Guidelines for Concussion / Mild Traumatic Brain Injury & Persistent Symptoms

Second Edition

For adults (18+ years of age)

Complete Version

Ontario Neurotrauma Foundation
Fondation ontarienne de neurotraumatologie

COMPLETE VERSION

The project team would like to acknowledge the Ontario Neurotrauma Foundation (ONF), who initiated and funded the development of the original guideline, as well as the current update. ONF is an applied health research organization with a focus on improving the quality of lives for people with an acquired brain injury or spinal cord injury, and on preventing neurotrauma injuries from occurring in the first place. ONF uses strategic research funding activity embedded within a knowledge mobilization and implementation framework to build capacity within systems of care. ONF works with numerous stakeholders and partners to achieve its objective of fostering, gathering and using research knowledge to improve care and quality of life for people who have sustained neurotrauma injuries, and to influence policy towards improved systems. The foundation receives its funding from the Ontario Government through the Ministry of Health and Long-Term Care.

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

Ontario Neurotrauma Foundation
90 Eglinton East
Toronto, ON, Canada M4P 2Y3
Tel.: 1 (416) 422-2228
Fax: 1 (416) 422-1240
Email: info@onf.org

www.onf.org

Published September 2013

The recommendations and resources found within the *Guidelines for Concussion/Mild Traumatic Brain Injury & Persistent 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. These guidelines are not intended for use with patients or clients under the age of 18 years. These guidelines are 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 these guidelines.

The recommendations provided in these guidelines are informed by best available evidence at the time of publication, and relevant evidence published after these guidelines 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.

The developers, contributors and supporting partners shall not be liable for any damages, claims, liabilities, costs or obligations arising from the use or misuse of this material, including loss or damage arising from any claims made by a third party.

Table of Contents

FIGURES

Unique Features & 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 following 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 20 are key clinical practice guidelines recommendations for implementation.

The following symbol has been placed to the left of one key guideline recommendation in each of the sections that did not include a recommendation with a prioritization score greater than 20 (determined by expert consensus members during the endorsement/prioritization process).

At the bottom of each page in the current document, 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 Mild TBI and Persistent Symptoms

Mild traumatic brain injury (mTBI) is a significant cause of morbidity and mortality, with many survivors of 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. In this document, the terms mTBI and concussion are used interchangeably and denote the acute neurophysiological effects of blunt impact or other mechanical energy applied to the head, such as from sudden acceleration, deceleration or rotational forces.[4,5] Mild TBI is among the most common neurological conditions with an estimated annual incidence of 500/100,000 in the United States.[6] A recent 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]

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. Computed Axial Tomography (CAT) and conventional Magnetic Resonance Imaging (MRI) usually fail to detect evidence of structural brain abnormalities in mTBI. However, 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.[4,8,9]

Table A. Common Symptoms of mTBI

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

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.

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),[10] 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.[11] However, it should be noted that mTBI can occur in the absence of any loss of consciousness.

Disparities exist in the definitions used for mTBI, and several organizations have created formal diagnostic criteria in order to try to overcome inconsistencies. The diagnostic criteria recently revised at the 4th International Conference on Concussion in Sport held in Zurich, November 2012 by a panel of experts are presented in Table B.[12]

In most cases, patients who experience mTBI will recover fully, typically within days to months. The concern is that up to 15% of patients diagnosed with mTBI will continue to experience persistent disabling problems.[13] The consequences for these individuals may include reduced functional ability, heightened emotional distress, and delayed return to work or school.[5] When symptoms persist beyond the typical recovery period of three months, the term post-concussion syndrome or disorder may be applied.

Table B. Diagnostic Criteria for Concussion/Mild Traumatic Brain Injury*

Concussion/mTBI is defined as a complex pathophysiological process affecting the brain, induced by biomechanical forces. Several common features that incorporate clinical, pathologic and biomechanical injury constructs that may be utilised in defining the nature of a concussion/mTBI include:

1. Concussion/mTBI may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an ‘‘impulsive’ force transmitted to the head.
2. Concussion/mTBI typically results in the rapid onset of short-lived impairment of neurological function that resolvesspontaneously. However, in some cases, symptoms and signs may evolve over a number of minutes to hours.
3. Concussion/mTBI may result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.
4. Concussion/mTBI results in a graded set of clinical symptoms that may or may not involve loss of consciousness Resolution of the clinical and cognitive symptoms typically follows a sequential course. However, it is important to note that in some cases symptoms may be prolonged.

* 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.*

Table C. Diagnostic Criteria for Post-Concussion Syndrome (ICD-10)

A. History of head trauma with loss of consciousness preceding symptom onset by a maximum of 4 weeks.
B. Symptoms in 3 or more of the following symptom categories:
- Headache, dizziness, malaise, fatigue, noise intolerance
- Irritability, depression, anxiety, emotional lability
- Subjective concentration, memory, or intellectual difficulties without neuropsychological evidence of marked impairment
- Insomnia
- Reduced alcohol tolerance
- Preoccupation with above symptoms and fear of brain damage with hypochondriacal concern and adoption of sick role

Just as there is confusion surrounding the definition of mTBI, this is also the case with the definition of post-concussion disorder. Diagnostic criteria have been offered by the International Classification of Diseases Tenth Edition (ICD-10; Table C).[14] These criteria require the presence of a number of the same symptoms noted to occur acutely following mTBI (Table A).

There has been debate as to whether persistent 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.[15,16] 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,[17-19] depression,[20] and post-traumatic stress disorder,[21] and are observed to varying extent among healthy individuals.[22-24]

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.[25] Further, it must not be assumed that the initiation of a compensation claim arises solely from the pursuit of secondary gain.[26,27] 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.[28,29] The focus within the health care 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.

The Need for a Guideline

The Ontario Neurotrauma Foundation (ONF) initiated this project in 2008 with the overall objective to create a set of guidelines that can be used by health care professionals to implement evidence-based, best-practice care of individuals who incur a mTBI and experience persistent symptoms. Persistent symptoms are not an uncommon complication of mTBI; 10% to 15% of individuals who incur mTBI will continue to experience significant symptoms beyond the normal recovery period of three months,[30-32] which can include post-traumatic headache, sleep disturbance, disorders of balance, cognitive impairments, fatigue, and mood or affective disorders. The high incidence of mild TBI could translate 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 persistent 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 health professionals to effectively identify and treat individuals who manifest persistent symptoms following mTBI. Specifically, the aims of the guideline update were:

1. To update the Guidelines for Mild Traumatic Brain Injury and Persistent Symptoms: First Edition in order to maintain their relevancy and utility for primary care providers.
2. To modify the guideline format based on feedback from stakeholders and frontline users of the guidelines in order to improve the accessibility and utility of the guidelines.
3. To work with stakeholders to generate further ideas for knowledge translation.

c. Target Population

The present guidelines are appropriate for use with adults (≥ 18 years) who have experienced mTBI (note that similar ONF guidelines are currently being developed for children and youth, due for release 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 persistent 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) or the Scottish Intercollegiate Guidelines Network Early Management of Patients with a Head Injury - A National Clinical Guideline (2009).

d. Target Users

The present document is targeted toward health care professionals providing service to individuals who have experienced mTBI, including family physicians, primary health care providers, neurologists, physiatrists, psychiatrists, psychologists, counselors, physiotherapists, occupational therapists, and nurses.

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 persistent symptoms. The present guidelines offer 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 PTA and immediate complications of traumatic brain injury such as intracranial bleeding and potential neurologic deterioration (see Appendix 1.2), 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 Edition 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. All sections have been reviewed by the project team, as well as consensus members and external reviewers.

Clinicians are encouraged to prioritize treatments in a hierarchical fashion (see Table D). Individual guideline recommendations that should be prioritized for implementation are also highlighted in the Key Recommendations section and throughout the guideline document with a red helmet 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 D. Symptom Treatment Hierarchy

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

References

1 McMillan TM, Teasdale GM, Stewart E. Disability in young people and adults after head injury: 12-14 year follow-up of a prospective cohort. *Journal of Neurology, Neurosurgery & Psychiatry.* 2012;83:1086–1091. doi:10.1136/jnnp-2012-302746

2 Thornhill S, Teasdale GM, Murray GD, McEwen J, Roy, CW, Penny KI. Disability in young people and adults one year after head injury: prospective cohort study. *BMJ*. 2000;320:1631-1635.

3 Whitnall L, McMillan TM, Murray GD, Teasdale GM. Disability in young people and adults after head injury: 5–7 year follow up of a prospective cohort study. *Journal of Neurology, Neurosurgery & Psychiatry.* 2006;77:640–645. doi: 10.1136/jnnp.2005.078246.

4 Bigler ED. Neuropsychology and clinical neuroscience of persistent post-concussive syndrome. *Journal of the International Neuropsychological Society*. 2008;14:1-22.

5 Motor Accidents Authority of NSW (MAA NSW). Guidelines for Mild Traumatic Brain Injury following a Closed Head Injury; 2008.

6 Bazarian JJ, McClung J, Shah MN, Cheng YT, Flesher W, Kraus J. Mild traumatic brain injury in the United States, 1998-2000. *Brain Injury*. 2005;19(2):85-91.

7 Ryu WH, Feinstein A, Colantonio A, Streiner DL, Dawson DR. Early identification and incidence of mild TBI in Ontario. The *Canadian Journal of Neurological Sciences*. 2009;36:429-435.

8 Son BC, Park CK, Choi BG. Metabolic changes in pericontusional oedematous areas in mild head injury evaluated by 1H MRS. *Acta Neurochirurgica*. 2000(suppl);76:13-16.

9 Giza CC, Hovda DA. The neurometabolic cascade of concussion. *Journal of Athletic Training*. 2001;36(3):228-235.

10 Teasdale G, Jennett B. Assessment of coma and impaired consciousness. A practical scale. *Lancet.* 1974;2:81-84.

11 Von Holst H, Cassidy JD. Mandate of the WHO collaborating centre task force on mild traumatic brain injury. *Journal of Rehabilitation Medicine*. 2004;S43:8-10.

12 McCrory P, Meeuwisse WH, Aubry M, Cantu B, Dvorák J, Echemendia RJ, 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):250-258.

13 Kraus F, Chu LD. Epidemiology. In: Silver JM, McAllister TW, Yudofsky SC, eds. Textbook of traumatic brain injury. Washington DC: American Psychiatric Publishing, 2005:3-e26.

14 World Health Organization (WHO). International statistical classification of disease and related health problems (10th edition). Geneva: Author; 1992.

15 Ryan LM, Warden DL. Post concussion syndrome. *International Review of Psychiatry*. 2003;15:310-316.

16 Wood RLL. Understanding the 'miserable minority': A diasthesis-stress paradigm for post-concussional syndrome. *Brain Injury*. 2004;18:1135-1153.

17 Gasquoine PG. Postconcussional symptoms in chronic back pain. *Applied Neuropsychology*. 2000;7:83-89.

18 Iverson GL, McCracken LM. 'Post concussive' symptoms in persons with chronic pain. *Brain Injury*. 1997;11:783-790.

19 Smith-Seemiller L, Fow NR, Kant R, Franzen MD. Presence of post-concussion syndrome symptoms in patients with chronic pain vs. mild traumatic brain injury. *Brain Injury*. 2003;17(3):199-206.

20 Iverson GL. Misdiagnosis of the persistent postconcussion syndrome in patients with depression. *Archives of Clinical Neuropsychology*. 2006;21:303-310.

21 Foa EB, Cashman L, Jaycox L, Perry K. The validation of a self-report measure of posttraumatic stress disorder: The Posttraumatic Diagnostic Scale. *Psychological Assessment.* 1997;9:445-451.

22 Iverson GL, Lange RT. Examination of "Postconcussion-Like" symptoms in a healthy sample. *Applied Neuropsychology*. 2003;10:137-144.

23 Mittenberg W, DiGiulio DV, Perrin S, Bass AE. Symptoms following mild head injury: Expectation as aetiology. *Journal of Neurology, Neurosurgery and Psychiatry*. 1992;55:200-204.

24 Sawchyn JM, Brulot MM, Strauss E. Note on the use of the Postconcussion Syndrome Checklist. *Archives of Clinical Neuropsychology*. 2000;15:1-8.

25 Carroll LJ, Cassidy JD, Peloso PM, Borg J, von Holst H, Holm L, et al. Prognosis for mild traumatic brain injury: results of the WHO Collaborating Centre Task Force on Mild Traumatic Brain Injury. *Journal of Rehabilitation Medicine*. 2004;(43 Suppl):84-105.

26 Reynolds S, Paniak C, Toller-Lobe G, Nagy J. A longitudinal study of compensation-seeking and return to work in a treated mild traumatic brain injury sample. *Journal of Head Trauma Rehabilitation*. 2003 Mar-Apr;18(2):139-47.

27 Martelli MF, Nicholson K, Zasler ND, Bender M (2007). Assessment of response bias in clinical and forensic evaluations of impairment following TBI. In Brain Injury Medicine by Zasler et al., pp 1183-1203.

28 Greiffenstein MF. Late postconcussion syndrome as learned illness behavior: Proposal for a multifactorial model. *Brain Injury*. 2000;4:26–27.

29 Stulemeijer M, Andriessen TM, Brauer JM, Vos PE, Van Der Werf S. Cognitive performance after mild traumatic brain injury: The impact of poor effort on test results and its relation to distress, personality and litigation. *Brain Injury*. 2007;21:309-318.

30 Iverson GL. Outcome from mild traumatic brain injury. *Current Opinion in Psychiatry*. 2005;18:301-317.

31 Ruff RM, Weyer JC. Myths and mild traumatic brain injury. *Psychological Injury and Law*. 2005;2:34-42.

32 Ponsford J, Willmott C, Rothwell A, Cameron P, Kelly AM, Nelms R, et al. Factors influencing outcome following mild traumatic brain injury in adults. *Journal of the International Neuropsychological Society*. 2000;6:568–579.

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 red helmet.

