post-Concussion Symptom Score (PCSS) 2 weeks after MTBI compared to patients who received usual care MTBI discharge instructions. Methods: This was a pragmatic, randomized trial of adult (18–64 years) patients of an academic ED (annual census 60,000) diagnosed with MTBI occurring within 24 hours of ED visit. The intervention group received cognitive rest and graduated return to usual activity discharge instructions, and the control group received usual care discharge instructions that did not instruct cognitive rest or graduated return. Patients were contacted by text message or phone 2 and 4 weeks post-ED discharge and asked to complete the PCSS, a validated, 22-item questionnaire, to determine if there was a change in their symptoms. Secondary outcomes included change in PCSS at 4 weeks, number follow-up physician visits, and time off work/school. Results: A total of 118 patients were enrolled in the study (58 in the control group and 60 in the intervention). The mean (\pm SD) age was 35.2 (\pm 13.7) years and 43 (36.4%) were male. There was no difference with respect to change in PCSS at 2 weeks (10.5 vs. 12.8; Δ 2.3, 95% confidence interval [CI] = 7.0 to 11.7) and 4 weeks post-ED discharge (21.1 vs 18.3; Δ 2.8,				

95% CI = 6.9 to 12.7) for the intervention and control groups, respectively. The number of follow-up physician visits and time off work/school were similar when the groups were compared. Thirty-eight (42.2%) and 23 (30.3%) of patients in this cohort had ongoing MTBI symptoms (PCSS > 20) at 2 and 4 weeks, respectively. Conclusions: Results from this study suggest graduated return to usual activity discharge instructions do not impact rate of resolution of MTBI symptoms 2 weeks after ED discharge. Given that patients continue to experience symptoms 2 and 4 weeks after MTBI, more investigation is needed to determine how best to counsel and treat patients with postconcussive symptoms.

Recommendation(s) Supported: 3.4, 4.5, 5.5, 11.3, 12.2, 12.5				
Reference	Year	Country	Design	Quality Rating
Maerlender A, Rieman W, Lichtenstein J, Condiracci C. Programmed Physical Exertion in Recovery From Sports-Related Concussion: A Randomized Pilot Study. <i>Dev Neuropsychol.</i> 2015;40(5):273-278.	2015	USA	Pilot Randomized Control Trial	PEDro: 6/11
Abstract				
Although no data exist, general practice recommends only rest following concussion. This randomized clinical trial found that programmed physical exertion during recovery produced no significant differences in recovery time between groups of participants. However, high levels of exertion were deleterious. This study provides initial evidence that moderate physical activity is a safe replacement behavior during recovery.				

Recommendation(s) Supported: 3.4, 4.5, 5.5, 11.3, 12.2, 12.5				
Reference	Year	Country	Design	Quality Rating
Schneider KJ, Iverson GL, Emery CA, McCrory P, Herring SA, Meeuwisse WH. The effects of rest and treatment following sport-related concussion: a systematic review of the literature. <i>Br J Sports Med.</i> 2013;47(5):304-307.	2013	Canada	Systematic Review	PRISMA: 10/27*
Abstract				
Objective: To evaluate the evidence for rest, treatment, and rehabilitation following sport-related concussion (SRC). Data sources: PubMed, CINAHL, PsychInfo, Cochrane Controlled Trials Registers, Health STAR, Sport Discus, EMBASE, Web of Science, and ProQuest. Study selection: Articles were included if they met the following criteria: original research, reported SRC as a source of injury, and evaluated the effect of rest or treatment. Data extraction: Study design, participants, treatment, outcome measures, and key findings. Data synthesis: Three studies met the inclusion criteria for evaluating the effects of rest and twelve for treatment. Low-intensity aerobic exercise may be of benefit. Conclusions: The current evidence evaluating the effect of rest and treatment following SRC is sparse. An initial period of rest may be of benefit. Low-level exercise and multimodal physiotherapy may be of benefit for those who are slow to recover. There is a strong need for high level studies evaluating the effects of rest and treatment following SRC.				

*Additional analyses were not undertaken (i.e., meta-analyses), so 5 of the items were not applicable

Recommendation(s) Supported: 4.4, 5.6				
Reference	Year	Country	Design	Quality Rating
Weyer Jamora C, Schroeder SC, Ruff RM. Pain and mild traumatic brain injury: the implications of pain severity on emotional and cognitive functioning. <i>Brain Inj.</i> 2013;27(10):1134-1140.	2013	USA	Case-Control	DOWNS & BLACK: 14/32*
Abstract				
Primary objective: The aim of this study was to examine the effect of high chronic pain on (a) neuropsychological test performance and (b) self-reported emotional complaints in persons suffering from Postconcussional Disorders (PCD) after a mild traumatic brain injury (TBI). Research design: A two-group comparative research design was employed. Methods and procedure: An outpatient sample of 66 patients with mild TBI and PCD using the Ruff Neurobehavioural Inventory (RNBI) and a neuropsychological test battery. Main outcomes and results: According to ANOVAs, no significant between-group differences were found on neuropsychological test performances; however, the high pain group had significantly more emotional residuals; particularly elevated on the RNBI were the Anger and Aggression, Anxiety, Depression and Paranoia and Suspicion sub-scales. Furthermore, an ANOVA found participants of the high				

pain group reporting significantly higher impairments on the RNBI Cognitive, Physical and Quality-of-Life composite scores and several RNBI sub-scales compared to their pre-morbid functioning. Conclusions: High chronic pain exacerbates the emotional aspect of PCD and, therefore, should be given special observance in treatment settings.

*6 of the sections were not applicable

Recommendation(s) Supported: 4.5, 5.5, 11.3, 12.5				
Reference	Year	Country	Design	Quality Rating
Chin LM, Keyser RE, Dsurney J, Chan L. Improved cognitive performance following aerobic exercise training in people with traumatic brain injury. <i>Arch Phys Med Rehabil.</i> 2015;96(4):754-759.	2015	USA	Case Series	DOWN'S & BLACK: 14/32*
Abstract				
Objective: To examine cognitive function in individuals with traumatic brain injury (TBI) prior to and after participation in an aerobic exercise training program. Design: Pre-post intervention study. Setting: Medical research center. Participants: Volunteer sample of individuals (N=7) (age, 33.37.9y) with chronic nonpenetrating TBI (injury severity: 3=mild, 4=moderate time since most current injury: 4.0±5.5y) who were ambulatory. Intervention: Twelve weeks of supervised vigorous aerobic exercise training performed 3 times a week for 30 minutes on a treadmill. Main Outcome Measures: Cognitive function was assessed using the Trail Making Test Part A (TMT-A), Trail Making Test Part B (TMT-B), and Repeatable Battery for the Assessment of Neuropsychological Status (RBANS). Sleep quality and depression were measured with the Pittsburgh Sleep Quality Index (PSQI) and Beck Depression Inventory, version 2 (BDI-II). Indices of cardiorespiratory fitness were used to examine the relation between improvements in cognitive function and cardiorespiratory fitness. Results: After training, improvements in cognitive function were observed with greater scores on the TMT-A (10.3±6.8; P=.007), TMT-B (9.6±7.0; P=.011), and RBANS total scale (13.3±9.3; P=.009). No changes were observed in measures of the PSQI and BDI-II. The magnitude of cognitive improvements was also strongly related to the gains in cardiorespiratory fitness. Conclusions: These findings suggest that vigorous aerobic exercise training may improve specific aspects of cognitive function in individuals with TBI and cardiorespiratory fitness gains may be a determinant of these improvements.				

*4 of the sections were not applicable

Recommendation(s) Supported: 4.5, 5.5, 11.3, 11.4, 12.5				
Reference	Year	Country	Design	Quality Rating
Chin LM, Chan L, Woolstenhulme JG, Christensen EJ, Shenouda CN, Keyser RE. Improved Cardiorespiratory Fitness With Aerobic Exercise Training in Individuals With Traumatic Brain Injury. <i>J Head Trauma Rehabil.</i> 2015;30(6):382-390.	2015	USA	Case Series	DOWN'S & BLACK: 14/32*
Abstract				
Objective: To examine cardiorespiratory fitness in individuals with traumatic brain injury (TBI), before and following participation in a supervised 12-week aerobic exercise training program. Methods: Ten subjects with nonpenetrating TBI (TBI severity: mild, 50%; moderate, 40%; severe, 10%; time since injury [mean ± SD]: 6.6 ± 6.8 years) performed exercise training on a treadmill 3 times a week for 30 minutes at vigorous intensity (70%-80% of heart rate reserve). All subjects completed a cardiopulmonary exercise test, with pulmonary gas exchange measured and a questionnaire related to fatigue (Fatigue Severity Scale) at baseline and following exercise training. Results: After training, increases (P < .01) in peak oxygen consumption ($\dot{V}O_2$; +3.1 ± 2.4 mL/min/kg), time to volitional fatigue (+1.4 ± 0.8 minutes), and peak work rate (+59 ± 43 W) were observed. At the anaerobic threshold, $\dot{V}O_2$ (+3.6 ± 2.1 mL/kg/min), treadmill time (+1.8 ± 1.1 minutes), and work rate (+37 ± 39 W) were higher (P < .01) following exercise training. Subjects also reported significantly lower (P < .05) Fatigue Severity Scale composite scores (-0.9 ± 1.3) following exercise training. Conclusion: These findings suggest that individuals with TBI may benefit from participation in vigorous aerobic exercise training with improved cardiorespiratory fitness and diminished fatigue.				

*4 of the sections were not applicable

Recommendation(s) Supported: 4.5, 5.5, 11.3, 12.5				
Reference	Year	Country	Design	Quality Rating
Baker JG, Freitas MS, Leddy JJ, Kozlowski KF, Willer BS. Return to full functioning after graded exercise assessment and progressive exercise treatment of postconcussion syndrome. <i>Rehabil Res Pract.</i> 2012;2012:705309.	2012	USA	Retrospective Chart Review	DOWNES & BLACK: 14/32*
Abstract				
<p>Exercise assessment and aerobic exercise training for postconcussion syndrome (PCS) may reduce concussion-related physiological dysfunction and symptoms by restoring autonomic balance and improving cerebral blood flow auto regulation. In a descriptive pilot study of 91 patients referred to a university clinic for treatment of PCS, a subset of 63 patients were contacted by telephone for assessment of symptoms and return to full daily functioning. Those who experienced symptoms during a graded exercise treadmill test (physiologic PCS, n = 40) were compared to those who could exercise to capacity (PCS, n = 23). Both groups had been offered progressive exercise rehabilitation. Overall 41 of 57 (72%) who participated in the exercise rehabilitation program returned to full daily functioning. This included 27 of 35 (77%) from the physiologic PCS group, and 14 of 22 (64%) from the PCS group. Only 1 of the 6 patients who declined exercise rehabilitation returned to full functioning. Interpretation of these results is limited by the descriptive nature of the study, the small sample size, and the relatively few patients who declined exercise treatment. Nonetheless, exercise assessment indicates that approximately one third of those examined did not have physiologic PCS.</p>				

*4 of the sections were not applicable

Recommendation(s) Supported: 4.5, 5.5, 11.3				
Reference	Year	Country	Design	Quality Rating
Leddy J, Hinds A, Sirica D, Willer B. The Role of Controlled Exercise in Concussion Management. <i>PM R.</i> 2016;8(3 Suppl):S91-S100.	2016	USA	Discussion/Review Article	N/A*
Abstract				
<p>Concussion affects the autonomic nervous system and its control of cerebral blood flow, which may be why uncontrolled activity can exacerbate symptoms after concussion. Traditionally, patients have been advised to restrict physical and cognitive activity until all symptoms resolve. However, recent research suggests that prolonged rest beyond the first couple of days after a concussion might hinder rather than aid recovery. Humans do not respond well to removal from their social and physical environments, and sustained rest adversely affects the physiology of concussion and can lead to physical deconditioning and reactive depression. Some animal data show that early forced exercise is detrimental to recovery after concussion, but other animal data show that voluntary exercise is not detrimental to recovery. We developed the Buffalo Concussion Treadmill Test to systematically evaluate exercise tolerance in persons with prolonged symptoms after concussion (ie, more than 4-6 weeks, which is called postconcussion syndrome [PCS]). Using a predetermined stopping criterion (symptom-exacerbation threshold), akin to voluntary exercise in animals, the Buffalo Concussion Treadmill Test is the only functional test known to safely and reliably reveal exercise intolerance in humans with PCS. The test data are used to develop individualized subthreshold exercise treatment programs to restore the physiology to normal and enhance recovery. Return of normal exercise tolerance can then be used to establish physiological recovery from concussion. New research suggests that absolute rest beyond the first few days after concussion may be detrimental to concussion recovery. However, further research is required to determine the appropriate mode, duration, intensity, and frequency of exercise during the acute recovery phase of a concussion prior to making specific exercise recommendations. For patients with PCS, subsymptom threshold exercise improves activity tolerance and is an appropriate treatment option for this patient population.</p>				

*No checklists were appropriate to score this article design

Recommendation(s) Supported: 5.1				
Reference	Year	Country	Design	Quality Rating
McMahon P, Hricik A, Yue JK, et al. Symptomatology and functional outcome in mild traumatic brain injury: results from the prospective TRACK-TBI study. <i>J Neurotrauma.</i> 2014;31(1):26-33.	2014	USA	Prospective Cohort	DOWNES & BLACK: 14/32*
Abstract				

Mild Traumatic Brain Injury (mTBI), or concussion, is a major public health concern. There is controversy in the literature regarding the true incidence of postconcussion syndrome (PCS), with the constellation of physical, cognitive, emotional, and sleep symptoms after mTBI. In the current study, we report on the incidence and evolution of PCS symptoms and patient outcomes after mTBI at 3, 6, and 12 months in a large, prospective cohort of mTBI patients. Participants were identified as part of the prospective, multi-center Transforming Research and Clinical Knowledge in Traumatic Brain Injury Study. The study population was mTBI patients (Glasgow Coma Scale score of 13–15) presenting to the emergency department, including patients with a negative head computed tomography discharged to home without admission to hospital; 375 mTBI subjects were included in the analysis. At both 6 and 12 months after mTBI, 82% (n = 250 of 305 and n = 163 of 199, respectively) of patients reported at least one PCS symptom. Further, 44.5 and 40.3% of patients had significantly reduced Satisfaction With Life scores at 6 and 12 months, respectively. At 3 months after injury, 33% of the mTBI subjects were functionally impaired (Glasgow Outcome Scale-Extended score ≤ 6); 22.4% of the mTBI subjects available for follow-up were still below full functional status at 1 year after injury. The term “mild” continues to be a misnomer for this patient population and underscores the critical need for evolving classification strategies for TBI for targeted therapy.

*6 of the sections were not applicable

Recommendation(s) Supported: 5.2				
Reference	Year	Country	Design	Quality Rating
Sasse N, Gibbons H, Wilson L, et al. Coping strategies in individuals after traumatic brain injury: associations with health-related quality of life. <i>Disabil Rehabil</i> . 2014;36(25):2152-2160.	2014	Germany	Cross-Sectional	DOWNNS & BLACK: 12/32*
Abstract				
Purpose: This study investigates coping strategies after traumatic brain injury (TBI) and their associations with health-related quality of life (HRQoL). Methods: Participants were 141 adults followed up 3 months to 15 years after TBI of all severity degrees. Coping was assessed by the Freiburg Questionnaire of Coping with Illness (FQCI) and HRQoL by the Quality of Life after Brain Injury (QOLIBRI) scale and the Short Form-36 Health Survey (SF-36). Coping dimensions were extracted by principal component analysis. Multiple linear regression analysis was used to identify predictors of coping strategies. Results: Two factors for coping after TBI were extracted: Action/Distraction and Trivialisation/Resignation. The Trivialisation/Resignation strategy was negatively correlated with all aspects of HRQoL, while relationships with the Action/Distraction strategy were positive and significant for two domains. These two factors also showed significant associations with anxiety, depression, recovery, cognitive status, mood states and trauma severity. Multiple regression analysis identified recovery status as a predictor for the maladaptive Trivialisation/Resignation strategy. Conclusion: Two coping factors were identified, which were differentially associated with HRQoL. Maladaptive coping strategies play a particularly important role, and less reliance on such strategies is associated with better HRQoL; use of adaptive strategies should correspondingly be fostered.				

*7 of the sections were not applicable

Recommendation(s) Supported: 5.2				
Reference	Year	Country	Design	Quality Rating
Tator CH, Davis HS, Dufort PA, et al. Postconcussion syndrome: demographics and predictors in 221 patients. <i>J Neurosurg</i> . 2016;125(5):1206-1216.	2016	Canada	Retrospective Cohort	DOWNNS & BLACK: 13/32*
Abstract				
Objective: The objective of this study was to determine the demographics and predictors of postconcussion syndrome (PCS) in a large series of patients using a novel definition of PCS. Methods: The authors conducted a retrospective cohort study of 284 consecutive concussed patients, 221 of whom had PCS on the basis of at least 3 symptoms persisting at least 1 month. This definition of PCS was uniformly employed and is unique in accepting an expanded list of symptoms, in shortening the postconcussion interval to 1 month from 3 months, and in excluding those with focal injuries such as hemorrhages and contusions. Results: The 221 cases showed considerable heterogeneity in clinical features of PCS. They averaged 3.3 concussions, with a range of 0 to 12 or more concussions, and 62.4% occurred during sports and recreation. The median duration of PCS was 7 months at the time of examination, with 11.8% lasting more than 2 years, and 23.1% with PCS had only 1 concussion. The average patient age was 27 years (range 10–74 years). The average number of persistent symptoms was 8.1; 26.2% had a previous psychiatric condition, attention-deficit disorder/attention-deficit hyperactivity disorder, a learning disability, or previous migraine headaches. The prevalence of arachnoid cysts and Chiari malformation in PCS exceeded the general population. Additionally, involvement in litigation, presence of extracranial injuries, amnesia and/or loss of consciousness, and female sex were predictive of reporting a high number of symptoms. A prior history of psychiatric conditions or				

migraines, cause of injury, number of previous concussions, and age did not significantly predict symptom number. Only the number of symptoms reported predicted the duration of PCS. To predict the number of symptoms for those who fulfilled PCS criteria according to the *International Classification of Diseases, 10th Revision (ICD-10)*, and the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV)*, the number of previous concussions was significant. Conclusions: PCS is commonly associated with multiple concussions, but 23.1% in the present series occurred after only 1 concussion. Most patients with PCS had multiple symptoms persisting for months or years. The median duration of PCS was 7 months, with a range up to 26 years. In only 11.3%, the PCS had ended at the time of consultation. Not all predictors commonly cited in the literature align with the findings in this study. This is likely due to differences in the definitions of PCS used in research. These results suggest that the use of ICD-10 and DSM-IV to diagnose PCS may be biased toward those who are vulnerable to concussions or with more severe forms of PCS. It is thus important to redefine PCS based on evidence-based medicine.

*8 of the sections were not applicable

Recommendation(s) Supported: 5.2, 6.1

Reference	Year	Country	Design	Quality Rating
Sawyer K, Bell KR, Ehde DM, et al. Longitudinal Study of Headache Trajectories in the Year After Mild Traumatic Brain Injury: Relation to Posttraumatic Stress Disorder Symptoms. <i>Arch Phys Med Rehabil.</i> 2015;96(11):2000-2006.	2015	USA	Longitudinal Perspective Cohort	DOWNS & BLACK: 16/32*

Abstract

Objective: To examine headache trajectories among persons with mild traumatic brain injury (MTBI) in the year after injury and the relation of headache trajectory to posttraumatic stress disorder (PTSD) at 1 year postinjury. Design: Prospective, longitudinal study. Setting: Participants were recruited through a university medical center and participated in follow-up assessments by telephone. Participants: Prospectively enrolled individuals (N2212) within 1 week of MTBI who were hospitalized for observation or other system injuries. Participants were assessed at baseline and 3, 6, and 12 months postinjury. Interventions: Not applicable. Main Outcome Measures: Participants rated average headache pain intensity using the 0 to 10 numerical rating scale at each assessment period. The PTSD Checklist-Civilian Version was completed at 12 months postinjury. Results: Latent class growth analysis produced a 4-trajectory group model, with groups labeled resolved, worsening, improving, and chronic. Multivariate regression modeling revealed that younger age and premonitory headache correlated with membership in the worse trajectory groups (worsening and chronic; $P < .001$). Univariate regression revealed a significant association between PTSD and membership in the worse trajectory groups ($P < .001$). Conclusions: Headache is common in the year after MTBI, with younger people, persons who previously had headaches, and persons with PTSD more likely to report chronic or worsening headache. Further research is needed to examine whether PTSD symptoms exacerbate headaches or whether problematic headache symptoms exacerbate PTSD.