Section 1. Diagnosis/Assessment of Concussion/mTBI		
		GRADE
1.1	Concussion/mTBI in the setting of closed head injury should be diagnosed as soon as possible because early recognition is associated with better health outcomes for patients. [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, cognitive screen, post-concussive symptom assessment, and review of mental health (see Table 1.2). [a]	**A**
1.3	The need for early neuroimaging should be determined according to the Canadian CT Head Rule (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	Standardized measurement of post-traumatic amnesia (PTA) should be routinely performed to assist with the monitoring, diagnosis, early management, and prognosis of patients who have experienced mTBI (see Appendix 1.2). [a]	**A**

1.5	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 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 (clinical judgment required)
	  • Persistent drug or alcohol intoxication (clinical judgment required)
	  • Presence of multi-system injuries (clinical judgment required)
	  • Presence of concurrent medical problems (clinical judgment required)
	  • Age >65 (clinical judgment required) [b]
		A

1.6	Patients with mTBI can be safely discharged for home observation after an initial period of observation if they meet the following discharge advice criteria:
	• Discharge summary prepared for primary care (or family) doctor.
	• Written and verbal brain injury advice (Appendix 1.3 and 1.4) given to patient (and nominated responsible person) covering
	  • Symptoms and signs of acute deterioration and when to seek urgent follow-up
	  • Lifestyle advice to assist recovery
	  • Typical post-concussive symptoms and reassurance about anticipated recovery
	  • Reasons for seeking routine follow up. [b]
		C

1.8	Clinicians should assess, monitor, and document persisting somatic, cognitive, and emotional/behavioural symptoms following mTBI using a standardized assessment scale (Appendix 1.5). [a]	**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 Health Guidelines: Initial Management of Closed Head Injury in Adults, 2nd Edition (NSW Health, 2011).*

Section 2. Management of Concussion/mTBI		
		GRADE
2.1	Initial treatment of a patient with concussion/mTBI is based upon a thorough evaluation of signs and symptoms, pre-injury history (e.g., premorbid conditions), and concurrent potential contributing factors (e.g., comorbid medical conditions, medications, mental health difficulties, impact of associated concurrent injuries).	**C**
2.2	Persons who complain about somatic, cognitive, or behavioral difficulties after mTBI should be assessed and treated symptomatically even if it has been a prolonged time after injury. [a]	**C**
2.3	The patient should be advised that a full recovery of symptoms is seen in the majority of cases. [b]	**A**
2.4	A patient experiencing reduced cognitive functioning in the first few days following injury, with education and support, should be expected, in the majority of cases, to have these symptoms resolve and pre-injury cognitive functioning return within days or up to three months. [c]	**A**
2.5	For patients who have 1) co-morbidities or identified health or risk factors (Table 1.1) and do not improve by one month, or 2) persistent symptoms at 3 months post-injury, it is recommended that these patients be referred for more comprehensive evaluation to a specialized brain injury environment (see Appendix 2.1). [c]	**A**
2.8	On presentation to health care providers, education about symptoms, including an advice card (Appendix 1.3 and 1.4) provided in writing and explained verbally, and reassurance should be provided to all patients and family members. Education should ideally be delivered at the time of initial assessment or minimally within one week of injury/first assessment. [b]	**A**
2.10	Education should be provided in printed material (Appendix 1.3 and 1.4) combined with verbal review and consist of: a. Symptoms and expected outcomes. b. Normalizing symptoms (education that current symptoms are expected and common after injury event). c. Reassurance about expected positive recovery. d. Gradual return to activities and life roles. e. Techniques to manage stress. [a]	**A (a-d)** **C (e)**
Section 3. Sport-Related Concussion/mTBI		
		GRADE
3.2	When a player shows any features of a mTBI: a. When possible, the player should be medically evaluated by a physician or other licensed health care provider 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 health care provider in a timely manner. If no health care provider 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 using the SCAT3 (Appendix 3.1 and 3.2) or other similar tool. d. The player should not be left alone following the injury, and serial monitoring for deterioration is essential over the initial few hours following injury. e. A player with diagnosed or suspected concussion should not be allowed to return to play or practice on the day of injury. "If in doubt, sit them out" [d]	**C**
Section 5. General Recommendations Regarding Management of Persistent Symptoms		
		GRADE
5.1	Patients should be advised that they are likely to experience one or more symptoms as a consequence of the concussion/mTBI that may persist for a short period of time and that this is usually expected (normal course). [b]	**A**

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

Section 5. General Recommendations Regarding Management of Persistent Symptoms		
		GRADE
5.3	Significant, prolonged complaints after mTBI should lead primary care providers to consider that many factors may contribute to [the persistence of] post-concussive symptoms (Table 1.1). All potential contributing factors should be investigated and a management strategy considered. [a]	A
Section 6. Post-Traumatic Headache		
		GRADE
6.1	Take a focused headache history (Table 6.1) in order to identify the headache subtype(s) that most closely resembles the patient's symptoms. To aid in determining the specific phenotype of headache disorder present, refer to the ICHD-II classification criteria in Appendix 6.3. Unfortunately, some post-traumatic headaches are unclassifiable.	C
Section 8. Persistent Mental Health Disorders		
		GRADE
8.1	Given their prevalence and potential impact, all patients with persistent symptoms following concussion/mTBI should be screened for mental health symptoms and disorders, including: • Depressive disorders (Appendix 8.1) • Anxiety disorders (Appendix 8.2), including post-traumatic stress disorder (PTSD) (Appendix 8.3 and 8.4) • Irritability and other personality changes • Substance use disorders (Appendix 8.5) • Somatoform disorders	C
Section 9. Persistent Cognitive Difficulties		
		GRADE
9.2	Certain conditions can affect cognition, such as ADHD, learning disabilities, anxiety or mood disorders, pain, fatigue, sleep disturbance, neuroendocrine dysfunction, or substance abuse. These conditions can be comorbid with mTBI and should be considered and evaluated as necessary.	A
9.4	Patients who have cognitive symptoms that are not resolving and continue to interfere in daily functioning (e.g., school, work) should be considered for referral for neuropsychological assessment. The evaluation may assist in clarifying appropriate treatment options based on individual patient characteristics and conditions.	A

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

1 Diagnosis/Assessment of Concussion/mTBI

Diagnosis of mTBI (Table B) is the first critical step in successful management leading to improved outcomes and prevention of further injury. Patients may present to the Emergency Department or health care provider'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 injury that is frequently associated with mTBI, such as motor vehicle collision. Patients may present in a post-traumatic amnestic (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.

Formal evaluation with a standardized tool is often key to documenting confusion or disorientation, particularly when a patient is denying or minimizing symptoms. The initial purpose of establishing the diagnosis of mTBI is to monitor for and rule out acute, life-threatening complications, such as intracranial hemorrhage, although the reality is that the vast majority of patients will not experience these complications. The need for neuroimaging should also be determined upon review of the Canadian CT Head Rule (Figure 1.1).[1] CT scans represent the most appropriate method of investigation for the exclusion of neurosurgically significant lesions, as normal skull x-rays are insufficiently sensitive and may mislead clinicians.[2]

When establishing the diagnosis of mTBI, primary care providers should also prepare the patient and family 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 is a key component to assisting patients in recovery. 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.[3] 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 persistent symptoms post mTBI. Regular follow up by the family physician can monitor progress and ensure that patient symptoms are dealt with promptly and arrangements for specialty referral can be made if indicated. In both the initial assessment and the follow up period, the health care provider should also attempt to explore and document risk factors (Table 1.1) that may potentially delay recovery following mTBI, and consider closer monitoring of recovery 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.

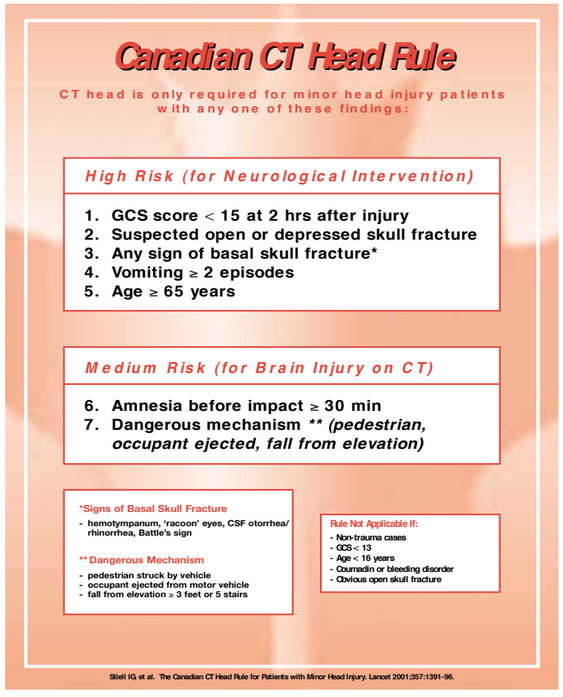


Figure 1.1 Canadian CT Head Rule
(Reproduced with permission)

Table 1.1. Risk Factors Influencing Recovery Post mTBI

Medical Factors (red flags): Pre-existing medical conditions or post-injury symptoms that are associated with poor outcomes post mTBI	• Post-traumatic amnesia (PTA) • History of previous traumatic brain injury • History of previous physical limitations • History of previous neurological or psychiatric problems • High number of symptoms reported early after injury • Skull fracture • Early onset of pain and in particular headache within 24 hours after injury • Reduced balance or dizziness during acute stage • Confounding effects of other health-related issues, e.g., pain medications, disabling effects of associated injuries, emotional distress • Presence of nausea after injury • Presence of memory problems after injury
Contextual Factors (yellow flags): Personal, psychosocial, or environmental factors that may negatively influence recovery post mTBI	• 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 • Less education/lower social economic status

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

(a) A medical history encompassing a review of: • 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, and • Potentially contributing psychosocial factors
(b) An examination including an assessment of: • Mental status and cognition • Cranial nerves • Extremity tone, strength, and reflexes, and • Gait and balance
(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.
(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.

Adapted from the NSW Health Guidelines: Initial Management of Closed Head Injury in Adults, 2nd Edition (NSW Health, 2011).

RECOMMENDATIONS FOR DIAGNOSIS/ASSESSMENT OF mTBI		
		GRADE
1.1	Concussion/mTBI in the setting of closed head injury should be diagnosed as soon as possible because early recognition is associated with better health outcomes for patients. [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, cognitive screen, post-concussive symptom assessment, and review of mental health (see Table 1.2). [a]	**A**

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

RECOMMENDATIONS FOR DIAGNOSIS/ASSESSMENT OF mTBI (CONTINUED)		
		GRADE
1.3	The need for early neuroimaging should be determined according to the Canadian CT Head Rule (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	Standardized measurement of post-traumatic amnesia (PTA) should be routinely performed to assist with the monitoring, diagnosis, early management, and prognosis of patients who have experienced mTBI (see Appendix 1.2). [a]	**A**

1.5	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 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 (clinical judgment required)
	  • Persistent drug or alcohol intoxication (clinical judgment required)
	  • Presence of multi-system injuries (clinical judgment required)
	  • Presence of concurrent medical problems (clinical judgment required)
	  • Age >65 (clinical judgment required) [b]
		A

1.6	Patients with mTBI can be safely discharged for home observation after an initial period of observation if they meet the following discharge advice criteria:
	• Discharge summary prepared for primary care (or family) doctor.
	• Written and verbal brain injury advice (Appendix 1.3 and 1.4) given to patient (and nominated responsible person) covering:
	  • Symptoms and signs of acute deterioration and when to seek urgent follow-up
	  • Lifestyle advice to assist recovery
	  • Typical post-concussive symptoms and reassurance about anticipated recovery
	  • Reasons for seeking routine follow up. [b]
		C

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: • Full re-evaluation, including an assessment for ongoing post-traumatic amnesia (PTA) • CT scan, if indicated • Emphasis and encouragement to the patients to attend their family physician for follow-up after discharge. [a]	**C**
1.8	Clinicians should assess, monitor, and document persisting somatic, cognitive, and emotional/behavioural symptoms following mTBI using a standardized assessment scale (Appendix 1.5). [a]	**C**

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

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 Health Guidelines: Initial Management of Closed Head Injury in Adults, 2nd Edition (NSW Health, 2011).*

RESOURCES (CONTINUED)	
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
3 Diagnostic Criteria for Concussion/Mild Traumatic Brain Injury	Table B
FIGURES	
1 Canadian CT Head Rule	Figure 1.1
ALGORITHM	
1 Initial Diagnosis/Assessment of Adult mTBI	Algorithm 1.1

References

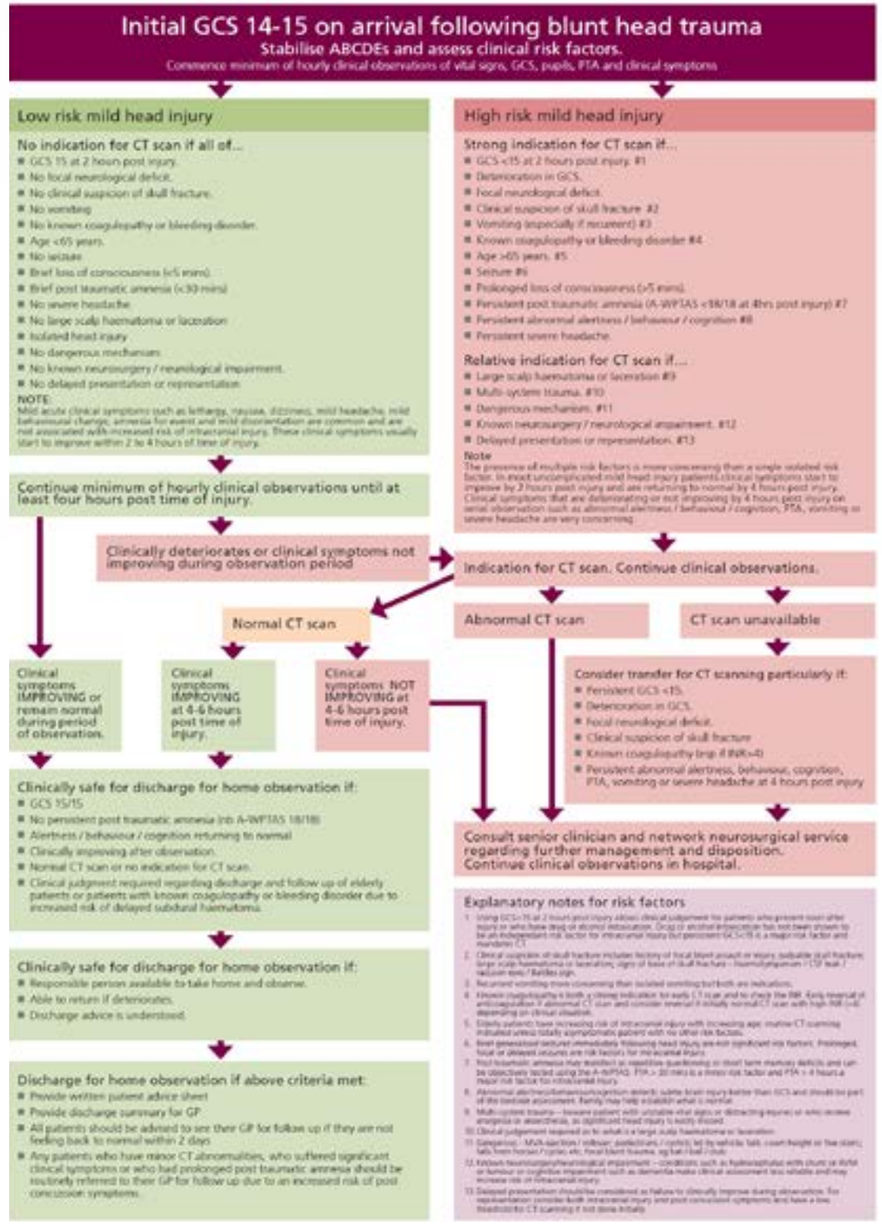
1 Stiell IG, Wells GA, Vandemheen K, et al. The Canadian CT Head Rule for patients with minor head injury. *Lancet*. 2001;357:1391–1396.

2 Hofman PA, Nelemans P, Kemerink GJ, Wilmink JT. Value of radiological diagnosis of skull fracture in the management of mild head injury: meta-analysis. *Journal of Neurology, Neurosurgery and Psychiatry*. 2000;68(4):416-422.

3 Carroll LJ, Cassidy JD, Peloso PM, Borg J, von Holst H, Holm L, et al. Prognosis for mild traumatic brain injury: results of the WHO Collaborating Centre Task Force on Mild Traumatic Brain Injury. *Journal of Rehabilitation Medicine*. 2004;(43 Suppl):84-105.

Algorithm 1.1

Initial Diagnosis/Assessment of mTBI*



For a narrative description and recommendations related to this algorithm, please refer to **Section 1**.

* Taken with permission from the *NSW Health Guidelines: Initial Management of Closed Head Injury in Adults, 2nd Edition (NSW Health, 2011)*.