*5 of the sections were not applicable

Recommendation(s) Supported: 5.3

Reference	Year	Country	Design	Quality Rating
Wojcik SM. Predicting mild traumatic brain injury patients at risk of persistent symptoms in the Emergency Department. <i>Brain Inj.</i> 2014;28(4):422-430.	2014	USA	Case-Control	DOWNS & Black: 16/32*

Abstract

Objective: To identify factors that can predict which emergency department (ED) patients with mTBI are likely to develop persistent post-concussion symptoms (PPCS). Design: A matched case-control study was conducted at a Level 1 trauma centre between June 2006 and July 2009. Patients diagnosed with mTBI in the ED and diagnosed at a concussion management programme with at least one PPCS (85 cases) were compared to patients diagnosed with mTBI in the ED (340 controls) to determine if factors assessed at the time of ED presentation could predict patients likely to develop persistent symptoms. Results: Multivariable hierarchical logistic regression with variables indicating increased risk for PPCS (prior mTBI, history of depression, history of anxiety, multiple injury, forgetfulness/poor memory, noise sensitivity, or light sensitivity) resulted in a final predictive model including prior mTBI, history of anxiety, forgetfulness/poor memory and light sensitivity. The final model had a specificity of 87.9% and a sensitivity of 69.9%. Conclusions: A strong prediction model to identify those ED patients with mTBI at risk for PPCS was developed and could be easily implemented in the ED; therefore, helping to target those patients who would potentially benefit from close follow-up.

*7 of the sections were not applicable

Recommendation(s) Supported: 5.8				
Reference	Year	Country	Design	Quality Rating
Walker WC, Franke LM, Cifu DX, Hart BB. Randomized, Sham-Controlled, Feasibility Trial of Hyperbaric Oxygen for Service Members With Postconcussion Syndrome: Cognitive and Psychomotor Outcomes 1 Week Postintervention. <i>Neurorehabil Neural Repair</i> . 2014;28(5):420-432.	2014	USA	Randomized Control Trial	PEDro: 11/11
Abstract				
<p>Background. Mild traumatic brain injury (mTBI) and residual postconcussion syndrome (PCS) are common among combatants of the recent military conflicts in Iraq and Afghanistan. Hyperbaric oxygen (HBO2) is a proposed treatment but has not been rigorously studied for this condition. Objectives. In a secondary analysis, examine for possible effects on psychomotor (balance and fine motor) and cognitive performance 1 week after an HBO2 intervention in service members with PCS after mTBI. Methods. A randomized, double-blind, sham control, feasibility trial comparing pretreatment and posttreatment was conducted in 60 male active-duty marines with combat-related mTBI and PCS persisting for 3 to 36 months. Participants were randomized to 1 of 3 preassigned oxygen fractions (10.5%, 75%, or 100%) at 2.0 atmospheres absolute (ATA), resulting in respective groups with an oxygen exposure equivalent to (1) breathing surface air (Sham Air), (2) 100% oxygen at 1.5 ATA (1.5 ATA02), and (3) 100% oxygen at 2.0 ATA (2.0 ATA02). Over a 10-week period, participants received 40 hyperbaric chamber sessions of 60 minutes each. Outcome measures, including computerized posturography (balance), grooved pegboard (fine motor speed/dexterity), and multiple neuropsychological tests of cognitive performance, were collected preintervention and 1-week postintervention. Results. Despite the multiple sensitive cognitive and psychomotor measures analyzed at an unadjusted 5% significance level, this study demonstrated no immediate postintervention beneficial effect of exposure to either 1.5 ATA02 or 2.0 ATA02 compared with the Sham Air intervention. Conclusions. These results do not support the use of HBO2 to treat cognitive, balance, or fine motor deficits associated with mTBI and PCS.</p>				

Recommendation(s) Supported: 5.8				
Reference	Year	Country	Design	Quality Rating
Cifu DX, Hart BB, West SL, Walker W, Carne W. The effect of hyperbaric oxygen on persistent postconcussion symptoms. <i>J Head Trauma Rehabil</i> . 2014;29(1):11-20.	2014	USA	Randomized Control Trial	PEDro: 10/11
Abstract				
<p>Background: The high incidence of persistent postconcussion symptoms in service members with combat-related mild traumatic brain injury has prompted research in the use of hyperbaric oxygen (HBO2) for management. Objective: The effects of HBO2 on persistent postconcussion symptoms in 60 military service members with at least 1 combat-related mild traumatic brain injury were examined in a single-center, double-blind, randomized, sham controlled, prospective trial at the Naval Medicine Operational Training Center at Naval Air Station Pensacola. Methods: Over a 10-week period, subjects received a series of 40, once-daily, hyperbaric chamber compressions at 2.0 atmospheres absolute (ATA). During each session, subjects breathed 1 of 3 preassigned oxygen fractions (10.5%, 75%, or 100%) for 60 minutes, resulting in an oxygen exposure equivalent to breathing surface air, 100% oxygen at 1.5 ATA, or 100% oxygen at 2.0 ATA, respectively. Individual, subscale and total item responses on the Rivermead Postconcussion Symptom Questionnaire and individual and total Posttraumatic Disorder Checklist–Military Version were measured just prior to intervention and immediately postintervention. Results: Between-group testing of pre- and postintervention means revealed no significant differences on individual or total scores on the Posttraumatic Disorder Checklist–Military Version or Rivermead Postconcussion Symptom Questionnaire, demonstrating a successful randomization and no significant main effect for HBO2 at 1.5 or 2.0 ATA equivalent compared with the sham compression. Within-group testing of pre- and postintervention means revealed significant differences on several individual items for each group and difference in the Posttraumatic Disorder Checklist–Military Version total score for the 2.0 ATA HBO2 group. Discussion: The primary analyses of between group differences found no evidence of efficacy for HBO2. The scattered within group differences are threatened by Type 2 errors and could be explained by nonspecific effects. Conclusion: This study demonstrated that HBO2 at either 1.5 or 2.0 ATA equivalent had no effect on postconcussion symptoms after mild traumatic brain injury when compared with sham compression.</p>				

Recommendation(s) Supported: 5.8				
Reference	Year	Country	Design	Quality Rating
Cifu DX, Walker WC, West SL, et al. Hyperbaric oxygen for blast-related postconcussion syndrome: three-month outcomes. <i>Ann Neurol.</i> 2014;75(2):277-286.	2014	USA	Randomized Control Trial	PEDro: 11/11
Abstract				
Objective: Mild traumatic brain injury (mTBI) and postconcussion syndrome (PCS) are common among military combatants. Hyperbaric oxygen (HBO2) is a proposed treatment for these conditions, but it has not been rigorously studied. The objective of this study was to determine the effects of HBO2 by 3 months post compression at 2 commonly employed dosing levels to treat PCS; whether specific subgroups may have benefited; and if no overall effect was found, whether benefit is masked by other conditions. Methods: This randomized, double-blind, sham-controlled study was conducted at the Naval Air Station in Pensacola, Florida on 61 male Marines with a history of mTBI and PCS. Intervention consisted of 40 once daily 60-minute hyperbaric chamber compressions at 2.0 atmospheres absolute (ATA) at 1 of 3 randomly preassigned oxygen fractions, resulting in respective blinded groups with an oxygen-breathing exposure equivalent to (1) surface air (sham), (2) 100% oxygen at 1.5ATA, or (3) 100% oxygen at 2.0ATA. The main outcome measure was the Rivermead PostConcussion Questionnaire-16 (RPQ-16) collected before compressions and at 2 later points. Results: The interaction of time by intervention group was not significant for improvement on the RPQ-16. Nor was there evidence of efficacy on the RPQ-16 for any subgroup. No significant time by intervention interaction was found for any functional, cognitive, or psychomotor secondary outcome measure at an unadjusted 0.05 significance level. Interpretation: Using a randomized control trial design and analysis including a sham, results showed no evidence of efficacy by 3 months post-compression to treat the symptomatic, cognitive, or behavioral sequelae of PCS after combat-related mTBI.				

Recommendation(s) Supported: 6.11				
Reference	Year	Country	Design	Quality Rating
Defrin R, Riabinin M, Feingold Y, Schreiber S, Pick CG. Deficient pain modulatory systems in patients with mild traumatic brain and chronic post-traumatic headache: implications for its mechanism. <i>J Neurotrauma.</i> 2015;32(1):28-37.	2015	Israel	Case-Control	DOWNNS & BLACK: 13/32*
Abstract				
Although the prevalence rate of chronic post-traumatic headache (CPTHA) after mild traumatic brain injury (TBI) reaches up to 95%, its mechanism is unknown, and little is known about the characteristics of the pain system in this condition. Our aim was to investigate the capabilities of two pain modulatory systems among individuals with CPTHA and study their association with CPTHA, here for the first time. Forty-six subjects participated; 16 with TBI and CPTHA, 12 with TBI without CPTHA, and 18 healthy controls. Testing included the measurement of heat-pain (HPT) and pressure-pain (PPT) thresholds in the forehead and forearm, pain adaptation to tonic noxious heat, and conditioned pain modulation (CPM). The participants completed a post-traumatic stress disorder (PTSD) questionnaire. The two TBI groups did not differ in the TBI and background characteristics. However, TBI patients with CPTHA had significantly higher HPT and lower PPT in the cranium and higher PTSD symptomatology than TBI patients without CPTHA and healthy controls. Adaptation to pain and CPM were diminished in the CPTHA group compared with the two control groups. The intensity of CPTHA correlated negatively with cranial PPT, magnitude of pain adaptation, and CPM. CPTHA intensity correlated positively with PTSD symptomatology. CPTHA appears to be characterized by cranial hyperalgesia and dysfunctional pain modulation capabilities, which are associated with CPTHA magnitude. It is concluded that damage to pain modulatory systems along with chronic cranial sensitization underlies the development of CPTHA. PTSD may reinforce CPTHA and vice versa. Clinical implications are discussed.				