2 Management of Concussion/mTBI

Whether a patient first presents to the Emergency Department or to the health care provider's office, ruling out injury that requires emergency intervention is the initial priority. However, 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).[1] 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 health care follow-up post injury. Pre-injury or current psychiatric difficulties, such as depression or anxiety, may place a patient at increased risk for persistent symptoms. Referral to specialist services and/or multidisciplinary treatment may be required early on for these patients.[2] 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 co-morbid conditions present (e.g., depression, PTSD). By applying the strategies outlined above consistently, both the acute and chronic complications of mTBI can be mitigated.

GENERAL RECOMMENDATIONS FOR MANAGEMENT OF mTBI		
		GRADE
2.1	Initial treatment of a patient with concussion/mTBI is based upon a thorough evaluation of signs and symptoms, pre-injury history (e.g., premorbid conditions), and concurrent potential contributing factors (e.g., comorbid medical conditions, medications, mental health difficulties, impact of associated concurrent injuries).	C
2.2	Persons who complain about somatic, cognitive, or behavioral difficulties after mTBI should be assessed and treated symptomatically even if it has been a prolonged time after injury. [a]	C
2.3	The patient should be advised that a full recovery of symptoms is seen in the majority of cases. [b]	A
2.4	A patient experiencing reduced cognitive functioning in the first few days following injury, with education and support, should be expected, in the majority of cases, to have these symptoms resolve and pre-injury cognitive functioning return within days or up to three months. [c]	A
2.5	For patients who have 1) co-morbidities or identified health or risk factors (Table 1.1) and do not improve by one month, or 2) persistent symptoms at 3 months post-injury, it is recommended that these patients be referred for more comprehensive evaluation to a specialized brain injury environment (see Appendix 2.1). [b]	C
2.6	The primary care provider should consider the risk of depression or other mental health disorders in patients who have experienced mTBI, which may be influenced by psychosocial factors and psychological responses to the injury. [b]	B
2.7	Multiple concussions should be considered a flag or signal that warrants a more intensive management strategy.	C

Although research on interventions delivered post-mTBI is scant, there is evidence to support the effectiveness of patient education interventions.[3] Educational interventions for mTBI should validate the current symptomatology, while encouraging the anticipated course of recovery and the importance of gradually achieving realistic functional goals.[4] Several studies have demonstrated that providing brief, single session education-oriented treatment is superior to standard procedures,[5-7] and even as effective as more intensive interventions.[8,9] There is also evidence to support that reassurance, in addition to education about symptoms, is more effective for lowering risk of persistent symptoms than education alone.[5] It is also necessary to educate the patient's family, as support from family members is a key component to maximizing survivors' independence and psychosocial adjustment.[10] In addition to providing verbal information and reassurance to patients, it is also advised that written patient information sheets are delivered (see Appendix 1.3 and 1.4).[11] See Algorithm 2.1, which outlines the key steps for initial management of mTBI.

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

RECOMMENDATIONS FOR MANAGEMENT OF mTBI: PROVIDING EDUCATION AFTER mTBI		
		GRADE
2.8	On presentation to health care providers, education about symptoms, including an advice card (Appendix 1.3 and 1.4) provided in writing and explained verbally, and reassurance should be provided to all patients and family members. Education should ideally be delivered at the time of initial assessment or minimally within one week of injury/first assessment. [a]	A
2.9	Individualized telephone or in-person follow-up with education on symptom management and encouragement to resume everyday activities should be provided over the 12 weeks after injury.	A
2.10	Education should be provided in printed material (Appendix 1.3 and 1.4) combined with verbal review and consist of: a. Symptoms and expected outcomes. b. Normalizing symptoms (education that current symptoms are expected and common after injury event). c. Reassurance about expected positive recovery. d. Gradual return to activities and life roles. e. Techniques to manage stress. [b]	A (a-d) C (e)

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

References

1 Preece MH, Horswill MS, Geffen GM. Driving after concussion: the acute effect of mild traumatic brain injury on drivers' hazard perception. *Neuropsychology*. 2010 Jul;24(4):493-503. doi: 10.1037/a0018903.
2 Ghaffar O McCullagh S, Ouchterlony D, Feinstein A. Randomized treatment trial in mild traumatic brain injury. *Journal of Psychosomatic Research*. 2006 Aug;61(2):153-60.
3 Borg J, Holm L, Peloso PM et al. Non-surgical intervention and cost for mild traumatic brain injury: Results of the WHO collaborating centre task force on mild traumatic brain injury. *Journal of Rehabilitation Medicine*. 2004;S43:76-83.
4 Riechers RG 2nd, Ruff RL. Rehabilitation in the patient with mild traumatic brain injury. *Continuum* (Minneap Minn). 2010 Dec;16(6 *Traumatic Brain Injury*):128-49. doi: 10.1212/01.CON.0000391456.60793.33.
5 Alves W, Macciocchi S, Barth J. Postconcussive symptoms after uncomplicated and complicated mild head injury. *Journal of Head Trauma Rehabilitation*. 1993;8:48-59.
6 Mittenberg W, Tremont G, Zielinski RE, Fichera S, Rayls KR. Cognitive-behavioral prevention of postconcussion syndrome. *Archives of Clinical Neuropsychology*. 1996;11:139-145.
7 Wade DT, Crawford S, Wenden FJ et al. Does routine follow up after head injury help? A randomised controlled trial. *Journal of Neurology, Neurosurgery and Psychiatry*. 1997;62:478-484.
8 Paniak C, Toller-Lobe G, Durand A, Nagy J. A randomized trial of two treatments for mild traumatic brain injury. *Brain Injury*. 1998;12:1011-1023.
9 Paniak C, Toller-Lobe G, Reynolds S et al. A randomized trial of two treatments for mild traumatic brain injury: 1 year follow-up. *Brain Injury*. 2000;14:219-226.
10 Stejskal TM. Removing barriers to rehabilitation: Theory-based family intervention in community settings after brain injury. *NeuroRehabilitation*. 2012;31(1):75-83. doi: 10.3233/NRE-2012-0776.
11 Ponsford J, Willmott C, Rothwell A et al. Impact of early intervention on outcome following mild head injury in adults. *Journal of Neurology, Neurosurgery and Psychiatry*. 2002;73:330-332.

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).*

Algorithm 2.1

Initial Management of Symptoms following mTBI*

Complete pre-injury history, physical examination, and psychosocial evaluation

↓

Clarify the symptoms: somatic, cognitive, behavioural (see Sidebar 1)

↓

Evaluate and treat potential contributing factors (such as current medical conditions, medications, mental health difficulties, and associated concurrent injuries)

↓

Educate patient/family on symptoms and expected recovery (see Sidebar 2)

↓

Determine treatment plan

↓

Provide early interventions (see Sidebar 2)

↓

Are all symptoms sufficiently resolved within days?

Yes → Follow up as needed and encourage resumption of everyday activities:

Return to work/school/activity
Community participation

No

↓

Initiate symptom-based multidisciplinary treatment (pharmacotherapy, psychotherapy, physiotherapy, occupational therapy)

↓

Follow-up and reassess in 4-6 weeks

↓

Are all symptoms sufficiently resolved?

Yes → Continue with Algorithm 5.1: Management of Persistent Symptoms following mTBI

Refer for comprehensive evaluation to a specialized brain injury environment (Appendix 2.1)

No

Sidebar 1: Symptom Attributes

- Duration of symptom
- Onset and triggers
- Location
- Previous episodes
- Intensity and impact
- Previous treatment and response
- Patient perception of symptom
- Impact on functioning

Sidebar 2: Early Intervention

- Provide information and education on symptoms and expected outcomes (i.e., expected positive recovery)
- Educate about prevention of further injuries
- Empower patient for self-management
- Provide sleep hygiene education
- Teach techniques to manage stress
- Encourage monitored progressive return to normal work/school/activity and life roles

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, 2009).*

3 Sports-Related Concussion/mTBI

Special contributors: Scott McCullagh, Lisa Fischer, Patricia McCord, Diana Velikonja

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 terms concussion and mTBI are considered to be interchangeable; however, the term "concussion" will be used for this particular section, as this is more commonly used in the sport literature. Sport-related injury is an important cause of concussion, although such injuries tend to lie on the milder end of the mTBI spectrum and are less often associated with concurrent extracranial injuries, loss of consciousness, and post-traumatic amnesia.[1] They typically occur in a population with unique characteristics: individuals tend to be younger, healthy, and highly motivated, and are often anticipating the blow or impact. The majority (80%-90%) of sport concussions in adults resolve in a short (7-10 day) period, although the recovery time frame may be longer in certain sports (e.g., ice hockey), as well as in children and adolescents.[2,3]

Patients with sport-related concussion may present to a health care setting acutely or after delay (e.g., several hours or days later). Once any necessary first aid measures have been implemented, an assessment of concussion symptoms should be done, including an assessment of somatic, cognitive, and emotional symptoms, physical signs, behaviour, balance, and sleep.[2,3] The Concussion in Sport Group has created a revised Sport Concussion Assessment Tool (SCAT3 and Pocket Concussion Recognition Tool, 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 outlined in Table A, concussion should be suspected and appropriate management initiated.

Accurate diagnosis, management, and return-to-play decisions are essential at all levels of sport (i.e., amateur to professional) and for all types of sport, including non-game activities (e.g., gymnastics). Experts unanimously agree that any player suspected of having experienced a concussion should not be allowed to return to play/activity in the same game/day of play. Physical and cognitive rest must also be followed until symptoms resolve.[3] Once symptoms have appeared to remit, a graded return to play/activity strategy should be adhered to so long as the athlete remains symptom free; see Recommendation 3.6 and Table 3.2 for explicit direction on this step-wise process. A reasonable approach involves the gradual return to school/work (prior to sports) in a way that does not result in a significant exacerbation of symptoms. Extra caution is warranted during the stepwise return to play/activity for athletes returning to sports with a high inherent risk of re-injury (e.g., high contact).

It should be noted that sport-related injuries represent one area of study in the mTBI field that has received substantial focus and multiple attempts to develop treatment guidance. Given that the current guideline is not specific to sports-related injuries, the information and guidance included herein for acute and subacute management are limited. Thus, readers interested in more thorough guidance on the assessment and management of this specific patient group should consult the latest Consensus Statement on Concussion in Sport: the Fourth International Conference on Concussion in Sport held in Zurich, November 2012[3] or the American Academy of Neurology Evidence-based Guideline for Clinicians: Evaluation and Management of Concussion in Sports.[4] Many sports organizations also formally provide specific guidance and recommendations for health care professionals 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 H). Further, as discussed above, differences exist between the nature of injuries incurred due to sport compared with other types of injuries, and research regarding how these guidelines apply to non-sport-related concussion has not been done. Therefore, the application of clinical guidance for sport-related concussion may not be appropriate for patients who have sustained other types of injuries.

Please keep in mind that the guideline recommendations were developed for and are appropriate for use with adults (≥18 years) who have experienced concussion.

Table 3.1. Concussion Modifiers [a]

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

Table 3.2. Graduated Return-to-Play Protocol [a]

Rehabilitation Stage	Functional Exercise at Each Stage of Rehabilitation	Objective of Each Stage
1. No activity	Symptom limited physical and cognitive rest	Recovery
2. Light aerobic exercise	Walking, swimming, or stationary cycling keeping intensity <70% maximum permitted heart rate No resistance training	Increase heart rate
3. Sport-specific exercise	Skating drills in ice hockey, running drills in soccer. No head impact activities	Add movement
4. Non-contact training drills	Progression to more complex training drills (e.g., passing drills in football and ice hockey)	Exercise, co-ordination, and cognitive load
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	Normal game play	

GENERAL RECOMMENDATIONS FOR ASSESSMENT & MANAGEMENT OF SPORT-RELATED CONCUSSION		
		GRADE
3.1	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. a. Symptoms: somatic (e.g., headache), cognitive (e.g., feeling like in a fog), and/or emotional symptoms (e.g., lability) b. Physical signs (e.g., loss of consciousness, amnesia) c. Behavioral changes (e.g., irritability) d. Cognitive impairment (e.g., slowed reaction times) e. Sleep disturbance (e.g., insomnia). Refer to Table A for a comprehensive list of signs for possible concussion. [a]	C

a. 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.*

GENERAL RECOMMENDATIONS FOR ASSESSMENT & MANAGEMENT OF SPORT-RELATED CONCUSSION (CONTINUED)		
		GRADE
3.2	When a player shows any features of a concussion: a. When possible, the player should be medically evaluated by a physician or other licensed health care provider 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 health care provider in a timely manner. If no health care provider 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 using the SCAT3 (Appendix 3.1 and 3.2) or other similar tool. d. The player should not be left alone following the injury, and serial monitoring for deterioration is essential over the initial few hours following injury. e. A player with diagnosed or suspected concussion should not be allowed to return to play or practice on the day of injury. “If in doubt, sit them out” [a]	C
3.3	The cornerstone of concussion management is physical and cognitive rest until the acute symptoms resolve and then a graded program of exertion prior to medical clearance and return to play. • An initial period of rest in the acute symptomatic period following injury (24-48 hours) may be of benefit. • A sensible approach involves the gradual return to school and social activities (prior to contact sports) in a manner that does not result in a significant exacerbation of symptoms. [a]	C
3.4	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 a multidisciplinary manner by health care providers with experience in sports-related concussion (see Table 3.1). [a]	C
3.5	Physicians or other licensed health care providers are encouraged to evaluate the concussed athlete for mood symptoms such as depression and anxiety. [a]	C
RECOMMENDATIONS FOR RETURN TO PLAY		
		GRADE
3.6	Return to play 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 he or she is 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. [b]	C
3.7	An important consideration in return to play is that athletes who have experienced concussion not only should be symptom free, but also should not be taking any pharmacological agents/ medications that may mask or modify the symptoms of concussion. [b]	C

RESOURCES		
APPENDICES		
1	Sport Concussion Assessment Tool (SCAT3)	Appendix 3.1
2	Pocket Concussion Recognition Tool (Pocket CRT)	Appendix 3.2
3	Other Links/References for Resources to Consider	Appendix H

a. 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.*
b. Taken 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 (CONTINUED)		
TABLES		
1	Common Symptoms of mTBI	Table A
2	Concussion Modifiers	Table 3.1
3	Graduated Return-to-Play Protocol	Table 3.2

References

1 Iverson, GL. Sport-related concussion. In M.R. Schoenberg and J.G. Scott (eds.), The Little Black Book of Neuropsychology: A Syndrome-Based Approach. New York: Springer Science+Business Media; 2011.

2 Makdissi, M, Cantu RC, Johnston KM, McCrory P, Meeuwisse WH. The difficult concussion patient: what is the best approach to investigation and management of persistent (>10 days) postconcussive symptoms? *British Journal of Sport Medicine*. 2013;47:308-313.

3 McCrory P, Meeuwisse WH, Aubry M, Cantu B, Dvorák J, Echemendia RJ, 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):250-258.

4 Giza CC, Kutcher JS, Ashwal S, Barth J, Getchius TS, Gioia GA, et al. Summary of evidence-based guideline update: Evaluation and management of concussion in sports: Report of the Guideline Development Subcommittee of the American Academy of Neurology. *Neurology*. 2013 Jun 11;80(24):2250-2257.

4 General Recommendations Regarding Diagnosis/Assessment of Persistent Symptoms

While full recovery is expected within 3 months after concussion/mTBI,[1,2] not all patients experience such rapid recovery, with up to 15% experiencing ongoing symptoms.[3,4] A number of factors influence the rate of recovery such as the mechanism and setting for the initial injury; for example, mTBI due to non-sport-related causes is often unexpected, emotionally charged, or associated with multiple or even life-threatening injuries. Other potential risk factors (Table 1.1) may signal the need to monitor patient recovery more closely, given that these individuals are at higher risk for persistent symptoms and poorer outcome.[5-7] For persons with persistent symptoms at 1 month post-injury, referral for specialized assessment may be indicated.

There is controversy regarding the diagnosis of post-concussion syndrome 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 post-traumatic headache or whiplash associated disorder (Table 4.1, Appendix 4.1). Regardless of formal diagnosis (e.g., post-concussion syndrome versus depression), 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 primary emphasis for health care providers remains identifying and managing symptoms to prevent potential delay in recovery.
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).

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 guidelines is to assist in providing recommendations for management of these patients at risk using a symptom-based approach.

Table 4.1. Differential Diagnoses Related to mTBI.

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

GENERAL RECOMMENDATIONS REGARDING DIAGNOSIS/ASSESSMENT OF PERSISTENT SYMPTOMS		
		GRADE
4.1	*Clinicians should assess, monitor ,and document persisting somatic, cognitive, and emotional/ behavioural symptoms following concussion/mTBI using a standardized assessment scale (Appendix 1.5).**	C
4.2	The assessment and management of an individual with persistent mTBI-related symptoms should be directed toward the specific symptoms regardless of their etiology or elapsed time from injury. [a]	C
4.3	The assessment should include a review of currently prescribed medications, over-the-counter medications/supplements, and substance use, including alcohol.	C
4.4	Persistent symptoms following mTBI can be nonspecific. Therefore, careful and thorough differential diagnoses should be considered as similar symptoms are common in chronic pain, depression, anxiety disorders, and other medical and psychiatric disorders (see Table 4.1 and Appendix 4.1).	C

** THIS RECOMMENDATION IS DUPLICATED FROM SECTION 1 (SAME AS 1.8).*

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

RESOURCES		
APPENDICES		
1	Rivermead Post Concussion Symptoms Questionnaire	Appendix 1.5
2	ICD-10 Definitions of Each Differential Diagnosis Mentioned in Table 4.1	Appendix 4.1
TABLES		
1	Differential Diagnoses Related to mTBI	Table 4.1
2	Risk Factors Influencing Recovery Post mTBI	Table 1.1

References

1 King N. Mild head injury: Neuropathology, sequelae, measurement and recovery. *British Journal of Clinical Psychology*. 1997;36:161-184.

2 Van der Naalt J. Prediction of outcome in mild to moderate head injury: A review. *Journal of Clinical and Experimental Neuropsychology*. 2001;23:837-851.

3 Kraus F, Chu LD. Epidemiology. In: Silver JM, McAllister TW, Yudofsky SC, eds. Textbook of traumatic brain injury. Washington DC: American Psychiatric Publishing, 2005:3-26.

4 Ruff RM, Weyer Jamora C. Myths and mild traumatic brain injury. *Psychological Injury and Law* 2005;2:34-42.

5 Kashluba S, Paniak C, Casey JE. Persistent symptoms associated with factors identified by the WHO Task Force on Mild Traumatic Brain Injury. *Journal of Clinical and Experimental Neuropsychology* 2008;22(2):195-208.

6 Luis CA, Vanderploeg RD, Curtiss G. Predictors of postconcussion symptom complex in community dwelling male veterans. *Journal of the International Neuropsychological Society* 2003;9(7):1001-15.

7 Ponsford J, Willmott C, Rothwell A, Cameron P, Kelly AM, Nelms R, Curran C, Ng K. Factors influencing outcome following mild traumatic brain injury in adults. *Journal of the International Neuropsychological Society* 2000;6(5):568-79.

5 General Recommendations Regarding Management of Persistent Symptoms

Consistent with general expectations of both patients and health care personnel, symptoms following mTBI are anticipated to resolve in a timely fashion in the majority (85-90%) of cases; however, these guidelines have been developed to assist in managing those individuals who continue to have persistent symptoms or delayed recovery following concussion/mTBI.

While providing education and reassurance that symptoms are expected to recover following mTBI, primary care providers must also 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 persistent symptoms or decline in function, emphasis needs to be placed on regular monitoring by health care providers and identification of potentially treatable symptoms. Timely intervention for symptoms should be initiated, as well as consideration for referral to a specialist or multidisciplinary treatment clinic if available. 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.[1,2] Accordingly, suspected symptom exaggeration or perceived compensation seeking should not influence the clinical care rendered, as doing so can be counter-therapeutic and negatively impact the quality of care.

The diagnosis of post-concussion syndrome is based on a constellation of symptoms commonly experienced following mTBI. These symptoms are not specific to mTBI, however, and show substantial overlap with other conditions such as depression, pain, and chronic fatigue. Symptoms associated with post-concussion syndrome are also common in normal populations.[3] Nonetheless, patients are often functionally affected by these symptoms, and therefore they clearly need to be addressed. This guideline has been designed to highlight a symptomatic approach to management of persistent symptoms 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 persistent symptoms following mTBI.

GENERAL RECOMMENDATIONS REGARDING MANAGEMENT OF PERSISTENT SYMPTOMS		
		GRADE
5.1	Patients should be advised that they are likely to experience one or more symptoms as a consequence of the concussion/mTBI that may persist for a short period of time and that this is usually expected (normal course). [a]	**A**
5.2	*The patient should be advised that a full recovery of symptoms is seen in the majority of cases.**	**A**
5.3	Significant, prolonged complaints after mTBI should lead primary care providers to consider that many factors may contribute to [the persistence of] post-concussive symptoms (Table 1.1). All potential contributing factors should be investigated and a management strategy considered. [a]	**A**

** THIS RECOMMENDATION IS DUPLICATED FROM SECTION 2 (SAME AS 2.3).*

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

GENERAL RECOMMENDATIONS REGARDING MANAGEMENT OF PERSISTENT SYMPTOMS (CONTINUED)		
		GRADE
5.4	Persons with mTBI and complicating health-related or contextual factors should be considered for early referral to a multidisciplinary treatment clinic (Appendix 2.1) capable of managing post-concussive symptoms because these factors have been associated with poorer outcomes.	C
5.5	The clinician should consider having a knowledgeable and supportive second-person informant (e.g., partner, family member, close friend, etc.) accompany the patient with mTBI to the initial assessment and to ongoing meetings if required to help the patient better understand the condition and provide an opportunity to discuss any coping difficulties. [a]	C
5.6	Low-level exercise for those who are slow to recover may be of benefit, although the optimal timing following injury for initiation of this treatment is currently unknown. However, 1 month post-injury has been proposed.[4]	C
5.7	New onset pain and concussive injuries are often co-morbid. Comprehensive evaluation and management of the pain should be considered as it may contribute to negatively influencing other symptoms associated with mTBI.	C
5.8	*Education should be provided in printed material (Appendix 1.3 and 1.4) combined with verbal review and consist of:* *a. Symptoms and expected outcomes.* *b. Normalizing symptoms (education that current symptoms are expected and common after injury event).* *c. Reassurance about expected positive recovery.* *d. Gradual return to activities and life roles.* *e. Techniques to manage stress.**	A (a-d) C (e)

** THIS RECOMMENDATION IS DUPLICATED FROM SECTION 2 (SAME AS 2.10).*

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

References

1 Martelli MF, Nicholson K, Zasler ND, Bender M (2007). Assessment of response bias in clinical and forensic evaluations of impairment following TBI. In Brain Injury Medicine by Zasler et al., pp 1183-1203.

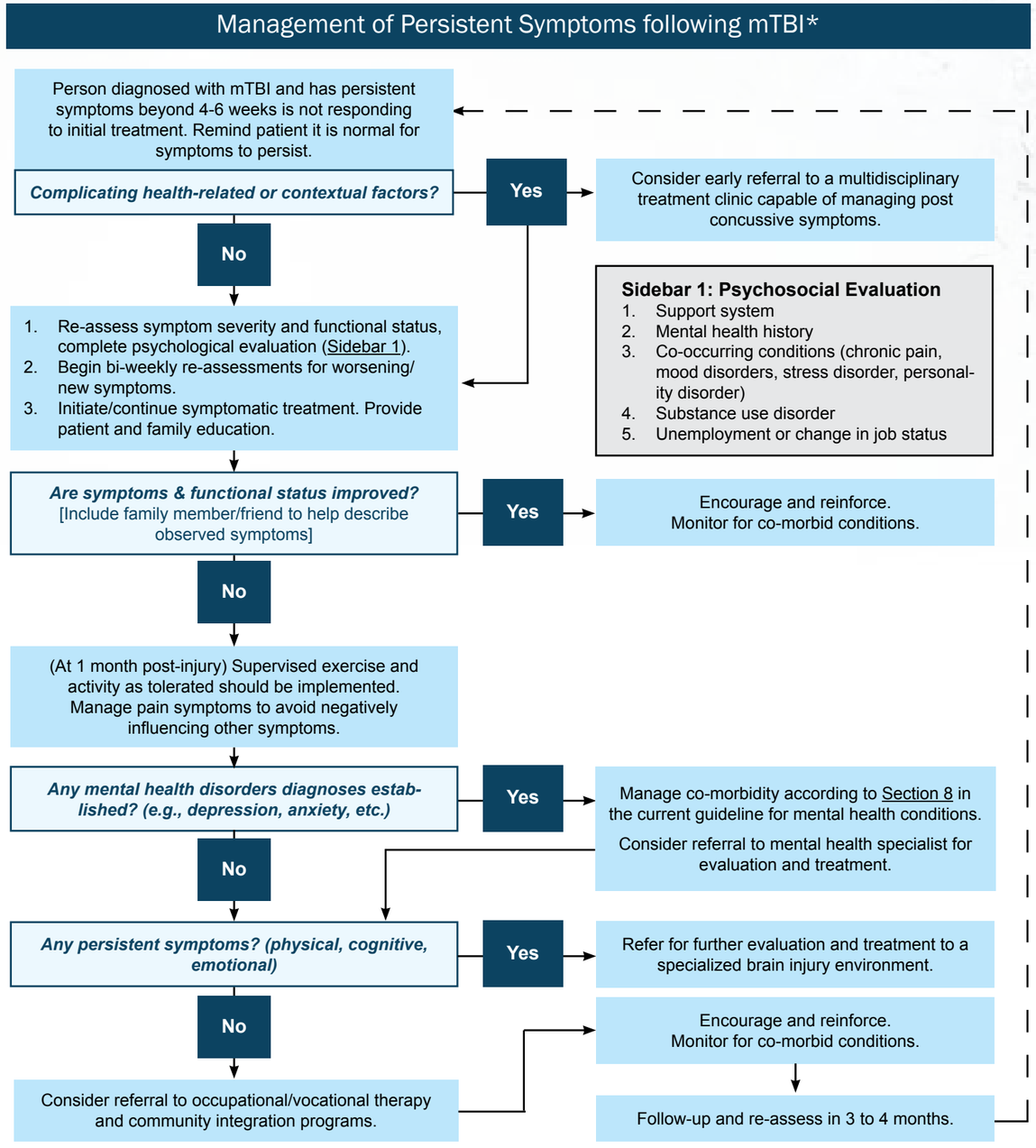
2 Stulemeijer M, Andriessen TM, Brauer JM, Vos PE, Van Der Werf S. Cognitive performance after mild traumatic brain injury: The impact of poor effort on test results and its relation to distress, personality and litigation. *Brain Injury*. 2007;21:309-318.

3 Iverson GL, Lange RT. Examination of "Postconcussion-Like" symptoms in a healthy sample. *Applied Neuropsychology*. 2003;10:137-144.

4 Silverberg ND, Iverson GL. Is rest after concussion "the best medicine?": Recommendations for activity resumption following concussion in athletes, civilians, and military service members. *Journal of Head Trauma Rehabilitatio*n. 2013;28(4):250-259.

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

Algorithm 5.1



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

Special contributor: Jonathan Gladstone

Headache is the most common symptom following mTBI.[1] Studies to date have documented that anywhere from 30-90% of individuals who sustain a mTBI develop post-traumatic headache.[2,3] Interestingly, several researchers have reported that post-traumatic headache is more common after mild TBI than after severe TBI.[2,4-11] Notably, post-traumatic headache is associated with a high degree of disability.[1] 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-II)[12] includes diagnostic criteria for both acute (Appendix 6.1) and chronic (Appendix 6.2) post-traumatic headache following mTBI.

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. Accordingly, the management of post-traumatic headache is based upon clinical experience and expert opinion.[12] The overall approach to the management of post-traumatic headache is: (i) to recommend implementation of basic lifestyle and non-pharmacologic strategies to try to mitigate headache occurrence and (ii) to determine the primary (or secondary) headache disorder that most closely resembles the patient's symptoms and then implement treatment strategies aimed at treating that headache subtype.[13]

In line with this, classification criteria for the common phenotypes of post-traumatic headache are provided in Appendix 6.3, and individual treatment pathways for these classes of primary headache 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.[6,13-19]

Unfortunately, too frequent use of analgesics is a significant problem in many individuals suffering from persistent post-traumatic headaches.[6,13] 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, and triptans 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 (diary). For example, advise 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 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-II criteria for Medication Overuse in Headache are presented in Appendix 6.4. 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	Take a focused headache history (Table 6.1) in order to identify the headache subtype(s) that most closely resembles the patient's symptoms. To aid in determining the specific phenotype of headache disorder present, refer to the ICHD-II classification criteria in Appendix 6.3. Unfortunately, some post-traumatic headaches are unclassifiable.	C
6.2	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 (see Appendix 6.5).	C
6.3	Perform a neurologic exam and musculoskeletal exam including cervical spine examination (refer to Appendix 6.6).	C
RECOMMENDATIONS FOR NON-PHARMACOLOGICAL TREATMENT OF POST-TRAUMATIC HEADACHE		
		GRADE
6.4	Education should be provided on lifestyle strategies and simple, self-regulated intervention strategies that may minimize headache occurrence. For more details on lifestyle management, see Appendix 6.7.	C
6.5	Consideration should be given to non-pharmacological therapies targeted to the presumed source of the headache, including relaxation therapy, biofeedback, massage therapy, manual therapy of the spine, acupuncture, vision therapy, and cognitive behavioral therapy.	C
RECOMMENDATIONS FOR PHARMACOLOGICAL TREATMENT OF POST-TRAUMATIC HEADACHE		
		GRADE
6.6	All patients with frequent headaches should be required to maintain an accurate headache and medication calendar in order to accurately gauge symptoms and guide management.	C
6.7	Based upon the patient's headache characteristics, consideration may be given to using acute headache medications, limited to <15 days per month, including: 1. Over-the-counter or prescription NSAIDs (e.g., Tylenol); 2. Acetylsalicylic acid; 3. Acetaminophen; and 4. Combination analgesics (with codeine or caffeine).	C
6.8	For patients with post-traumatic headaches that are migrainous in nature, the use of migraine-specific abortant triptan class medications (i.e., almotriptan, eletriptan, sumatriptan, rizatriptan, zolmitriptan, etc.) may be effective but should be limited to <10 days per month.	B
6.9	Narcotic analgesics should be avoided or restricted to "rescue therapy" for acute attacks when other first- and second-line therapies fail or are contraindicated.	C
6.10	Prophylactic therapy should be considered if headaches are occurring too frequently or are too disabling, or if acute headache medications are contraindicated, poorly tolerated, or being used too frequently (see Appendix 6.8).	C
6.11	Post-traumatic headaches may be unresponsive to conventional treatments. If headaches remain inadequately controlled, referral to a neurologist, pain management specialist, or traumatic brain injury clinic is recommended.	C

RESOURCES		
APPENDICES		
1	International Classification of Headache Disorders (ICHD-II): Acute Post-Traumatic Headache Attributed to Mild Head Injury	Appendix 6.1
2	International Classification of Headache Disorders (ICHD-II): Chronic Post-Traumatic Headache Attributed to Mild Head Injury	Appendix 6.2
3	Diagnostic Criteria for Selected Primary Headache Types from the International Classification of Headache Disorders (ICHD-II)	Appendix 6.3
4	International Classification of Headache Disorders (ICHD-II): Medication-Overuse Headache	Appendix 6.4

RESOURCES (CONTINUED)	
APPENDICES (CONTINUED)	
5 Headache Impact Test-6 (HIT-6)	Appendix 6.5
6 Important Components to Include in the Neurological and Musculoskeletal Exam	Appendix 6.6
7 Self-Regulated Intervention and Lifestyle Strategies to Minimize Headache Occurrence	Appendix 6.7
8 Prophylactic Therapy	Appendix 6.8
TABLES	
1 Important Components to Include in the Focused Headache History	Table 6.1
ALGORITHMS	
1 Assessment and Management of Post-Traumatic Headache following mTBI	Algorithm 6.1

References

1 Gladstone J. From psychoneurosis to ICHD-2: An overview of the state of the art in post-traumatic headache. *Headache*. 2009;49:1097-1111.