*6 of the sections were not applicable

Recommendation(s) Supported: 7.1				
Reference	Year	Country	Design	Quality Rating
Chan LG, Feinstein A. Persistent Sleep Disturbances Independently Predict Poorer Functional and Social Outcomes 1 Year After Mild Traumatic Brain Injury. <i>J Head Trauma Rehabil.</i> 2015;30(6):E67-75.	2016	Canada	Retrospective Cohort	DOWNNS & BLACK: 13/32*
Abstract				
Objective: To investigate the effect of sleep disturbances on functional and social outcomes after mild traumatic brain injury. Setting: Outpatient traumatic brain injury clinic in a tertiary trauma center. Participants: A total of 374 mild traumatic brain injury patients were assessed within 3 months of injury and followed up every 3 months for 1 year. Design: Analysis of a historical cohort in a naturalistic clinical setting. Main measures: At each visit, symptoms of concussion and psychological distress and indices of functional and social outcomes were measured with the Rivermead Postconcussion Questionnaire, 28-item General Health Questionnaire, and Rivermead Head Injury Follow-up Questionnaire, respectively. Changes in outcome scores over time were explored using repeated measures analysis of variance and compared between subjects with persistent (SD) and recovered (SR) sleep disturbances. Predictors of functional/social outcome were determined using linear regression. Results: The percentages of subjects reporting sleep disturbances at each time point were 71.9%, 57.2%, 55.1%, and 53.7%, respectively. For functional and social outcomes, significant effects of time ($F_{3,315} = 9.54$; $P < .001$), group (SD vs SR) $F_{1,317} = 5.32$; $P = .022$, and time X group interaction $F_{3,315} = 4.14$; $P = .007$ were found. Persistent sleep disturbance ($P = 0.011$) and higher symptom burden at 6 months postinjury ($P < .0001$) were independent predictors of poorer outcome. Conclusion: Sleep disturbance, independent of psychological distress, is an important prognostic factor of functional and social outcomes after mild traumatic brain injury.				

*7 of the sections were not applicable

Recommendation(s) Supported: 7.1				
Reference	Year	Country	Design	Quality Rating
Theadom A, Cropley M, Parmar P, et al. Sleep difficulties one year following mild traumatic brain injury in a population-based study. <i>Sleep Med.</i> 2015;16(8):926-932.	2015	New Zealand	Prospective Cohort	DOWNNS & BLACK: 16/32*
Abstract				
Background: Sleep quality affects all aspects of daily functioning, and it is vital for facilitating recovery from illness and injury. Sleep commonly becomes disrupted following moderate to severe brain injury, yet little is known about the prevalence of sleep disruption over time and how it impacts on recovery following mild injury. Methods: This was a longitudinal study of 346 adults who experienced a mild brain injury (aged ≥ 16 years) identified within a population-based incidence sample in New Zealand. The prevalence of sleep difficulties was assessed at baseline (within two weeks), one, six and 12 months, alongside other key outcomes. Results: One year post injury, 41.4% of people were identified as having clinically significant sleep difficulties, with 21.0% at a level indicative of insomnia. Poor sleep quality at baseline was significantly predictive of poorer post-concussion symptoms, mood, community integration, and cognitive ability one year post injury. The prevalence of insomnia following mild traumatic brain injury (TBI) was more than three times the rate found in the general population. Of those completing a sleep assessment at six and 12 months, 44.9% of the sample showed improvements in sleep quality, 16.2% remained stable, and 38.9% worsened. Conclusions: Screening for sleep difficulties should occur routinely following a mild brain injury to identify adults potentially at risk of poor recovery. Interventions to improve sleep are needed to facilitate recovery from injury, and to prevent persistent sleep difficulties emerging.				

*5 of the sections were not applicable

Recommendation(s) Supported: 7.5				
Reference	Year	Country	Design	Quality Rating
Tkachenko N, Singh K, Hasanaj L, Serrano L, Kothare SV. Sleep Disorders Associated With Mild Traumatic Brain Injury Using Sport Concussion Assessment Tool 3. <i>Pediatr Neurol.</i> 2016;57:46-50.e41.	2016	USA	Retrospective Cohort	DOWNNS & BLACK: 12/32*
Abstract				
Background: Sleep problems affect 30% to 80% of patients with mild traumatic brain injury. We assessed the prevalence of sleep disorders after mild traumatic brain injury and its correlation with other symptoms. Methods:				

Individuals with mild traumatic brain injury were assessed at the New York University Concussion Center during 2013-2014 with the Sports Concussion Assessment Tool, third edition, data following mild traumatic brain injury. The relationship between sleep problems (drowsiness, difficulty falling asleep, fatigue or low energy), psychiatric symptoms (sadness, nervousness or anxiousness), headache, and dizziness were analyzed by Spearman correlation and logistic regression using moderate to severe versus none to mild categorization. Results: Ninety-three patients were retrospectively considered. The most common injury causes were falls (34.4%) and motor vehicle accidents (21.5%). There was a positive correlation between dizziness, headache, psychiatric problems (sadness, anxiety, irritability), and sleep problems (fatigue, drowsiness, and difficulty falling asleep) ($P < 0.001$). Logistic regression showed a significant association between moderate to severe psychiatric symptoms and moderate to severe sleep symptoms ($P < 0.05$). Sleep symptoms became more severe with increased time interval from mild traumatic brain injury to Sport Concussion Assessment Tool 3 administration (odds ratio = 1.005, 1.006, and 1.008, $P < 0.05$). There was significant correlation between motor vehicle accident and drowsiness and difficulty falling asleep ($P < 0.05$). Medications given in the emergency department had a positive correlation with drowsiness ($P < 0.05$). Conclusions: Individuals who report moderate to severe headache, dizziness, and psychiatric symptoms have a higher likelihood of reporting moderate to severe sleep disorders following mild traumatic brain injury and should be counseled and initiated with early interventions.

*7 of the sections were not applicable

Recommendation(s) Supported: 7.5				
Reference	Year	Country	Design	Quality Rating
Suzuki Y, Khoury S, El-Khatib H, et al. Individuals with pain need more sleep in the early stage of mild traumatic brain injury. <i>Sleep Med.</i> 2017;33:36-42.	2017	Canada	Prospective Cohort	DOWNS & BLACK: 17/32*
Abstract				
Objective: Hypersomnia is frequently reported after mild traumatic brain injury (mTBI), but its cause(s) remain elusive. This study examined sleep/wake activity after mTBI and its association with pain, a comorbidity often associated with insomnia. Methods: Actigraphy recording was performed for 7 ± 2 consecutive days in 56 individuals at one month post-mTBI (64% male; 38 ± 12 years), 24 individuals at one year post-mTBI (58% male; 44 ± 11 years), and in 20 controls (50% male; 37 ± 12 years). Pain intensity and its effect on quality of life was assessed with a visual analogue scale and the Short Form Health Survey (SF-36) bodily pain subscale. Results: Overall, few differences in sleep/wake patterns were found between mTBI patients and controls. However, higher percentages of mTBI individuals with moderate-to-severe pain were found to require more than eight hours of sleep per day (37% vs 11%; $p = 0.04$) and to be frequent nappers (defined as those who took three or more naps per week) (42% vs 22%; $p = 0.04$) compared to those with mild or no pain at one month postinjury. Correcting for age and depression, The SF-36 score was found to be a significant predictor of sleep duration exceeding eight hours per day at one month (odds ratio = 0.95; 95% confidence interval = 0.92-0.99; $p = 0.01$), but not at one year post-mTBI. Pain and increased sleep need (in terms of hours per day or napping frequency) were found to co-exist in as much as 29% of mTBI patients at one month postinjury. Conclusion: Pain could be associated with more pronounced sleep need in about one-third of mTBI patients during early recovery. Unalleviated pain, found in more than 60% of mTBI patients, should therefore be looked for in all mTBI patients reporting new onset of sleep disorder, not only in those with insomnia.				

*4 of the sections were not applicable

Recommendation(s) Supported: 7.10				
Reference	Year	Country	Design	Quality Rating
Menn SJ, Yang R, Lankford A. Armodafinil for the treatment of excessive sleepiness associated with mild or moderate closed traumatic brain injury: a 12-week, randomized, double-blind study followed by a 12-month open-label extension. <i>J Clin Sleep Med.</i> 2014;10(11):1181-1191.	2014	USA	Randomized Control Trial	PEDro: 10/11
Abstract				
Objective: To evaluate the efficacy and tolerability of armodafinil in patients with excessive sleepiness following mild or moderate closed traumatic brain injury (TBI). Design: Randomized, placebo-controlled, double-blind trial followed by open-label extension. Setting: 40 US centers. Patients: Adults with closed TBI (N = 117), Glasgow Coma Scale score > 8 at time of injury; baseline Epworth Sleepiness Scale (ESS) ≥ 10 ; sleep latency < 8 minutes on multiple sleep latency test (MSLT); and Clinical Global Impression-Severity of Illness (CGI-S) score ≥ 4 for excessive sleepiness. Intervention: Patients received armodafinil (50, 150, or 250 mg/day) or placebo for 12 weeks followed by an optional 12-month open-label extension. Measurements and Results: Outcomes included MSLT, ESS, Clinical				

Global Impression-Change (CGI-C), TBI-Work Instability Scale (TBI-WIS), CGI-S, and tolerability. The study was terminated early due to low enrollment. Patients receiving 250 mg armodafinil showed significant improvement in sleep latency from baseline to final visit versus placebo (+7.2 minutes vs. +2.4 minutes; $p = 0.0010$). CGI-C ratings were much/very much improved in approximately 50% of patients receiving 150 and 250 mg armodafinil, compared to 38% on placebo. ESS and TBI-WIS scores were not significantly different between groups. In the open-label extension (N = 49), patients demonstrated gradual improvement in ESS, TBI-WIS, and CGI-S scores up to 48 weeks post-baseline. Armodafinil was generally well tolerated, with headache the most common adverse event in both double-blind and open-label portions. Conclusions: Armodafinil 250 mg significantly improved sleep latency in patients with excessive sleepiness associated with mild or moderate TBI. Efficacy and tolerability of armodafinil were sustained throughout the open-label extension.

Recommendation(s) Supported: 7.5, 9.2				
Reference	Year	Country	Design	Quality Rating
Waldron-Perrine B, McGuire AP, Spencer RJ, Drag LL, Pangilinan PH, Bieliauskas LA. The influence of sleep and mood on cognitive functioning among veterans being evaluated for mild traumatic brain injury. <i>Mil Med.</i> 2012;177(11):1293-1301.	2012	USA	Prospective Cohort	DOWNNS & BLACK: 14/32*
Abstract				
Objective: Veterans undergoing evaluation for mild traumatic brain injury commonly report insomnia, psychiatric symptoms, and cognitive dysfunction. This study examines the effects of self-reported amount of sleep and subjective sleep quality on neuropsychological test performance. Methods: 262 veterans were seen for neuropsychological assessment in a Veterans Affairs traumatic brain injury clinic. All participants completed measures of depression, anxiety, and sleep satisfaction, and also estimated the number of hours they slept the night before the assessment. Factor scores of attention/concentration and memory were created using factor analyses. Data were analyzed with linear regression. Results: Depression and anxiety were significantly correlated with sleep satisfaction and predictive of cognitive ability. Both sleep satisfaction and hours slept were significantly correlated with memory, but not attention. After controlling for the effects of depression and anxiety, hours slept but not sleep satisfaction was predictive of memory test performance. Conclusions: Perceived sleep quality is heavily influenced by psychiatric symptoms; therefore, veterans' report of sleep satisfaction may merely reflect their overall level of distress. Sleep quantity, however, appears to uniquely contribute to memory performance. Thus, assessment of sleep is important and provides clinicians with useful information, especially among individuals with psychiatric comorbidities.				