2 Bazarian JJ, Wong T, Harris M. Epidemiology and predictors of post-concussive syndrome after minor head injury in an emergency population. *Brain Injury*. 1999;13:173-189.

3 Dikmen S, Machamer J, Fann JR, Temkin NR. Rates of symptom reporting following traumatic brain injury. *Journal of the International Neuropsychological Society*. 2010;16:401-411.

4 Cartlidge NEF, Shaw DA. Head Injury. London: W.B. Saunders; 1981.

5 Evans RW. The postconcussion syndrome: 130 years of controversy. *Seminars in Neurology*. 1994;14:32-39.

6 Haas DC. Chronic post-traumatic headaches classified and compared with natural headaches. *Cephalalgia*. 1996;16:486-493.

7 Jensen OK, Nielsen FF. The influence of sex and pretraumatic headache on the incidence and severity of headache after head injury. *Cephalalgia*. 1990;10:285-293.

8 Keidel M, Ramadan NM. Chronic post-traumatic headache. In: Olesen J, Tfelt-Hansen P, Welch KMA, eds. *The Headaches*. Philadelphia: Lippincott, Williams & Wilkins; 2000:771-780.

9 Minderhoud JM, Boelens MEM, Huizenga J, Saan RJ. Treatment of minor head injuries. *Clinical Neurology and Neurosurgery*. 1980;82:127-140.

10 Packard RC. Posttraumatic Headache. *Seminars in Neurology*. 1994;14:40-45.

11 Yamaguchi M. Incidence of Headache and Severity of Head Injury. *Headache*. 1992;32:427-431.

12 Headache Classification Subcommittee of the International Headache Society. The International Classification of Headache Disorders, 2nd ed. *Cephalalgia*. 2004;24(suppl 1):1-159.

13 Baandrup L, Jensen R. Chronic post-traumatic headache: A clinical analysis in relation to the International Headache Classification, 2nd ed. *Cephalalgia*. 2005;25:132-138.

14 Lew HL, Lin P-H, Fuh J-L et al. Characteristics and treatment of headache after traumatic brain injury. *American Journal of Physical Medicine and Rehabilitation*. 2006;85:619-627.

15 Bettucci D, Aguggia M, Bolamperti L et al. Chronic post-traumatic headache associated with minor cranial trauma: A description of cephalalgic patterns. *Italian Journal of Neurological Sciences*. 1998;19:20-24.

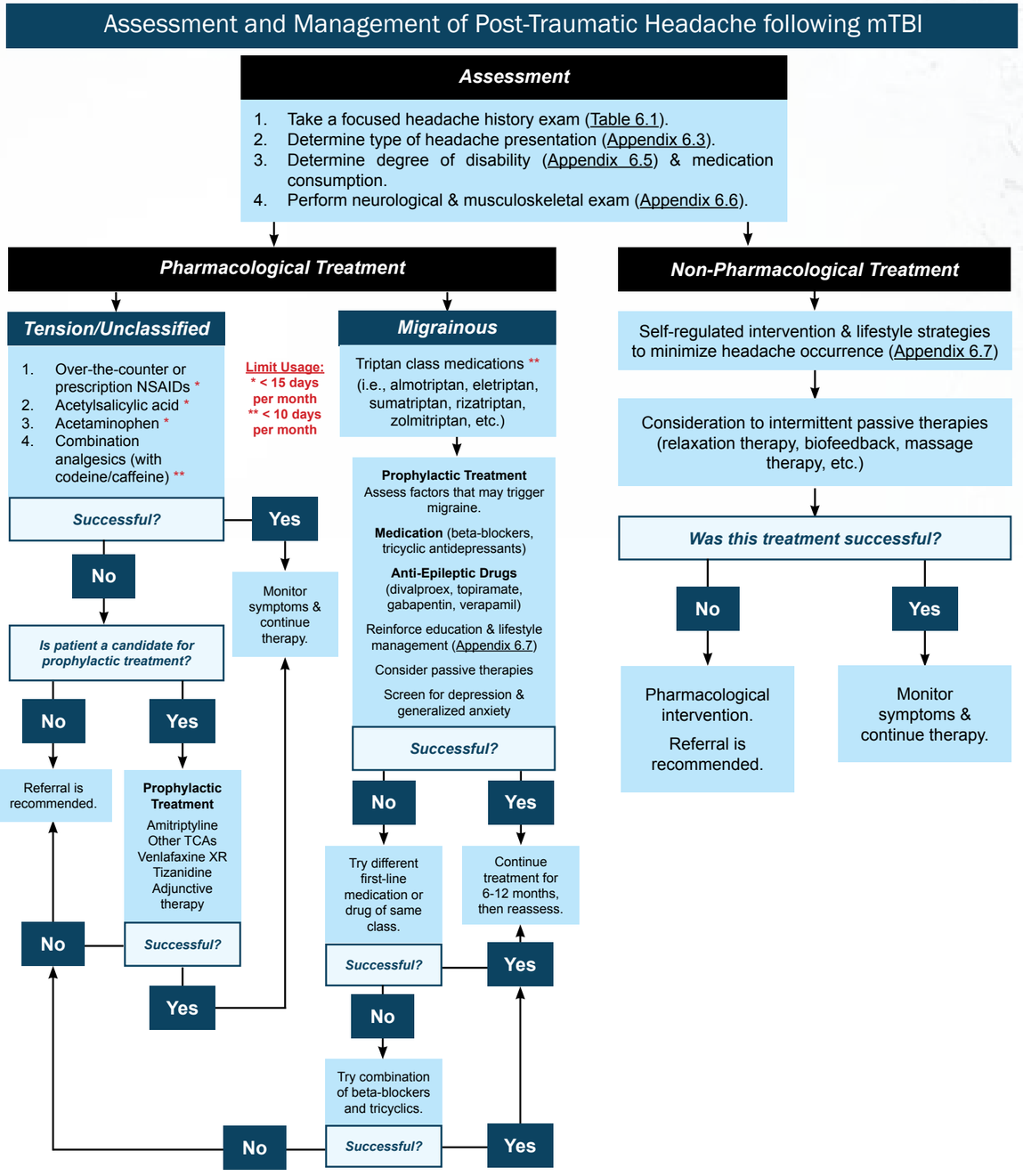
16 Radanov BP, Di Stefano G, Augustiny KF. Symptomatic approach to posttraumatic headache and its possible implications for treatment. *European Spine Journal*. 2001;10:403-407.

17 Bekkelund S, Salvesen R. Prevalence of head trauma in patients with difficult headache: The North Norway Headache Study. *Headache*. 2003;43:59-62.

18 Weiss HD, Stern BJ, Goldberg J. Post-traumatic migraine: Chronic migraine precipitated by minor head or neck trauma. *Headache*. 1991;31:451-456.

19 Lucas S, Hoffman JM, Bell KR, Walker W, Dikmen S. Characterization of headache after traumatic brain injury. *Cephalalgia*. 2012;32(8):600-606.

Algorithm 6.1



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

7 Persistent Sleep/Wake Disturbances

Special contributors: Simon Beaulieu-Bonneau, Marie-Christine Ouellet, Catherine Wiseman-Hakes

According to recent reviews, approximately 50% of patients suffer from sleep disturbances following mTBI, specifically insomnia, hypersomnia, obstructive sleep apnea, snoring, poor sleep maintenance and efficiency, early awakening, and delayed sleep onset (see Appendix 7.1).[1-4] Insomnia is the most common form of sleep disturbance following TBI, characterized by problems with sleep initiation and/or sleep maintenance that can lead to increases in daytime sleepiness and fatigue.[3,4] Although the research shows a discrepancy between subjective sleep complaints and objective evidence of sleep disturbance, this is a common finding in the insomnia literature in general, and the largest studies on the topic do report finding objective evidence of sleep disturbance following mTBI.[2] Recent findings also suggest that patients may experience circadian rhythm sleep disorders, specifically delayed sleep phase syndrome and irregular sleep-wake pattern. Patients experiencing sleep disturbance after mTBI commonly find these symptoms to interfere with mood, mental capacities, social or leisure activities, or principal occupation.[5] It has also been suggested that sleep disturbance among this population may be associated with impairment on neuropsychological testing.[6,7] As is the case with many persistent symptoms following mTBI, while sleep disturbances can be secondary to other symptoms such as depression or anxiety, they often exacerbate poor attention, memory, and learning capabilities.[5,8-10] Management strategies should take this potential interaction of symptoms into account.

Treatment of sleep disorders within the mTBI population has taken the form of both non-pharmacologic and pharmacologic methods. CBT (cognitive behavioural therapy) is recommended for insomnia and emotional well-being, 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.[11,12] 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 of sleep restriction and stimulus control can still be implemented by primary care providers with weekly monitoring of the patient for the first few weeks (Appendix 7.5).[2,13,14] Other indications for referral include 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.

Melatonin has been found to benefit patients with insomnia, issues with daytime alertness, and circadian rhythm difficulties.[2,10,14] However, there is limited data about the effect of sleep medications on patients with neurological impairment, and more controlled trials are needed. [2,15] Caution is therefore recommended when prescribing sleep medications, and the aim should be to use medications that will improve sleep-wake patterns, not produce dependency or adverse side-effects.[16]

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 Disturbances 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 H for useful references regarding specific classes of medications and their impact on sleep.**
Co-morbid 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

RECOMMENDATIONS FOR ASSESSMENT OF PERSISTENT SLEEP/WAKE DISTURBANCES		
		GRADE
7.1	Every person with concussion/mTBI who has identified sleep problems should be screened for sleep/wake disturbances (e.g., insomnia, excessive daytime sleepiness; Appendix 7.2 and 7.3).	C
7.2	Screen for medical conditions, current medication use, comorbid psychopathology, and risk factors for sleep disturbances, which may influence the sleep/wake cycle (Table 7.1).	C
7.3	Refer for sleep specialist consultation, ideally with experience in assessing mTBI, and polysomnography (e.g., sleep study, Multiple Sleep Latency Test, Maintenance of Wakefulness Test) if sleep disturbances persist or if there is suspicion of sleep-related breathing disorders, nocturnal seizures, periodic limb movements, or narcolepsy.	C
RECOMMENDATIONS FOR TREATMENT OF PERSISTENT SLEEP/WAKE DISTURBANCES		
		GRADE
7.4	Treating sleep/wake disturbances may positively affect other persistent symptoms (e.g., mood, anxiety, pain, fatigue, cognitive problems). Sleep/wake disturbances should thus be assessed and managed even in the presence of other problems.	C
7.5	All patients with persistent sleep/wake complaints should be placed on a program of sleep hygiene in addition to other interventions (or as part of a program of cognitive-behavioural therapy). See Appendix 7.4 for a sleep hygiene program and Appendix 7.5 for behavioural recommendations for optimal sleep.	C
7.6	Cognitive-behavioural therapy (CBT) for insomnia is established as the treatment of choice for either primary insomnia or insomnia co-morbid to a medical or psychiatric condition.	B
7.7	If medications are to be used, then the aim should be to use medications that will not produce dependency and have minimal adverse effects for mTBI patients. The aim is to establish a more routine sleep pattern. Medications should be used on a short-term basis only. Medications that can be used include trazodone, mirtazapine, and tricyclic antidepressants (e.g., amitryptyline). Benzodiazapines should generally be avoided; however, newer non-benzodiazepine medications (e.g., zopiclone, eszopiclone) may have fewer adverse effects and may be considered for short-term use.	C
7.8	Other non-pharmacologic treatment options that have been found to be useful in the treatment of insomnia include: • Daily supplements of magnesium, melatonin, and zinc. • Consider other interventions such as acupuncture, exercise, and mindfulness-based stress reduction.	C

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	Other Useful Links/References for Resources to Consider	Appendix H
TABLES		
1	Important Components to Include in the Sleep/Wake Disturbances Screen	Table 7.1
ALGORITHMS		
1	Assessment and Management of Persistent Sleep/Wake Disturbances Following mTBI	Algorithm 7.1

References

1 Mathias JL, Alvaro PK. Prevalence of sleep disturbances, disorders, and problems following traumatic brain injury: A meta-analysis. *Sleep Medicine*. 2012;13:898-905.

2 Baumann, CR. Traumatic brain injury and disturbed sleep and wakefulness. *Neuromolecular Medicine*. 2012;14:205-212.

3 Wiseman-Hakes C, Colantonio A, Gargaro J. Sleep and wake disorders following traumatic brain injury: A systematic review of the literature. *Critical Reviews in Physical and Rehabilitation Medicine*. 2009;21(3-4):317-374.

4 Castriotta RJ, Wilde MC, Lai JM, Atanasov S, Masel BE, Kuna ST. Prevalence and consequences of sleep disorders in traumatic brain injury. *Journal of Clinical Sleep Medicine*. 2007;4:349–356.

5 Ouellet M-C, Beaulieu-Bonneau S, Morin CM. Insomnia in patients with traumatic brain injury: Frequency, characteristics, and risk factors. *Journal of Head Trauma Rehabilitation*. 2006;21:199-212.

6 Chaput G, Giguere JF, ChaunyJM, Denis R, Lavigne G. Relationship among subjective sleep complaints, headaches, and mood alterations following a mild traumatic brain injury. *Sleep Medicine*. 2009;10:713-716.

7 Wiseman-Hakes C, Murray BJ, Moineddin R, Rochon E, Cullen N, Gargaro J, Colantonio A. Evaluating the impact of treatment for trauma related sleep/ wake disorders on recovery of cognition and communication in adults with chronic TBI. *Brain Injury*. 2013. (*In Press*) doi: 10.3109/02699052.2013.823663.

8 Steele D, Ponsford J, Rajaratnam S, Redman J. Self-reported changes to night-time sleep following traumatic brain injury. *Archives of Physical Medicine and Rehabilitation*. 2006;87:278-285.

9 Parcell D, Ponsford JL, Redman JR, Rajaratnam SWM. Poor sleep quality and changes in objectively-recorded sleep after traumatic brain injury: A preliminary study. *Archives of Physical Medicine and Rehabilitation*. 2008;89:843-850.