*6 of the sections were not applicable

Recommendation(s) Supported: 7.8				
Reference	Year	Country	Design	Quality Rating
Zollman FS, Larson EB, Wasek-Throm LK, Cyborski CM, Bode RK. Acupuncture for treatment of insomnia in patients with traumatic brain injury: a pilot intervention study. <i>J Head Trauma Rehabil.</i> 2012;27(2):135-142.	2012	USA	Case-Control	DOWNNS & BLACK: 19/32*
Abstract				
Objectives: To assess the efficacy of acupuncture in treating insomnia in traumatic brain injury (TBI) survivors as compared to medication, to determine whether acupuncture has fewer cognitive and affective adverse effects than does medication. Participants: Twenty-four adult TBI survivors, randomized to acupuncture or control arms. Setting: Outpatient rehabilitation clinic. Measures: Insomnia Severity Index (degree of insomnia); actigraphy (sleep time); Hamilton Depression Rating Scale (depression); Repeatable Battery for the Assessment of Neuropsychological Status and Paced Auditory Serial Addition Test (cognitive function) administered at baseline and postintervention. Results: Sleep time did not differ between the treatment and control groups after intervention, whereas cognition improved in the former but not the latter. Conclusion: Acupuncture has a beneficial effect on perception of sleep or sleep quality and on cognition in our small sample of patients with TBI. Further studies of this treatment modality are warranted to validate these findings and to explore factors that contribute to treatment efficacy.				

*1 section was not applicable

Recommendation(s) Supported: 8.1				
Reference	Year	Country	Design	Quality Rating
Haarbauer-Krupa J, Taylor CA, Yue JK, et al. Screening for Post-Traumatic Stress Disorder in a Civilian Emergency Department Population with Traumatic Brain Injury. <i>J Neurotrauma</i> . 2017;34(1):50-58.	2017	USA	Prospective Cohort	DOWNNS & BLACK: 14/32*
Abstract				
<p>Post-traumatic stress disorder (PTSD) is a condition associated with traumatic brain injury (TBI). While the importance of PTSD and TBI among military personnel is widely recognized, there is less awareness of PTSD associated with civilian TBI. We examined the incidence and factors associated with PTSD 6 months post-injury in a civilian emergency department population using measures from the National Institute of Neurological Disorders and Stroke TBI Common Data Elements Outcome Battery. Participants with mild TBI (mTBI) from the Transforming Research and Clinical Knowledge in Traumatic Brain Injury Pilot study with complete 6-month outcome batteries (n = 280) were analyzed. Screening for PTSD symptoms was conducted using the PTSD Checklist-Civilian Version. Descriptive measures are summarized and predictors for PTSD were examined using logistic regression. Incidence of screening positive for PTSD was 26.8% at 6 months following mTBI. Screening positive for PTSD was significantly associated with concurrent functional disability, post-concussive and psychiatric symptomatology, decreased satisfaction with life, and decreased performance in visual processing and mental flexibility. Multi-variable regression showed injury mechanism of assault (odds ratio [OR] 3.59; 95% confidence interval [CI] 1.69–7.63; p = 0.001) and prior psychiatric history (OR 2.56; 95% CI 1.42–4.61; p = 0.002) remained significant predictors of screening positive for PTSD, while education (per year OR 0.88; 95% CI 0.79–0.98; p = 0.021) was associated with decreased odds of PTSD. Standardized data collection and review of pre-injury education, psychiatric history, and injury mechanism during initial hospital presentation can aid in identifying patients with mTBI at risk for developing PTSD symptoms who may benefit from closer follow-up after initial injury care.</p>				

*7 of the sections were not applicable

Recommendation(s) Supported: 8.1				
Reference	Year	Country	Design	Quality Rating
Iverson KM, Pogoda TK, Gradus JL, Street AE. Deployment-related traumatic brain injury among Operation Enduring Freedom/Operation Iraqi Freedom veterans: associations with mental and physical health by gender. <i>J Womens Health (Larchmt)</i> . 2013;22(3):267-275.	2013	USA	Survey	DOWNNS & BLACK: 17/32*
Abstract				
<p>Background: Traumatic brain injury (TBI) research among Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) veterans has focused primarily on men. We examine associations between probable deployment-related TBI and postdeployment mental and physical health symptoms separately by gender. To identify unique associations of probable TBI with health symptoms, analyses were also conducted separately for veterans with and without probable posttraumatic stress disorder (PTSD). Methods: A mail survey, including self-report measures of probable deployment-related TBI and mental and physical health symptoms, was completed by 2348 OEF/OIF veterans (51% female), sampled randomly within gender from a national roster. We conducted logistic regressions stratified by gender and probable PTSD status to evaluate associations between probable TBI and health symptoms. Results: Of the respondents, 10.7% of women and 19.7% of men screened positive for probable deployment-related TBI. Probable TBI was significantly associated with increased risk of mental and physical health symptoms for both genders, even after adjusting for potential confounders. Odds ratios for the associations of probable TBI with health symptoms ranged between 2.63 and 9.20 for women and between 1.94 and 7.44 for men. Among veterans with probable PTSD, symptomatic anxiety and symptomatic physical health remained associated with probable TBI. Among veterans without probable PTSD, TBI remained strongly associated with all health symptoms for women and symptomatic anxiety and physical health for men, suggesting an association between TBI and some health symptoms independent of PTSD. Conclusions: Strong associations between probable TBI and health symptoms for women and men confirm the importance of screening for TBI and treatment of associated health symptoms for all OEF/OIF veterans.</p>				

*6 of the sections were not applicable

Recommendation(s) Supported: 8.3				
Reference	Year	Country	Design	Quality Rating
Bryan CJ, Clemans TA, Hernandez AM, Rudd MD. Loss of consciousness, depression, posttraumatic stress disorder, and suicide risk among deployed military personnel with mild traumatic brain injury. <i>J Head Trauma Rehabil.</i> 2013;28(1):13-20.	2013	USA	Prospective Cohort	DOWNNS & BLACK: 17/32*
Abstract				
Objective: To identify clinical variables associated with suicidality in military personnel with mild traumatic brain injury (mTBI) while deployed to Iraq. Setting: Outpatient TBI clinic on a US military base in Iraq. Participants: Military personnel (N = 158) referred to an outpatient TBI clinic for a standardized intake evaluation, 135 (85.4%) who had a diagnosis of mTBI and 23 (14.6%) who did not meet criteria for TBI. Main Measures: Suicidal Behaviors Questionnaire–Revised, Depression subscale of the Behavioral Health Measure-20, Posttraumatic Stress Disorder Checklist–Military Version, Insomnia Severity Index, self-report questionnaire, and clinical interview addressing TBI-related symptoms. Results: Among patients with mTBI, increased suicidality was significantly associated with depression and the interaction of depression with posttraumatic stress disorder symptoms. Longer duration of loss of consciousness was associated with decreased likelihood for any suicidality. Conclusion: Assessment after TBI in a combat zone may assist providers in identifying those at risk for suicidality and making treatment recommendations for service members with mTBI.				

*5 of the sections were not applicable

Recommendation(s) Supported: 8.5				
Reference	Year	Country	Design	Quality Rating
Bedard M, Felteau M, Marshall S, et al. Mindfulness-based cognitive therapy reduces symptoms of depression in people with a traumatic brain injury: results from a randomized controlled trial. <i>J Head Trauma Rehabil.</i> 2014;29(4):E13-22	2014	Canada	Randomized Control Trial	PEDro: 7/11
Abstract				
Objective: We sought to determine if we could reduce symptoms of depression in individuals with a traumatic brain injury using mindfulness-based cognitive therapy. Setting: The study was conducted in a community setting. Participants: We enrolled adults with symptoms of depression after a traumatic brain injury. Design: We conducted a randomized controlled trial; participants were randomized to the 10-week mindfulness-based cognitive therapy intervention arm or to the wait-list control arm. Main Measures: The primary outcome measure was symptoms of depression using the Beck Depression Inventory-II. Results: The parallel group analysis revealed a greater reduction in Beck Depression Inventory-II scores for the intervention group (6.63, n = 38,) than the control group (2.13, n = 38, P = .029). A medium effect size was observed (Cohen d = 0.56). The improvement in Beck Depression Inventory-II scores was maintained at the 3-month follow-up. Conclusion: These results are consistent with those of other researchers that use mindfulness-based cognitive therapy to reduce symptoms of depression and suggest that further work to replicate these findings and improve upon the efficacy of the intervention is warranted.				

Recommendation(s) Supported: 8.8				
Reference	Year	Country	Design	Quality Rating
Kennedy SH, Lam RW, McIntyre RS, et al. Canadian Network for Mood and Anxiety Treatments (CANMAT) 2016 Clinical Guidelines for the Management of Adults with Major Depressive Disorder: Section 3. Pharmacological Treatments. <i>Can J Psychiatry.</i> 2016;61(9):540-560.	2016	Canada	Non-Concussion/mTBI Guideline	N/A*
Abstract				
Background: The Canadian Network for Mood and Anxiety Treatments (CANMAT) conducted a revision of the 2009 guidelines by updating the evidence and recommendations. The scope of the 2016 guidelines remains the management of major depressive disorder (MDD) in adults, with a target audience of psychiatrists and other mental health professionals. Methods: Using the question-answer format, we conducted a systematic literature search focusing on systematic reviews and meta-analyses. Evidence was graded using CANMAT-defined criteria for level of evidence. Recommendations for lines of treatment were based on the quality of evidence and clinical expert				

consensus. “Pharmacological Treatments” is the third of six sections of the 2016 guidelines. With little new information on older medications, treatment recommendations focus on second-generation antidepressants. Results: Evidence-informed responses are given for 21 questions under 4 broad categories: 1) principles of pharmacological management, including individualized assessment of patient and medication factors for antidepressant selection, regular and frequent monitoring, and assessing clinical and functional outcomes with measurement-based care; 2) comparative aspects of antidepressant medications based on efficacy, tolerability, and safety, including summaries of newly approved drugs since 2009; 3) practical approaches to pharmacological management, including drug-drug interactions and maintenance recommendations; and 4) managing inadequate response and treatment resistance, with a focus on switching antidepressants, applying adjunctive treatments, and new and emerging agents. Conclusions: Evidence-based pharmacological treatments are available for first-line treatment of MDD and for management of inadequate response. However, given the limitations of the evidence base, pharmacological management of MDD still depends on tailoring treatments to the patient.