10 Kempf J, Werth E, Kaiser PR, Bassetti CL, Baumann CR. Sleep-wake disturbances 3 years after traumatic brain injury. *Journal of Neurological and Neurosurgical Psychiatry*. 2010;81;1402-1405.

11 Ouellet MC, Morin, CM. Cognitive-behavioral therapy for the management of insomnia associated with traumatic brain injury: a case study. *Archives of Physical Medicine and Rehabilitation*. 2004;5:1298-1302.

12 Ouellet MC, Morin, CM. Efficacy of cognitive-behavioral therapy for insomnia associated with traumatic brain injury: A single-case experimental design. *Archives of Physical Medicine and Rehabilitation*. 2007;88:1581-1592.

13 Castriotta M. Sleep Disorders in patients with traumatic brain injury. *CNS Drugs*. 2011;25(3):175-185.

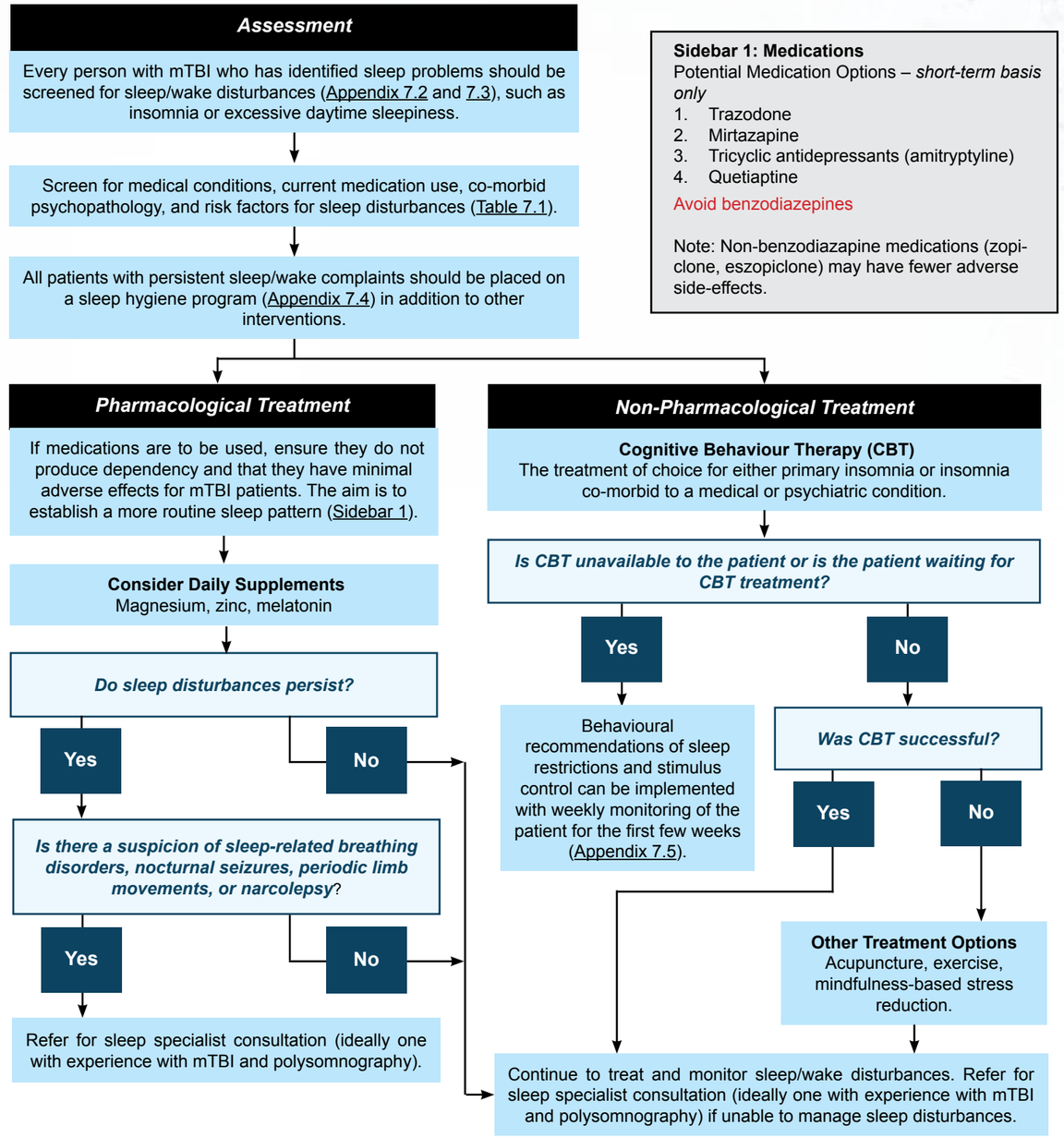
14 Espie CA, MacMahon KM, Kelly HL, Broomfield NM, Douglas NJ, Engleman HM, et al. Randomized clinical effectiveness trial of nurse-administered small-group cognitive behavior therapy for persistent insomnia in general practice. *Sleep*. 2007;30(5):574-584.

15 Larson EB, Zollman FS. The effect of sleep medications on cognitive recovery from traumatic brain injury. *Journal of Head Trauma Rehabilitation*. 2010;25(1):61-67.

16 Mollayeva T, Shapiro CM. Medication effects. *The Encyclopedia of Sleep*. 2013;2:330-337.

Algorithm 7.1

Assessment and Management of Persistent Sleep/Wake Disturbances Following mTBI



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

8 Persistent Mental Health Disorders

Special contributors: Scott McCullagh, Laura Rees, Diana Velikonja

Assessment

Early post-concussive symptoms following mTBI can include irritability, anxiety, emotional lability, depressed mood, and apathy. Thereafter a significant proportion of individuals may develop persistent mental health disorders, with major depression and anxiety disorders observed most frequently. Depressive disorders following TBI are commonly associated with increased irritability and often co-morbid with anxiety syndromes. The latter include generalized anxiety, panic attacks, phobic disorders, and post-traumatic stress disorder (PTSD). 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, given their frequency and potential to impede recovery in other symptom domains.[2] Pre-existing difficulties such as substance use disorders and poor psychosocial adjustment also place patients at risk for a slowed recovery.[3] Delays in returning to social and vocational roles can in turn produce demoralization and worsened emotional symptoms.[4]

The assessment of mental health disorders can be challenging, given the overlap in symptoms between mood and anxiety disorders, sleep disorders, pain syndromes, and other post-concussive cognitive difficulties. "Subthreshold" variants of certain conditions such as PTSD are also observed, in which a symptom cluster falls short of meeting formal diagnostic criteria yet contributes substantial morbidity. In general, it is recommended that DSM-V 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.[5,6] Potential contributing medical conditions should also be identified, such as anemia, thyroid dysfunction, B12 deficiency, and so forth. In situations of diagnostic uncertainty, a mental health referral should be sought.

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 (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; Appendix 8.4); and the CAGE questionnaire for substance use (i.e., alcohol; Appendix 8.5). Note, however, that these questionnaires have not been validated specifically with the mTBI population.

RECOMMENDATIONS FOR ASSESSMENT OF PERSISTENT MENTAL HEALTH DISORDERS		
		GRADE
8.1	Given their prevalence and potential impact, all patients with persistent symptoms following concussion/mTBI should be screened for mental health symptoms and disorders, including: • Depressive disorders (Appendix 8.1) • Anxiety disorders (Appendix 8.2), including post-traumatic stress disorder (PTSD) (Appendix 8.3 and 8.4) • Irritability and other personality changes • Substance use disorders (Appendix 8.5) • Somatoform disorders	C
8.2	The use of self-report questionnaires can aid in the assessment and monitoring of common mental health disorders.	C

RECOMMENDATIONS FOR ASSESSMENT OF PERSISTENT MENTAL HEALTH DISORDERS (CONTINUED)		
		GRADE
8.3	Referral to a psychiatrist/mental health team should be obtained if: • The presentation is complex and/or severe • The risk of suicide is judged significant • Initial treatment is not effective within two months • Failure of or contraindication to usual medication strategies • Presence of prominent/major risk factors known to potentially affect the course of recovery (Table 1.1)	C

Management

Treatment is warranted whenever symptoms impact on functional status or impede recovery. Once identified, appropriate psychological and/or pharmacological treatment should be initiated. Consultation with a psychiatrist or a mental health team may be sought, yet the initial steps of treatment should not be delayed. General measures can be initiated and symptoms such as headaches, sleep disturbance, dizziness, and co-morbid pain addressed. General measures include the provision of support, validation, and reassurance, as well as education regarding mTBI and positive expectations for recovery. Involvement of the family can be very helpful at this stage. Education about sleep hygiene and regular light exercise should be provided. The latter can improve mood, perceived fatigue, and well-being, and counteract deconditioning. See Algorithm 8.1, which outlines care pathways for mild to moderate and severe mental health disorders following mTBI.

Medication may be required for those with moderate to severe, persistent depressive or anxiety symptoms. Of note, patients with marked irritability or emotional lability (i.e., even in the absence of a clear-cut depression) may also benefit from pharmacotherapy. Selective serotonin reuptake inhibitors (SSRIs) are recommended as first-line treatments after mTBI, based upon their favourable side-effect profile and broader utility when compared to agents from other classes. A small clinical literature[6-8] supports the utility of SSRIs in treating depression, reducing anxiety and irritability, and, in some reports, improving cognition, somatic symptoms, and psychosocial function. The efficacy and tolerability of both sertraline (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.[6] Common clinical experience suggests that other agents (e.g., alternate SSRIs, venlafaxine, mirtazepine) may also be useful after mTBI, yet clinical data with these agents is lacking. There are no studies of medication treatment for PTSD in the setting of TBI, yet the use of sertraline, paroxetine , and venlafaxine, a serotonin-norepinephrine

Table 8.1 General Considerations Regarding Pharmacotherapy after 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 mTBI 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 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, Arcinigas DB, Yudosky SC. Psychopharmacology. In: Silver JM, Arciniegas DB, Yudovsky SC, eds. *Textbook of Traumatic Brain Injury*. Arlington, VA: American Psychiatric Publishing Inc;2005:609-640.

reuptake inhibitor (SNRI), is supported by high-quality evidence in the non-TBI population.[9] 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 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 after mTBI remains elevated at about 1.5 times the rate for the general population for 1-4 years after injury.[10] 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.[11] The use of benzodiazepines as first-line therapy for anxiety after mTBI is generally not recommended due to potential effects on arousal, cognition, and motor coordination.[12] 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.[13] Nonetheless, short-term use of these agents may be helpful during periods of crisis or acute distress.

Psychological interventions are critical in the management of primary mental health disorders and include supportive counselling and problem-solving strategies, as well as formal psychotherapies. Cognitive-behavioural therapy (CBT) refers to a combination of symptom-focused strategies aimed at improving emotional status and coping abilities by altering maladaptive thought patterns and behaviour. There is robust support for the efficacy of this treatment in a range of mental health disorders among patients without TBI (such as mood/anxiety disorders, PTSD, insomnia, fatigue, chronic pain, and excessive health anxiety/maladaptive illness behaviour). An emerging evidence base supports the use of this modality following mTBI, both to alleviate emotional distress and to manage post-concussive symptoms in general.[13,14] Psychotherapeutic approaches for mental health conditions other than CBT may also be quite appropriate after mTBI but have not been studied.

The decision to recommend psychological intervention will depend on factors such as patient preference and motivation, symptom severity and co-morbidity, skills and experience of the treating clinician, and the ease of access to such resources. Primary care physicians may be well-suited to provide supportive counselling, along with low-intensity interventions based on CBT principles.[15] For more difficult cases, such as moderate to severe depression or anxiety, persistent PTSD, or the presence of complex co-morbities, referral for specialist treatment should be sought. The latter presentations will likely also require pharmacotherapy.

Limited data address the length of time required for continuation therapy after resolution of mood and/or symptoms.[16] Nonetheless, 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 within psychological treatment approaches.

RECOMMENDATIONS FOR NON-PHARMACOLOGICAL TREATMENT OF PERSISTENT MENTAL HEALTH DISORDERS		
		GRADE
8.4	Treatment of emotional/behavioural symptoms following mTBI should be based upon individual factors, patient preference, and symptom severity and co-morbidity; it may include psychotherapeutic and/or pharmacological treatment modalities. See Algorithm 8.1 which outlines care pathways for different severities. a. Mild, moderate: consider management by a local health care provider, or referral to a psychologist or psychiatrist if unable to manage. b. Severe: consider referral to a psychologist or psychiatrist as required. [a]	C
8.5	While awaiting specialist referral, the initial steps of treatment should not be delayed, nor symptoms left unmanaged. General measures can be instituted and common symptoms such as headache, sleep disturbance, dizziness, and pain addressed in an ongoing manner.	C
8.6	Cognitive-behavioural therapy (CBT) has well-established efficacy for treatment of primary mood and anxiety disorders; as such, it may be appropriate in the treatment of mood and anxiety symptoms following mTBI.	A

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

RECOMMENDATIONS FOR PHARMACOLOGICAL TREATMENT OF PERSISTENT MENTAL HEALTH DISORDERS		
		GRADE
8.7	When prescribing any medication for patients who have sustained a mTBI, the following should be considered: a. Use caution when initiating pharmacologic interventions to minimize potential adverse effects on arousal, cognition, motivation, and motor coordination. b. Start at the lowest effective dose and titrate slowly upwards, based upon tolerability and clinical response. Allow adequate time and duration for drug trials. c. 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. d. Follow-up should occur at regular intervals: initially more frequently while increasing medication to monitor tolerability and efficacy. For more details regarding pharmacotherapy after mTBI, refer to Table 8.1. [a]	C
8.8	An SSRI is generally recommended as the first-line pharmacological treatment for mood and anxiety syndromes after 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.	A
8.9	After successful treatment of depression with an SSRI, the optimal duration of continuation/maintenance treatment remains inconclusive.	A
8.10	SSRIs are also recommended as first-line pharmacotherapy for PTSD after mTBI; the SNRI venlafaxine may be considered second-line. Both can improve the core symptom of re-experiencing, hyperarousal, and avoidance. Marked sleep disruption may require adjunctive treatment with trazodone, mirtazapine, 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)	Appendix 8.4
5	CAGE Questionnaire	Appendix 8.5
TABLES		
1	General Considerations Regarding Pharmacotherapy after mTBI	Table 8.1
2	Risk Factors Influencing Recovery Post mTBI	Table 1.1
ALGORITHMS		
1	Assessment and Management of Persistent Mental Health Disorders Following mTBI	Algorithm 8.1

References

1 Whelan-Goodinson R, Ponsford J, Johnston L, Grant F. Psychiatric disorders following traumatic brain injury: their nature and frequency. *Journal of Head Trauma Rehabilitation*. 2009;24:324-332.

2 Rapoport MJ, McCullagh S, Streiner D, Feinstein A. The clinical significance of major depression following mild traumatic brain injury. *Psychosomatics*. 2003;44:31-37.

3 Wood RLL. Understanding the 'miserable minority': A diasthesis-stress paradigm for post-concussional syndrome. *Brain Injury*. 2004;18:1135-1153.

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

4 Pagulayan KF, Hoffman JM, Temkin NR, Machamer JE, Dikmen SS. Functional limitations and depression after traumatic brain injury: examination of the temporal relationship. *Archives of Physical Medicine and Rehabilitation*. 2008;89:1887-1892.

5 Bombardier CH, Fann JR, Temkin N et al. Posttraumatic stress disorder symptoms during the first six months after traumatic brain injury. *Journal of Neuropsychiatry and Clinical Neurosciences*. 2006;18:501-508.