*No checklists were appropriate to score this article design

Recommendation(s) Supported: 9.5				
Reference	Year	Country	Design	Quality Rating
Cooper DB, Bunner AE, Kennedy JE, et al. Treatment of persistent post-concussive symptoms after mild traumatic brain injury: a systematic review of cognitive rehabilitation and behavioral health interventions in military service members and veterans. <i>Brain Imaging Behav.</i> 2015;9(3):403-420.	2015	USA	Systematic Review	PRISMA: 10/27*
Abstract				
Increased prevalence of traumatic brain injury (TBI) has been associated with service members and veterans who completed combat deployments in support of Operation Enduring Freedom (OEF) and Operation Iraqi Freedom(OIF). Management of persistent post-concussive symptoms (PCS) has been a challenge to healthcare providers throughout the Military and Veterans Healthcare Systems, as well as civilian healthcare providers, due in part to the chronic nature of symptoms, co-occurrence of behavioral health disorders such as depression, Posttraumatic Stress Disorder (PTSD), and substance use disorders, and fear of a potential stigma associated with psychiatric diagnoses and behavioral health treatment(s). This systematic review examined non-pharmacologic behavioral health interventions and cognitive rehabilitation interventions for PCS in military service members and veterans with a history of mild TBI (mTBI). Six electronic databases were searched with specific term limitations, identifying 121 citations. Ultimately, 19 articles met criteria for inclusion in this systematic review. Studies were broadly categorized into four subtypes: psychoeducational interventions, cognitive rehabilitation, psychotherapeutic approaches, and integrated behavioral health interventions for PCS and PTSD. The review provides an update of the empirical evidence for these four types of interventions for PCS in active duty service members and veterans. Recommendations for future research are discussed, including the need to expand and improve the limited evidence basis on how to manage persistent postconcussive symptoms in this population.				

*Additional analyses were not undertaken (i.e., meta-analyses), so 5 of the items were not applicable

Recommendation(s) Supported: 9.1				
Reference	Year	Country	Design	Quality Rating
Oldenburg C, Lundin A, Edman G, Nygren-de Boussard C, Bartfai A. Cognitive reserve and persistent post-concussion symptoms--A prospective mild traumatic brain injury (mTBI) cohort study. <i>Brain Inj.</i> 2016;30(2):146-155.	2016	Sweden	Prospective Cohort	DOWNS & BLACK: 14/32*
Abstract				
Primary objective: Having three or more persisting (i.e. > 3 months) post-concussion symptoms (PCS) affects a significant number of patients after a mild traumatic brain injury (mTBI). A common complaint is cognitive deficits. However, several meta-analyses have found no evidence of long-term cognitive impairment in mTBI patients. The study sought to answer two questions: first, is there a difference in cognitive performance between PCS and recovered mTBI patients? Second, is lower cognitive reserve a risk factor for developing PCS? Research design: Prospective inception cohort study. Methods and procedure: One hundred and twenty-two adult patients were recruited from emergency departments within 24 hours of an mTBI. Three months post-injury, participants completed the Rivermead Post Concussion Symptoms Questionnaire and a neuropsychological assessment. A healthy control group (n = 35) were recruited. The estimate of cognitive reserve was based upon sub-test Information from Wechsler				

Adult Intelligence Scale and international classifications of educational level and occupational skill level. Main outcome and results: mTBI patients showed reduced memory performance. Patients with lower cognitive reserve were 4.14-times more likely to suffer from PCS. Conclusions: mTBI may be linked to subtle executive memory deficits. Lower cognitive reserve appears to be a risk factor for PCS and indicates individual vulnerabilities.

*5 of the sections were not applicable

Recommendation(s) Supported: 9.1				
Reference	Year	Country	Design	Quality Rating
Na KS, Jung HY, Lee SI, Kim SG. Mediating effects of cognitive effort and depression on intelligence, memory, and executive functions in individuals with mild traumatic brain injury. <i>Psychiatry Investig.</i> 2014;11(2):112-118.	2014	Korea	Retrospective Cohort	DOWNNS & BLACK: 14/32*
Abstract				
Objective: Mild traumatic brain injury (mTBI) is frequently associated with psychiatric symptoms and cognitive dysfunction, as well as with the receipt of workers' compensation, as many mTBIs occur due to work-related accidents. We hypothesized that depression and insufficient cognitive effort mediate the relationship between sociodemographic variables and cognitive dysfunction in mTBI. Methods: A retrospective chart review study was conducted using 115 records of patients with mTBI. Cognitive effort was measured based on scores on the Rey 15-Item Test. Multivariate linear regression analysis was performed to examine factors predictive of cognitive functions. Path analysis was subsequently performed to investigate the mediating effects of depression and cognitive effort in relation to receipt of workers' compensation and demographic variables. Results: Fifteen of the 115 participants (13.0%) received failing scores on the Rey 15-Item Test, which indicated insufficient cognitive effort. Path analysis indicated that cognitive effort mediated the effects of age and workers' compensation on cognitive functions. Conclusion: Given the significant mediating effects of cognitive effort on cognitive performance, it is important to address patient motivation and encourage mTBI patients covered by workers' compensation to perform tests with authentic effort.				

*7 of the sections were not applicable

Recommendation(s) Supported: 9.2				
Reference	Year	Country	Design	Quality Rating
Dean PJ, Sterr A. Long-term effects of mild traumatic brain injury on cognitive performance. <i>Front Hum Neurosci.</i> 2013;7:30.	2013	United Kingdom	Case-Control	DOWNNS & BLACK: 17/32*
Abstract				
Although a proportion of individuals report chronic cognitive difficulties after mild traumatic brain injury (mTBI), results from behavioral testing have been inconsistent. In fact, the variability inherent to the mTBI population may be masking subtle cognitive deficits. We hypothesized that this variability could be reduced by accounting for post-concussion syndrome (PCS) in the sample. Thirty-six participants with mTBI (>1 year post-injury) and 36 non-head injured controls performed information processing speed (Paced Visual Serial Addition Task, PVSAT) and working memory (n-Back) tasks. Both groups were split by PCS diagnosis (4 groups, all n = 18), with categorization of controls based on symptom report. Participants with mTBI and persistent PCS had significantly greater error rates on both the n-Back and PVSAT, at every difficulty level except 0-Back (used as a test of performance validity). There was no difference between any of the other groups. Therefore, a cognitive deficit can be observed in mTBI participants, even 1 year after injury. Correlations between cognitive performance and symptoms were only observed for mTBI participants, with worse performance correlating with lower sleep quality, in addition to a medium effect size association (falling short of statistical significance) with higher PCS symptoms, post-traumatic stress disorder (PTSD), and anxiety. These results suggest that the reduction in cognitive performance is not due to greater symptom report itself, but is associated to some extent with the initial injury. Furthermore, the results validate the utility of our participant grouping, and demonstrate its potential to reduce the variability observed in previous studies.				

*5 sections were not applicable

Recommendation(s) Supported: 9.2				
Reference	Year	Country	Design	Quality Rating
Van Patten R, Keith C, Bertolin M, Wright JD. The effect of premorbid attention-deficit/hyperactivity disorder on neuropsychological functioning in individuals with acute mild traumatic brain injuries. <i>J Clin Exp Neuropsychol</i> . 2016;38(1):12-22.	2016	USA	Case-Control	DOWN'S & BLACK: 16/32*
Abstract				
<p>Introduction. Mild traumatic brain injury (mTBI) is a frequent, yet undertreated condition that typically manifests with transient neurological and cognitive symptoms that resolve over the course of several weeks. In contrast, attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder that presents initially in childhood but often persists into adulthood. mTBI and ADHD include overlapping symptomatology, making it difficult for clinicians to disentangle the sequelae of each condition when they co-occur in the same individual. We hypothesized that neuropsychological tests would be sensitive to preexisting ADHD in in-patients with acute mTBIs. Method. We retrospectively examined the medical charts of 100 inpatients, aged 18–40 years (96% Caucasian; 77% male) with mTBIs in an acute care setting, half of whom had self-reported the presence of premorbid ADHD, and half of whom were matched controls. We analyzed group differences across neuropsychological tests of attention, processing speed, and executive functions, examined the profile ratings of independent, blinded, board-certified neuropsychologists, and correlated cognitive performance with time from traumatic injury to testing. Results. Individuals with premorbid ADHD (a) performed significantly worse than their matched counterparts on several tests of attention, processing speed, and working memory, and (b) were significantly more likely to produce profiles later rated as impaired by independent, board-certified clinical neuropsychologists. In addition, time from traumatic injury to testing was found to be negatively correlated with neurocognitive performance. Conclusions. These findings (a) argue for the utility of a brief assessment of premorbid ADHD in the acute care of individuals with mTBIs and (b) provide clinicians with a barometer for gauging the relative contributions of premorbid ADHD to neuropsychological impairments in the neurocognitive profiles of individuals with mTBIs. Reported effect sizes will assist clinicians in accurately weighing the impact of premorbid ADHD when interpreting such profiles.</p>				

*6 of the sections were not applicable

Recommendation(s) Supported: 9.5				
Reference	Year	Country	Design	Quality Rating
Twamley EW, Thomas KR, Gregory AM, et al. CogSMART Compensatory Cognitive Training for Traumatic Brain Injury: Effects Over 1 Year. <i>J Head Trauma Rehabil</i> . 2015;30(6):391-401.	2015	USA	Randomized Control Trial	PEDro: 6/11
Abstract				
<p>Objective: There are very few evidence-based treatments for individuals with mild to moderate traumatic brain injuries. We developed and tested a 12-week, manualized, compensatory cognitive training intervention, Cognitive Symptom Management and Rehabilitation Therapy (CogSMART), which targeted postconcussive symptom management, prospective memory, attention, learning/memory, and executive functioning. The intervention focused on psychoeducation and compensatory strategies such as calendar use, self-talk, note taking, and a 6-step problem-solving method. Setting: VA Healthcare System. Participants: A total of 50 Veterans with mild to moderate traumatic brain injuries receiving supported employment. Design: Twelve-month randomized controlled trial with participants assigned to receive CogSMART or additional supported employment sessions for the first 12 weeks. Outcome assessments were administered at baseline and 3, 6, and 12 months. Main Measures: Assessments measured postconcussive symptoms, neuropsychological performance, functional capacity, psychiatric symptom severity, quality of life, and weeks worked during the 12-month trial. Results: Hierarchical linear modeling analyses using all 4 time points demonstrated significant CogSMART-associated reductions in postconcussive symptoms ($r = -0.28$, $P = .026$, $d = 0.64$) and improvements in prospective memory ($r = 0.35$, $P = .031$, $d = 0.55$) and quality of life ($r = 0.34$, $P = .009$, $d = 1.0$). The groups did not differ on weeks worked during the trial. Conclusion: CogSMART has the potential to improve postconcussive symptoms, cognitive performance, and self-rated quality of life in individuals with mild to moderate traumatic brain injuries.</p>				