6 Silver JM, McAllister TW, Arciniegas DB. Depression and cognitive complaints following mild traumatic brain injury. *American Journal of Psychiatry*. 2009;166:653-661.

7 Rapoport MJ. Depression following traumatic brain injury: epidemiology, risk factors and management. *CNS Drugs*. 2012;26(2):111-121.

8 Warden DL, Gordon B, McAllister TW et al. (Neurobehavioral Guidelines Working Group). Guidelines for the pharmacologic treatment of neurobehavioral sequelae of traumatic brain injury. *Journal of Neurotrauma*. 2006;23:1468-1501.

9 Capehart B, Bass D. Review: managing posttraumatic stress disorder in combat veterans with comorbid traumatic brain injury. *Journal of Rehabilitation Research & Development*. 2012;49(5):789-812.

10 Annegers JF, Hauser WA, Coan SP, Rocca WA. A population-based study of seizures after traumatic brain injuries. *New England Journal of Medicine*. 1998;338:20-24.

11 McAllister TW. Psychopharmacological issues in the treatment of TBI and PTSD. *Clinical Neuropsychologist*. 2009;23:1338-1367.

12 Graham DP, Cardon AL. An update on substance use and treatment following traumatic brain injury. *Annals of the New York Academy of Sciences*. 2008;1141:148-162.

13 Al Sayegh A, Sandford D, Carson AJ. Psychological approaches to treatment of postconcussion syndrome: a systematic review. *Journal of Neurology, Neurosurgery and Psychiatry*. 2010;81(10):1128-1134.

14 Silverberg ND, Hallam BJ, Rose A, Underwood H, Whitfield K, Thornton AE, Whittal ML. Cognitive-behavioral prevention of postconcussion syndrome in at-risk patients: a pilot randomized controlled trial. *Journal of Head Trauma Rehabilitation*. 2013;28(4):313-322.

15 Espie CA, MacMahon KM, Kelly HL, Broomfield NM, Douglas NJ, Engleman HM, et al. Randomized clinical effectiveness trial of nurse-administered small-group cognitive behavior therapy for persistent insomnia in general practice. *Sleep*. 2007;30(5):574-584.

16 Rapoport MJ, Mitchell RA, McCullagh S, Herrmann N, Chan F, Kiss A, et al. A randomized controlled trial of antidepressant continuation for major depression following traumatic brain injury. *Journal of Clinical Psychiatry*. 2010;71(9):1125-1130.

Algorithm 8.1

Assessment and Management of Persistent Mental Health Disorders Following mTBI

Assessment

Assess for:
- Depressive disorders (Appendix 8.1)
- Anxiety disorders (Appendix 8.2)
  - Post-traumatic stress disorder (Appendix 8.3 and 8.4)
- Substance use disorders (Appendix 8.5)
- Other conditions that may require specific attention/management (refer to narrative in Section 8)

Based on the screening scales, determine the *severity* of any persistent mental health disorders.

If Mild/Moderate

Consider management by local health care provider.

Non-Pharmacological Treatment

General Measures:
- Support and psychoeducation re: proper sleep hygiene; regular social and physical activity

Psychosocial Interventions
Evidence-Based Psychotherapy:
- Cognitive-behavioural therapy (CBT); trauma-focused therapy for PTSD

Other Psychotherapy Interventions:
- Depending on availability

Was the treatment successful?

No

Pharmacological Treatment **

Anxiety/Mood Disorders
1st Line: SSRI
2nd Line: SNRI, mirtazepine, TCA

PTSD
1st Line: SSRI
2nd Line: SNRI (venlafaxine)

PTSD & Sleep Disruption
Trazadone, mirtazapine, prazosin

Was the treatment successful?

No → Referral to a psychologist or psychiatrist.

Yes → Monitor symptoms & continue therapy.

Yes

If Severe

Consider referral to a psychologist or psychiatrist as required.

Non-Pharmacological Treatment

General Measures
Psychosocial Interventions
Evidence-Based Psychotherapy:
- CBT; trauma-focused therapy for PTSD

Other Psychotherapy Interventions:
- Depending on availability

Pharmacological Treatment**

Anxiety/Mood Disorders
1st Line: SSRI
2nd Line: SNRI, mirtazepine, TCA

PTSD
1st Line: SSRI
2nd Line: SNRI (venlafaxine)

PTSD & Sleep Disruption
Trazadone, mirtazapine, prazosin

**** Medication Considerations**
- Use caution to minimize potential adverse effects
- Begin therapy at lowest effective dose and titrate based on tolerability and response
- <1 medication change at a time
- Regular follow ups are necessary

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

9 Persistent Cognitive Difficulties

Special contributor: Laura Rees

The presence and persistence of cognitive symptoms following mTBI can impact successful reintegration into work, academic, and social activities following such injuries.[1] mTBI is associated with disruptions in cognitive skills that include difficulties with attention/concentration, speed of information processing, memory, and aspects of executive cognitive skills.[2,3] In the acute phase of injury there are changes in cerebral metabolic activity and perfusion particularly in the frontal lobes associated with cognitive changes.[4,5] Generally, the expected recovery from cognitive-based symptoms following mTBI ranges from 1 week to 6 months, with more rapid rates of recovery found in young athletes.[6] However, a small percentage of individuals (5%-15%)[7] 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 or are related to the impact of a variety of additional factors that can influence cognitive functioning such as pain, fatigue, medications, sleep, pre-morbid personality factors, litigation, psychological factors and emotional disturbance (i.e., anxiety and depression).[7-11] 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.

Attempts should be made to document cognitive symptoms in order to characterize the nature of these symptoms and to track progress over time. When evidence for cognitive dysfunction is obtained with screening and does not resolve with treatment of potentially contributing factors or if cognitive symptoms persist at 3 months, practitioners should consider referral for neuropsychological assessment. Impairments 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. This combination has demonstrated reductions in the presence of persistent symptoms.[12]

RECOMMENDATIONS FOR ASSESSMENT OF PERSISTENT COGNITIVE DIFFICULTIES		
		GRADE
9.1	A patient sustaining a concussion/mTBI should be evaluated for cognitive difficulties using a focused clinical interview, in conjunction with a validated post-concussive questionnaire (Appendix 1.5) and cognition screening tool (Appendix 9.1).	C
9.2	Certain conditions can affect cognition, such as ADHD, learning disabilities, anxiety or mood disorders, pain, fatigue, sleep disturbance, neuroendocrine dysfunction, or substance abuse. These conditions can be co-morbid with mTBI and should be considered and evaluated as necessary.	C
9.3	*A patient experiencing reduced cognitive functioning in the first few days following injury, with education and support, should be expected, in the majority of cases, to have these symptoms resolve and pre-injury cognitive functioning return within days or up to three months.**	A
9.4	Patients who have cognitive symptoms that are not resolving and continue to interfere in daily functioning (e.g., school, work) should be considered for referral for neuropsychological assessment. The evaluation may assist in clarifying appropriate treatment options based on individual patient characteristics and conditions.	A

** THIS RECOMMENDATION IS DUPLICATED FROM SECTION 2 (SAME AS 2.4).*

There is good evidence that early education intervention is associated with a significant reduction in the persistence and misattribution of symptoms. 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 a 3- to 6-month time frame.[13,14] 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 provided by various practitioners within the area of mTBI as well as by self (e.g., OT, SLP, family physician, nursing staff, community therapists).

RECOMMENDATIONS FOR TREATMENT OF PERSISTENT COGNITIVE DIFFICULTIES		
		GRADE
9.5	Rehabilitation of cognitive impairments should be initiated if: a. The individual exhibits persisting cognitive impairments on formal evaluation, or b. The learning of compensatory strategies is necessary in order to facilitate the resumption of functional activities and work.	C
9.6	For cognitive sequelae following mTBI, the cognitive rehabilitation strategies that should be considered include compensatory strategies and remediation approaches.	A
9.7	If persisting cognitive deficits are identified by neuropsychologists or other health professionals, efforts should be made to inform employers or teachers of possible temporary accommodations to tasks or schedules (see Section 12) so as to avoid excessive anxiety related to cognitive difficulties and experiencing of repeated errors or setbacks in work or school.	C

RESOURCES		
APPENDICES		
1	Rivermead Post Concussion Symptoms Questionnaire	Appendix 1.5
2	Montreal Cognitive Assessment (MoCA)	Appendix 9.1

References

1 Vanderploeg RD, Curtiss G, Luis CA, Salazar AM. Long term morbidities following self-reported mild traumatic brain injury. *Journal of Clinical and Experimental Neuropsychology.* 2007;29:585-598.

2 Frenchman KA, Fox AM, Mayberry MT. Neuropsychological studies of mild traumatic brain injury: A meta-analytic review of research since 1995. *Journal of Clinical and Experimental Neuropsychology*. 2005;27:334-351.

3 Silver JM, McAllister TW, Arciniegas DB. Depression and cognitive complaints following mild traumatic brain injury. *The American Journal of Psychiatry*. 2009;166:653-661.

4 Metting Z, Rodiger L, Stewart R, Oudkerk M, DeKeyser J. Perfusion computed tomography in the acute phase of mild head injury: region dysfunction and prognostic value. *Annals of Neurology*. 2009;66:809-816.

5 Bartnik BL, Hovda DA, Lee PW (2007). Glucose metabolism after traumatic brain injury: Estimation of pyruvate carboxylase and pyruvate dehydrogenase flux by mass isotopomer analysis. *Journal of Neurotrauma*. 2007;24:181-194.

6 Iverson GL, Lange RT, Brooks, BL, Rennison VLA. “Good Old Days” bias following mild traumatic brain injury. *The Clinical Neuropsychologist*. 2010;24:17-37.

7 Beaupré M, De Guise E, McKerral M. The association between pain-related variables, emotional factors, and attentional functioning following mild traumatic brain injury. *Rehabilitation Research and Practice*. 2012. doi:10.1155/2012/924692.

8 Bigler ED. Neuropsychology and clinical neuroscience of persistent post-concussion syndrome. *Journal of the International Neuropsychology Society*. 2008;14:1-22.

9 Etherton JL, Bianchini KJ, Heinly MT, Greve KW. Pain, malingering, and performance on the WAIS-III Processing Speed Index. *Journal of Clinical and Experimental Neuropsychology*. 2006;28:1218-1237.

10 Wood RLL. Understanding the ‘miserable minority’: A diasthesis-stress paradigm for post-concussional syndrome. *Brain Injury*. 2004;18:1135-1153.

11 Mittenberg W, Strauman S. Diagnosis of mild head injury and postconcussion syndrome. *Journal of Head Trauma Rehabilitation*. 2000;15:783-791.

12 Tiersky LA, Anselmi V, Johnston MV, Kurtyka J, Roosen E, Schwartz T, Deluca J. A trial of neuropsychologic rehabilitation in mild-spectrum traumatic brain injury. *Archives of Physical Medicine and Rehabilitation*. 2005;86:1565-1574.

13 Mittenberg W, Canyock EM, Condit D, Patton C. Treatment of post-concussion syndrome following mild head injury. *Clinical and Experimental Neuropsychology*. 2001;23:829-836.

14 Borg J, Holm L, Peloso PM, Cassidy JD, Carroll LJ, von Holst H, Paniak C, Yates D. Non-surgical intervention and cost for mild traumatic brain injury: Results of the WHO Collaborating Centre Task Force on Mild Traumatic Brain Injury. *Journal of Rehabilitation Medicine*. 2004;43:76-83.

10 Persistent Vestibular (Balance/ Dizziness) & Vision Dysfunction

Special contributors:
Angela Peddle (vision),
Jennifer Shea (vestibular)

Vestibular (Balance/Dizziness) Dysfunction

Persistent vertigo, dizziness, imbalance, and vision changes are common complaints post mTBI and are often associated with vestibular system impairments.[1,2] Vestibular deficits can be peripheral in origin, affecting the inner ear, or central, affecting central nervous system integration and output to maintain balance and posture. The peripheral vestibular organs also affect eye movement through the vestibulo-occular reflex (VOR). Thus, vestibular dysfunction presents as balance impairments and VOR abnormalities.

The most common cause of post-traumatic peripheral vestibular dysfunction is benign paroxysmal positional vertigo (BPPV).[3] Patients experience episodes of vertigo, nystagmus, and nausea with sudden changes in position, often including rolling over in bed or looking up. These attacks usually last less than 30 seconds, but can be quite disabling and occur multiple times per day. BPPV is most commonly caused by dislodged otoconia in the posterior semicircular canal (SCC).

Assessment of vestibular function is important following mTBI to identify vestibular deficits, which may benefit from evidence-based interventions. Evaluation should minimally include a balance screen, the Dix-Hallpike manoeuvre and VOR screening. Balance testing should reference normal values to document impairment (see Figure 10.1).[4,5]

Table 10.1 Important Components to Include in the Neurological Exam

Vision	• Acuity • Tracking • Saccades • Nystagmus • Vergence
Auditory	• Hearing screen • Otoscopic exam
Sensory	• Sharp • Light tough • Proprioception • Vibration
Motor	• Power • Coordination
Vestibular	• Dynamic activity • Positional testing
Functional Activities	Sitting and standing • Romberg with eyes open/closed • Single leg stance Balance Transfers • Supine ↔ sit • Sit ↔ stand Gait • Walking • Tandem walking • Turning

When the history suggests BPPV, posterior SCC involvement can be diagnosed by the Dix-Hallpike manoeuvre (see Appendix 10.1 for more information and Appendix H for links to video demonstrations). VOR abnormalities will often present as nystagmus in one or more directions of gaze. When assessment suggests vestibular dysfunction, vestibular interventions can be considered. Although, historically, medications have been used to suppress vestibular symptoms, including nausea, current evidence does not support this approach. A Cochrane review by Hillier and Hollohan (2007) identifies vestibular rehabilitation (VR) as an effective intervention for unilateral peripheral vestibular dysfunction.[1] Weaker evidence also suggests VR may be helpful for central vestibular dysfunction.[6] VR is typically provided by a specialized physiotherapist 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 VR techniques.[1]

Figure 10.1 Clinical Assessment of Balance

Instructions

The 10 Second Balance Screen:

Age 49 and Under: Ask the subject to stand on one leg, arms free to move. He or she can choose which leg to stand on and are allowed to alternate between legs in between trials. Patients perform the tests with eyes closed. A subject who requests help to assume a testing position is allowed to use the investigator's arm to steady him- or herself prior to starting the timed trials. No instructions are given regarding the subject's knee position. Timing starts when the subject assumes the proper position and indicates that he or she is ready to begin the test. Timing stops when the subject disengages from the starting position or reaches the 30-second time limit. The best of three trials is taken for the result.

Age 69 and Under: Ask the subject to stand with one foot just in front of the other with arms free to move (Tandem Romberg). He or she can choose which leg to be in front and can change position in between trials. Patients perform the tests with eyes closed. A subject who requests help to assume a testing position is allowed to use the investigator's arm to steady him- or herself prior to starting the timed trials. Timing starts when the subject assumes the proper position and indicates that he or she is ready to begin the test. Timing stops when the subject disengages from the starting position or reaches the 30-second time limit. The best of three trials is taken for the result.

Age 70 and Older: Ask the subject to stand on one leg, arms free to move. He or she can choose which leg to stand on and is allowed to alternate between legs in between trials. Patients perform the tests with eyes open. A subject who requests help to assume a testing position is allowed to use the investigator's arm to steady him- or herself prior to starting the timed trials. No instructions are given regarding the subject's knee position or visual fixation. Timing starts when the subject assumes the proper position and indicates that he or she is ready to begin the test. Timing stops when the subject disengages from the starting position or reaches the 30-second time limit. The best of three trials is taken for the result.