Recommendation(s) Supported: 9.5				
Reference	Year	Country	Design	Quality Rating
Twamley EW, Jak AJ, Delis DC, Bondi MW, Lohr JB. Cognitive Symptom Management and Rehabilitation Therapy (CogSMART) for veterans with traumatic brain injury: pilot randomized controlled trial. <i>J Rehabil Res Dev.</i> 2014;51(1):59-70.	2015	USA	Pilot Randomized Control Trial	PE德罗: 6/11
Abstract				
Traumatic brain injury (TBI) can result in cognitive impairments and persistent postconcussive symptoms that limit functional recovery, including return to work. We evaluated a 12 wk compensatory cognitive training intervention (Cognitive Symptom Management and Rehabilitation Therapy [CogSMART]) in the context of supported employment for Veterans with mild to moderate TBI. Participants were randomly assigned to receive 12 wk of supported employment plus CogSMART or enhanced supported employment that controlled for therapist attention (control). CogSMART sessions were delivered by the employment specialist and included psychoeducation regarding TBI; strategies to improve sleep, fatigue, headaches, and tension; and compensatory cognitive strategies in the domains of prospective memory, attention, learning and memory, and executive functioning. Compared with controls, those assigned to supported employment plus CogSMART demonstrated significant reductions in postconcussive symptoms (Cohen $d = 0.97$) and improvements in prospective memory functioning (Cohen $d = 0.72$). Effect sizes favoring CogSMART for posttraumatic stress disorder symptom severity, depressive symptom severity, and attainment of competitive work within 14 wk were in the small to medium range (Cohen $d = 0.35$ – 0.49). Those who received CogSMART rated the intervention highly. Results suggest that adding CogSMART to supported employment may improve postconcussive symptoms and prospective memory. These effects, as well as smaller effects on psychiatric symptoms and ability to return to work, warrant replication in a larger trial.				

Recommendation(s) Supported: 9.5				
Reference	Year	Country	Design	Quality Rating
Storzbach D, Twamley EW, Roost MS, et al. Compensatory Cognitive Training for Operation Enduring Freedom/Operation Iraqi Freedom/Operation New Dawn Veterans With Mild Traumatic Brain Injury. <i>J Head Trauma Rehabil.</i> 2017;32(1):16-24.	2017	USA	Randomized Control Trial	PE德罗: 8/11
Abstract				
Objective: The purpose of the study was to evaluate the efficacy of group-based compensatory cognitive training (CCT) for Operation Enduring Freedom (OEF)/Operation Iraqi Freedom(OIF)/ Operation New Dawn (OND) Veterans with a history of mild traumatic brain injury. Method: One hundred nineteen OEF/OIF/OND Veterans with history of mild traumatic brain injury participated at 3 sites, and 50 of the Veterans were randomized to CCT group, while 69 Veterans were randomized to the usual care control group. The CCT group participated in 10 weeks of CCT. Both CCT and usual care groups were assessed at baseline, 5 weeks (midway through CCT), 10 weeks (immediately following CCT), and 15 weeks (5-week follow-up) on measures of subjective cognitive complaints, use of cognitive strategies, psychological functioning, and objective cognitive performance. Results: Veterans who participated in CCT reported significantly fewer cognitive and memory difficulties and greater use of cognitive strategies. They also demonstrated significant improvements on neurocognitive tests of attention, learning, and executive functioning, which were 3 of the cognitive domains targeted in CCT. Conclusions: Findings indicate that training in compensatory cognitive strategies facilitates behavioral change (ie, use of cognitive strategies) as well as both subjective and objective improvements in targeted cognitive domains.				

Recommendation(s) Supported: 9.7				
Reference	Year	Country	Design	Quality Rating
Theadom A, Mahon S, Barker-Collo S, et al. Enzogenol for cognitive functioning in traumatic brain injury: a pilot placebo-controlled RCT. <i>Eur J Neurol.</i> 2013;20(8):1135-1144.	2013	New Zealand	Pilot Randomized Control Trial	PE德罗: 10/11
Abstract				
Background and purpose: Enzogenol, a flavonoid-rich extract from Pinus radiata bark with antioxidant and anti-inflammatory properties has been shown to improve working memory in healthy adults. In traumatic brain injury (TBI), oxidation and inflammation have been linked to poorer cognitive outcomes. Hence, this phase II, randomized				

controlled trial investigated safety, compliance and efficacy of Enzogenol for improving cognitive functioning in people following mild TBI. Methods: Sixty adults, who sustained a mild TBI, 3–12 months prior to recruitment, and who were experiencing persistent cognitive difficulties [Cognitive Failures Questionnaire (CFQ) score > 38], were randomized to receive Enzogenol (1000 mg/day) or matching placebo for 6 weeks. Subsequently, all participants received Enzogenol for a further 6 weeks, followed by placebo for 4 weeks. Compliance, side-effects, cognitive failures, working and episodic memory, post-concussive symptoms and mood were assessed at baseline, 6, 12 and 16 weeks. Simultaneous estimation of treatment effect and breakpoint was effected, with confidence intervals (CIs) obtained through a treatment–placebo balance-preserving bootstrap procedure. Results: Enzogenol was found to be safe and well tolerated. Trend and breakpoint analyses showed a significant reduction in cognitive failures after 6 weeks [mean CFQ score, 95% CI, Enzogenol versus placebo -6.9 (-10.8 to -4.1)]. Improvements in the frequency of self-reported cognitive failures were estimated to continue until week 11 before stabilizing. Other outcome measures showed some positive trends but no significant treatment effects. Conclusions: Enzogenol supplementation is safe and well tolerated in people after mild TBI, and may improve cognitive functioning in this patient population. This study provides Class IIB evidence that Enzogenol is well tolerated and may reduce self-perceived cognitive failures in patients 3–12 months post-mild TBI.

Recommendation(s) Supported: 9.1				
Reference	Year	Country	Design	Quality Rating
Armistead-Jehle P, Cooper DB, Vanderploeg RD. The role of performance validity tests in the assessment of cognitive functioning after military concussion: A replication and extension. <i>Appl Neuropsychol Adult</i> . 2016;23(4):264-273.	2015	USA	Prospective Cohort	DOWNES & BLACK: 16/32*
Abstract				
The current investigation is a replication and extension of a previously published study by Cooper, Vanderploeg, Armistead-Jehle, Lewis, and Bowles (2014) demonstrating that performance validity test scores accounted for more variance in cognitive testing among service members with a history of concussion than did demographic variables, etiology of and time since injury, and symptom severity. The present study included a sample of 142 active-duty service members evaluated following a suspected or confirmed history of mild traumatic brain injury. Participants completed a battery of neuropsychological measures that included scales of performance and symptom validity (specifically the Medical Symptom Validity Test, Nonverbal Medical Symptom Validity Test, and Personality Assessment Inventory). Among the factors considered in the current study, performance validity test results accounted for the most variance in cognitive test scores, above demographic, concussion history, symptom validity, and psychological distress variables. Performance validity test results were modestly related to symptom validity as measured by the Personality Assessment Inventory Negative Impression Management scale. In sum, the current results replicated the original Cooper et al. study and highlight the importance of including performance validity tests as part of neurocognitive evaluation, even in clinical contexts, within this population.				

*5 of the sections were not applicable

Recommendation(s) Supported: 10.1				
Reference	Year	Country	Design	Quality Rating
Balaban C, Hoffer ME, Szczupak M, et al. Oculomotor, Vestibular, and Reaction Time Tests in Mild Traumatic Brain Injury. <i>PLoS One</i> . 2016;11(9):e0162168.	2016	USA	Case-Control	DOWNES & BLACK: 16/32*
Abstract				
Objective: Mild traumatic brain injury is a major public health issue and is a particular concern in sports. One of the most difficult issues with respect to mild traumatic brain injury involves the diagnosis of the disorder. Typically, diagnosis is made by a constellation of physical exam findings. However, in order to best manage mild traumatic brain injury, it is critically important to develop objective tests that substantiate the diagnosis. With objective tests the disorder can be better characterized, more accurately diagnosed, and studied more effectively. In addition, prevention and treatments can be applied where necessary. Methods: Two cohorts each of fifty subjects with mild traumatic brain injury and one hundred controls were evaluated with a battery of oculomotor, vestibular and reaction time related tests applied to a population of individuals with mild traumatic brain injury as compared to controls. Results: We demonstrated pattern differences between the two groups and showed how three of these tests yield an 89% sensitivity and 95% specificity for confirming a current diagnosis of mild traumatic brain injury. Interpretation: These results help better characterize the oculomotor, vestibular, and reaction time differences between those the mild				

traumatic brain injury and non-affected individuals. This characterization will allow for the development of more effective point of care neurologic diagnostic techniques and allow for more targeted treatment which may allow for quicker return to normal activity.

*5 of the sections were not applicable

<i>Recommendation(s) Supported: 10.3</i>				
Reference	Year	Country	Design	Quality Rating
Hilton MP, Pinder DK. The Epley (canalith repositioning) manoeuvre for benign paroxysmal positional vertigo. <i>Cochrane Database Syst Rev.</i> 2014(12):CD003162.	2014	United Kingdom	Cochrane Review	N/A*
Abstract				
<p>Background: This is an update of a Cochrane Review first published in The Cochrane Library in Issue 1, 2002 and previously updated in 2004 and 2007. Benign paroxysmal positional vertigo (BPPV) is a syndrome characterised by short-lived episodes of vertigo in association with rapid changes in head position. It is a common cause of vertigo presenting to primary care and specialist otolaryngology clinics. Current treatment approaches include rehabilitative exercises and physical manoeuvres, including the Epley manoeuvre. Objectives: To assess the effectiveness of the Epley manoeuvre for posterior canal BPPV. Search methods: We searched the Cochrane Ear, Nose and Throat Disorders Group Trials Register; CENTRAL; PubMed; EMBASE; CINAHL; Web of Science; Cambridge Scientific Abstracts; ICTRP and additional sources for published and unpublished trials. The date of the most recent search was 23 January 2014. Selection criteria: Randomised controlled trials of the Epley manoeuvre versus placebo, no treatment or other active treatment for adults diagnosed with posterior canal BPPV (including a positive Dix-Hallpike test). The primary outcome of interest was complete resolution of vertigo symptoms. Secondary outcomes were conversion of a 'positive' Dix-Hallpike test to a 'negative' Dix-Hallpike test and adverse effects of treatment. Data collection and analysis: We used the standard methodological procedures expected by The Cochrane Collaboration. Main results: We included 11 trials in the review with a total of 745 patients. Five studies compared the efficacy of the Epley manoeuvre against a sham manoeuvre, three against other particle repositioning manoeuvres (Semont, Brandt-Daroff and Gans) and three against a control (no treatment, medication only, postural restriction). Patients were treated in hospital otolaryngology departments in eight studies and family practices in two studies. All patients were adults aged 18 to 90 years old, with a sex ratio of 1:1.5 male to female. There was a low risk of overall bias in the studies included. All studies were randomised with six applying sealed envelope or external allocation techniques. Eight of the trials blinded the assessors to the participants' treatment group and data on all outcomes for all participants were reported in eight of the 11 studies. Complete resolution of vertigo: Complete resolution of vertigo occurred significantly more often in the Epley treatment group when compared to a sham manoeuvre or control (odds ratio (OR) 4.42, 95% confidence interval (CI) 2.62 to 7.44; five studies, 273 participants); the proportion of patients resolving increased from 21% to 56%. None of the trials comparing Epley versus other particle repositioning manoeuvres reported vertigo resolution as an outcome. Conversion of Dix-Hallpike positional test result from positive to negative: Conversion from a positive to a negative Dix-Hallpike test significantly favoured the Epley treatment group when compared to a sham manoeuvre or control (OR 9.62, 95% CI 6.0 to 15.42; eight studies, 507 participants). There was no difference when comparing the Epley with the Semont manoeuvre (two studies, 117 participants) or the Epley with the Gans manoeuvre (one study, 58 participants). In one study a single Epley treatment was more effective than a week of three times daily Brandt-Daroff exercises (OR 12.38, 95% CI 4.32 to 35.47; 81 participants). Adverse effects: Adverse effects were infrequently reported. There were no serious adverse effects of treatment. Rates of nausea during the repositioning manoeuvre varied from 16.7% to 32%. Some patients were unable to tolerate the manoeuvres because of cervical spine problems. Authors' conclusions: There is evidence that the Epley manoeuvre is a safe, effective treatment for posterior canal BPPV, based on the results of 11, mostly small, randomised controlled trials with relatively short follow-up. There is a high recurrence rate of BPPV after treatment (36%). Outcomes for Epley manoeuvre treatment are comparable to treatment with Semont and Gans manoeuvres, but superior to Brandt-Daroff exercises.</p>				

*No checklists were appropriate to score this article design

Recommendation(s) Supported: 10.5				
Reference	Year	Country	Design	Quality Rating
Kleffelgaard I, Soberg HL, Bruusgaard KA, Tamber AL, Langhammer B. Vestibular Rehabilitation After Traumatic Brain Injury: Case Series. <i>Phys Ther.</i> 2016;96(6):839-849.	2016	Norway	Case Series	DOWNES & BLACK: 11/32*
Abstract				
Background and Purpose: There has been an increasing focus on vestibular rehabilitation (VR) after traumatic brain injury (TBI) in recent years. However, detailed descriptions of the content of and patient responses to VR after TBI are limited. The purposes of this case series are (1) to describe a modified, group-based VR intervention and (2) to examine changes in self-reported and performance-based outcome measures. Case Description: Two women and 2 men (aged 24-45 years) with mild TBI, dizziness, and balance problems participated in an 8-week intervention consisting of group sessions with guidance, individually modified VR exercises, a home exercise program, and an exercise diary. Self-reported and performance-based outcome measures were applied to assess the impact of dizziness and balance problems on functions related to activity and participation. Outcomes: The intervention caused no adverse effects. Three of the 4 patients reported reduced self-perceived disability because of dizziness, diminished frequency and severity of dizziness, improved health-related quality of life, reduced psychological distress, and improved performance-based balance. The change scores exceeded the minimal detectable change, indicating a clinically significant change or improvement in the direction of age-related norms. The fourth patient did not change or improve in most outcome measures. Discussion: A modified, group-based VR intervention was safe and appeared to be viable and beneficial when addressing dizziness and balance problems after TBI. However, concurrent physical and psychological symptoms, other neurological deficits, and musculoskeletal problems might influence the course of central nervous system compensation and recovery. The present case series may be useful for tailoring VR interventions to patients with TBI. Future randomized controlled trials are warranted to evaluate the short- and long-term effects of VR after TBI.				

*4 of the sections were not applicable

Recommendation(s) Supported: 10.9				
Reference	Year	Country	Design	Quality Rating
Yadav NK, Ciuffreda KJ. Objective assessment of visual attention in mild traumatic brain injury (mTBI) using visual-evoked potentials (VEP). <i>Brain Inj.</i> 2015;29(3):352-365.	2014	USA	Case-Control	DOWNES & BLACK: 16/32*
Abstract				
Purpose: To quantify visual attention objectively using the visual-evoked potential (VEP) in those having mild traumatic brain injury (mTBI) with and without a self-reported attentional deficit. Research design and methods: Subjects were comprised of 16 adults with mTBI: 11 with an attentional deficit and five without. Three test conditions were used to assess the visual attentional state to quantify objectively the VEP alpha band attenuation ratio (AR) related to attention: (1) pattern VEP; (2) eyes-closed; and (3) eyes-closed number counting. The AR was calculated for both the individual and combined alpha frequencies (8–13 Hz). The objective results were compared to two subjective tests of visual and general attention (i.e. the VSAT and ASRS, respectively). Results: The AR for both the individual and combined alpha frequencies was found to be abnormal in those with mTBI having an attentional deficit. In contrast, the AR was normal in those with mTBI but without an attentional deficit. The AR correlated with the ASRS, but not with the VSAT, test scores. Conclusions: The objective and subjective tests were able to differentiate between those having mTBI with and without an attentional deficit. The proposed VEP protocol can be used in the clinic to detect and assess objectively and reliably a visual attentional deficit in the mTBI population.				

*5 of the sections were not applicable

Recommendation(s) Supported: 10.9				
Reference	Year	Country	Design	Quality Rating
Goodrich GL, Martinsen GL, Flyg HM, et al. Development of a mild traumatic brain injury-specific vision screening protocol: a Delphi study. <i>J Rehabil Res Dev.</i> 2013;50(6):757-768.	2013	USA	Delphi Study	DOWNES & BLACK: 10/32*
Abstract				
Although traumatic brain injury (TBI) can happen to anyone at any time, the wars in Iraq and Afghanistan have brought it renewed attention. Fortunately, most cases of TBI from the recent conflicts are mild TBI (mTBI). Still, many				

oculomotor and vision problems, many of which can impede daily activities such as reading. Therefore, correct diagnosis and treatment of these mTBI-related vision problems is an important part of patient recovery. Numerous eye care providers in the Department of Veterans Affairs, in military settings, and in civilian practices specialize and are proficient in examining patients who have a history of TBI. However, many do not have this level of experience working with and treating patients with mTBI. Recognizing this, we used a modified Delphi method to derive expert opinions from a panel of 16 optometrists concerning visual examination of the patient with mTBI. This process resulted in a clinical tool containing 17 history questions and 7 examination procedures. This tool provides a set of clinical guidelines that can be used as desired by any eye care provider either as a screening tool or adjunct to a full eye examination when seeing a patient with a history of mTBI. The goal of this process was to provide optimal and

*16 of the sections were not applicable due to the study design

Recommendation(s) Supported:				
Reference	Year	Country	Design	Quality Rating
Magone MT, Kwon E, Shin SY. Chronic visual dysfunction after blast-induced mild traumatic brain injury. <i>J Rehabil Res Dev.</i> 2014;51(1):71-80.	2014	USA	Case-Series	DOWN'S & BLACK: 15/32*
Abstract				
The purpose of this study was to investigate the long-term visual dysfunction in patients after blast-induced mild traumatic brain injury (mbTBI) using a retrospective case series of 31 patients with mbTBI (>12 mo prior) without eye injuries. Time since mbTBI was 50.5 +/- 19.8 mo. Age at the time of injury was 30.0 +/- 8.3 yr. Mean corrected visual acuity was 20/20. Of the patients, 71% (n = 22) experienced loss of consciousness; 68% (n = 15) of patients in this subgroup were dismounted during the blast injury. Overall, 68% (n = 21) of patients had visual complaints. The most common complaints were photophobia (55%) and difficulty with reading (32%). Of all patients, 25% were diagnosed with convergence insufficiency and 23% had accommodative insufficiency. Patients with more than one mbTBI had a higher rate of visual complaints (87.5%). Asymptomatic patients had a significantly longer time (62.5 +/- 6.2 mo) since the mbTBI than symptomatic patients (42.0 +/- 16.4 mo, p < 0.004). Long-term visual dysfunction after mbTBI is common even years after injury despite excellent distance visual acuity and is more frequent if more than one incidence of mbTBI occurred. We recommend obtaining a careful medical history, evaluation of symptoms, and binocular vision assessment during routine eye examinations in this prepresbyopic patient population.				

*7 of the sections were not applicable

Reference	Year	Country	Design	Quality Rating
Leddy JJ, Willer B. Use of graded exercise testing in concussion and return-to-activity management. <i>Curr Sports Med Rep.</i> 2013;12(6):370-376.	2013	USA	Protocol	N/A*
Abstract				
Concussion is a physiologic brain injury that produces systemic and cognitive symptoms. The metabolic and physiologic changes of concussion result in altered autonomic function and control of cerebral blood flow. Evaluation and treatment approaches based upon the physiology of concussion may therefore add a new dimension to concussion care. In this article, we discuss the use of a standard treadmill test, the Buffalo Concussion Treadmill Test (BCTT), in acute concussion and in postconcussion syndrome (PCS). The BCTT has been shown to diagnose physiologic dysfunction in concussion safely and reliably, differentiate it from other diagnoses (e.g., cervical injury), and quantify the clinical severity and exercise capacity of concussed patients. It is used in PCS to establish a safe aerobic exercise treatment program to help speed recovery and return to activity. The use of a provocative exercise test is consistent with world expert consensus opinion on establishing physiologic recovery from concussion.				

No checklists were appropriate to score this article design