Any test score of 10 seconds or less suggests balance impairment.

Normative Data

Decade	Mean	SD	Median	Perc 05	Interquartile range	Perc 95	Valid N	% 30 s	% 10 s
One leg standing (eyes open)									
3	30.00	.00	30.00	30.00	30.00 - 30.00	30.00	N = 74	100	100
4	30.00	.00	30.00	30.00	30.00 - 30.00	30.00	N = 43	100	100
5	29.64	2.06	30.00	25.91	30.00 - 30.00	30.00	N = 32	97	100
6	30.00	.00	30.00	30.00	30.00 - 30.00	30.00	N = 30	100	100
7	27.74	5.25	30.00	11.59	30.00 - 30.00	30.00	N = 56	80	95
8	21.43	10.08	26.33	2.05	13.04 - 30.00	30.00	N = 56	48	86
One leg standing (eyes closed)									
3	27.52	6.45	30.00	9.45	30.00 - 30.00	30.00	N = 74	86	96
4	27.48	6.48	30.00	8.46	30.00 - 30.00	30.00	N = 43	86	95
5	21.77	9.09	24.75	3.94	10.90 - 30.00	30.00	N = 31	45	90
6	19.92	9.81	20.90	3.78	10.55 - 30.00	30.00	N = 29	38	79
7	8.93	7.54	5.66	1.61	3.32 - 12.13	28.33	N = 56	4	34
8	4.87	3.46	3.93	1.18	2.87 - 6.03	11.78	N = 56	0	5
Tandem Romberg (eyes closed)									
3	29.94	.43	30.00	30.00	30.00 - 30.00	30.00	N = 58	98	100
4	30.00	.00	30.00	30.00	30.00 - 30.00	30.00	N = 42	100	100
5	28.82	4.66	30.00	11.46	30.00 - 30.00	30.00	N = 32	94	97
6	28.03	4.87	30.00	13.57	29.70 - 30.00	30.00	N = 28	82	100
7	17.96	10.33	16.50	4.18	7.66 - 30.00	30.00	N = 56	36	64
8	13.20	9.50	11.26	2.27	4.68 - 18.74	30.00	N = 56	16	54

Cut-Off It is recommended that a 10-second time limit per decade is used to delineate poor performance.

RECOMMENDATIONS FOR PERSISTENT VESTIBULAR (BALANCE/DIZZINESS) DYSFUNCTION		
		GRADE
10.1	Evaluation should include a thorough neurologic examination that emphasizes vision, vestibular, balance and coordination, and hearing. See Table 10.1 for specific exam details. [a]	C
10.2	If symptoms of benign positional vertigo are present, the Dix-Hallpike manoeuvre (see Appendix 10.1) should be used for assessment.	A
10.3	A canalith repositioning manoeuvre (Appendix 10.1) should be used to treat benign positional vertigo if the Dix-Hallpike manoeuvre is positive.	A
10.4	For persons with functional balance impairments and screening positive on a balance measure, consideration for further balance assessment and treatment by a qualified health care professional may be warranted pending clinical course.	C
10.5	Vestibular rehabilitation therapy is recommended for unilateral peripheral vestibular dysfunction.	A

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

RECOMMENDATIONS FOR PERSISTENT VESTIBULAR (BALANCE/DIZZINESS) DYSFUNCTION (CONTINUED)		
		GRADE
10.6	When the patient identifies a problem with hearing the following steps should be followed: 1. Perform an otologic examination. 2. Review medications for ototoxicity. 3. Refer to audiology for hearing assessment if no other apparent cause is found. [a]	C
10.7	When the patient identifies a problem with nausea the following steps should be followed: 1. Define triggers and patterns of nausea and conduct appropriate investigations as required. 2. Assess medication list for agents that may cause or worsen GI symptoms. 3. Perform oropharyngeal examination. 4. Assess vision and vestibular/balance systems. [a]	C

Vision Dysfunction

Patients presenting with vision disorders post-TBI may display anomalies of visual acuity, accommodation, version movements, vergence movements, photosensitivity, visual field integrity and ocular health–collectively termed post-trauma vision syndrome (PTVS; Table 10.2).[7-9] Practitioners should take a detailed history of any persistent vision symptoms and perform examinations to detect potentially unrecognized visual deficits or take note of the specific type of visual disorder the patient is experiencing.[8,10] Mild TBI patients with advanced ocular health changes and complex strabismic anomalies should be referred to a neuro-ophthalmologist.[11-13] Otherwise, patients who experience changes in accommodation, version or vergence movements, photosensitivity, and visual field integrity are amenable to rehabilitative techniques rendered by qualified optometrists.[8,10,11] See Table 10.3.

There is some current evidence that optometric vision rehabilitation can be an important modality in the rehabilitation of these patients in certain situations.[7,8,10,14] It should therefore be offered as a possible option for the treatment and management of persistent vision disorders. Treatment may include rehabilitative interventions such as vision therapy, reading spectacles, prism spectacles, and/or tinted spectacles.[8,12,14]

Table 10.2 Post-Trauma Vision Syndrome (PTVS) Definitions

Accommodation: The ability to clearly focus the lens of the eye for clear near vision. This ability is gradually lost with increased age (45 yrs +) as a result of loss of elasticity of the lens and its surrounding muscles.
Version Movements: The movement of both eyes in the same direction – easily tested by following a near target in an "H" pattern about 40 cm from the patient.
Vergence Movements: Convergence and divergence eye movements, which enable accurate depth perception. Supra- and infra-vergence relate to the vertical fusional movements of the eyes.

Table 10.3 Common Visual Symptoms and Associated Visual Deficits

Symptom	Possible Visual Deficit
Blurry vision	Accommodative dysfunction
Reading comprehension or efficiency problems	Version eye movement deficits or visual perceptual processing deficits
Diplopia	Vergence eye movement deficits
Eyestrain/headaches	Accommodative or vergence dysfunction
Sensitivity to light/glare	Abnormal light-dark adaptation, photosensitivity
Dizziness	Impaired vestibular-ocular reflex and motion perception
Spatial deficits	Impaired visual field or visual processing deficits

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

RECOMMENDATIONS FOR PERSISTENT VISION DYSFUNCTION		
		GRADE
10.8	Take an appropriate case history, including questions on visual blur, scanning/reading ability, light sensitivity, diplopia, eyestrain, motion sensitivity, and spatial deficits (indicating loss of visual field integrity). See Table 10.2 for a detailed description of symptoms and their related vision dysfunction.	C
10.9	Perform tests of visual acuity, extra-ocular motility, vergence, visual fields, pupils, and fundoscopy. See Appendix 10.2 for an explanation of screening techniques.	C
10.10	Other functional vision changes should be given consideration for referral to a qualified optometrist specializing in neuro-optometric rehabilitation for vision therapy.	B

RESOURCES		
APPENDICES		
1	Dix-Hallpike Manoeuvre and Particle Repositioning Manoeuvre (PRM)	Appendix 10.1
2	Screening Techniques for Vision Dysfunction	Appendix 10.2
TABLES		
1	Important Components to Include in the Neurological Exam	Table 10.1
2	Post-Trauma Vision Syndrome (PTVS) Definitions	Table 10.2
3	Common Visual Symptoms and Associated Visual Deficits	Table 10.3
FIGURES		
1	Clinical Assessment of Balance	Figure 10.1

References

1 Hillier SL, Hollohan V. Vestibular Rehabilitation for unilateral peripheral vestibular dysfunction. Cochrane Database of Systematic Reviews Library. 2007; Issue 4, Art. No.: CD005397. DOI:10.1002/14651858.CD005397.pub2.

2 Maskell F, Chiarelli P, Isles R. Dizziness after traumatic brain injury: overview and measurement in the clinical setting. *Brain Injury*. 2006; 20:293-305.

3 Parnes LS, Agrawal SK, Atlas J. Diagnosis and management of benign paroxysmal positional vertigo (BPPV). *Canadian Medical Association Journal*. 2003;169:681-693.

4 Iverson GL, Kaarto ML, Koehle MS. Normative data for the balance error scoring system: implications for brain injury evaluations. *Brain Injury*. 2008;22:147-152.

5 Vereeck L, Wuyts F, Truijen S, Van de Heyning P. Clinical assessment of balance: normative data, and gender and age effects. *International Journal of Audiology*. 2008;47:67-75.

6 Hansson EE, Mansson NO & Hakansson A. Effects of specific rehabilitation for dizziness among patients in primary health care. A randomized controlled trial. *Clinical Rehabilitation*. 2004;18:558-565.

7 Green W, Ciuffreda KJ, Thiagarajam P, Szymanowicz D, Ludlam DP, Kapoor N. Accomodation in mild traumatic brain injury. *Journal of Rehabilitative Research & Development*. 2010;47(3):183-200.

8 Fox RS. The rehabilitation of vergence and accomodative dysfunctions in traumatic brain injury. *Brain Injury Professional*. 2005;2(3):12-15.

9 Ciuffreda KJ, Rutner, D, Kapoor N, Suchoff IB, Craig S, Han ME. Vision therapy for oculomotor dysfunctions in acquired brain injury: A retrospective analysis. *Optometry*. 2008;79:18-22.

10 Cohen AH. The role of optometry in the management of vestibular disorders. *Brain Injury Professional*. 2005;2(3):8-10.

11 Rutner D, Kapoor N, Ciuffreda KJ, Craig S, Han ME, Suchoff IB. Occurrence of ocular disease in traumatic brain injury in a selected sample: A retrospective analysis. *Brain Injury*. 2006;20(10):1079-1086.

12 Hillier CG. Vision rehabilitation following acquired brain injury: A case series. *Brain Injury Professional*. 2005;2(3):30-32.

13 Kapoor N, Ciuffreda KJ. Vision disturbances following traumatic brain injury. *Current Treatment Options in Neurology*. 2002;4:271-280.

14 Ciuffreda KJ, Suchoff IB, Marrone MA, Ahman E. Oculomotor rehabilitation in traumatic brain-injured patients. *Journal of Behavioural Optometry*. 1995;7:31-38.

11 Persistent Fatigue

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 is one of the most pervasive symptoms following mTBI, and it can actually be out of proportion to exertion or may even occur without any exertion.[1] In a recent study, participants reported a level of fatigue comparable to that of individuals with multiple sclerosis, which is known for clinically significant disease-related fatigue levels.[2] Fatigue is multidimensional and can affect physical, cognitive, motivational, psychological, and subjective aspects.[3] Patients can experience poorer problem-solving and coping skills, which increases stress, depression, and fatigue, and creates an ongoing cycle that contributes to disability.[2] 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.[4] 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.[3,4]

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 significant other to corroborate. A review of the relevant items from the Rivermead Post Concussion Symptoms Questionnaire (Appendix 1.5) and/or a specific measure of fatigue, such as the Barrow Neurological Institute (BNI) Fatigue Scale[5] (Appendix 11.1), can assist with this.

Post-mTBI fatigue can be persistent and has been shown to still be present up to five years post-injury.[3] Those who experience fatigue at three months post-injury are increasingly likely to continue to experience fatigue beyond six months post-injury.[6] Because certain medications can cause fatigue, the practitioner should also review the patient's medication use. 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 causes other symptoms to worsen, early intervention is required in order to prevent interference with the patient's ability to participate in rehabilitation therapies.[3,7] Patients should also be provided with advice on how to cope with fatigue (Appendix 11.3), such as general stress management techniques.[3] If debilitating fatigue persists, consider referral to a brain injury specialist or rehabilitation program.

RECOMMENDATIONS FOR ASSESSMENT AND MANAGEMENT OF PERSISTENT FATIGUE		
		GRADE
11.1	Determine whether fatigue is a significant symptom by taking a focused history and reviewing the relevant items from administered questionnaires (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	If identified as a significant symptom, some key considerations that may aid in the management of persistent fatigue can include: • Aiming for a gradual increase in activity levels that will parallel improvement in energy levels. • Reinforce that pacing activities across the day will help patients to achieve more and to avoid 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

Table 11.1 Fatigue: Assessment & Management Factors for Consideration

Characteristics	• Frequency • Intensity • Time of day • Aggravating factors
Assessment	• Focused history • Physical examination • Barrow Neurological Institute (BNI) Fatigue Scale to assess fatigue (Appendix 11.1) • Consider blood test screening if appropriate (CBC, TSH, electrolytes)
Secondary Causes of Fatigue	• Affective disorder, including depression, anxiety • Sleep disorder post-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
TABLES		
1	Fatigue: Assessment & Management Factors for Consideration	Table 11.1

References

1 Dijkers MPJM, Bushnik T. Assessing fatigue after traumatic brain injury: An evaluation of the Barroso Fatigue Scale. *Journal of Head Trauma Rehabilitation*. 2008;23:3-16.

2 Juengst S, Skidmore E, Arenth PM, Niyonkuru C, Raina K. Unique Ccontribution of fatigue to disability in community-dwelling adults with traumatic brain injury. *American Congress of Rehabilitation Medicine*. 2013;94:74-79.

2 Cantor JB, Ashman T, Gordon W et al. Fatigue after traumatic brain injury and its impact on participation and quality of life. *Journal of Head Trauma Rehabilitation*. 2008;23:41-51.

3 Bay E, de Leon M. Chronic stress and fatigue-related quality of life after mild to moderate traumatic brain injury. *Journal of Head Trauma Rehabilitation*. 2011;26(5):355-363.

4 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.

5 Krupp LB, Larocca NG, Muir-Nash J, et al. The Fatigue Severity Scale: application to patients with Multiple Sclerosis and Systemic Lupus Erythematosus. *Archives of Neurology*. 1989;46:1121-1123

6 Norrie J, Heitger M, Leathem J, Anderson T, Jones R, Flett R. Mild traumatic brain injury and fatigue: A prospective longitudinal study. *Brain Injury*. 2010; 24(13-14): 1528-1538.

12 Return-to-Activity/Work/School Considerations

Special contributors: Carol DeMatteo, Maureen Palmer, Mary Stergiou-Kita, Jane Storrie, Irene Sullivan, Carson Vanderwel, Diana Velikonja, Catherine Wiseman-Hakes

General Considerations Regarding Rest & Return to Activity

The majority of individuals (estimates range from 73-88%) who experience a concussion/mTBI are able to return to their principal occupation within a year of the injury.[1-4] Nevertheless, even when individuals return to work, school, or other pre-injury activities, they may still be experiencing symptoms, and resumption of these activities can be complicated and stressful. Patients who present to the Emergency Department or a health care provider's office following mTBI should have a period of rest to facilitate a prompt recovery; however, there are divergent opinions amongst researchers and health care professionals on the exact nature and duration of the rest period that is most beneficial for recovery.[5] Some evidence suggests that symptoms can be worsened by inactivity; thus, an initial period of minimal physical and mental exertion is recommended, with gradual resumption of pre-injury activities as soon as tolerated (with the exception of activities with high mTBI exposure risk).[5-8] In other words, while napping/graded rest may be useful during graduated return to activity, the idea of complete bed rest should be avoided.[5]

While the importance of physical rest has been stressed in the past, cognitive rest is an equally important consideration when returning to activity following mTBI.[9,10] Patients should be advised as to what cognitive rest is, in addition to physical rest, as the cognitive load of activities is not intuitive and can negatively impact symptom resolution. Suggestions to reduce physical and cognitive load include time off from work or school, no reading, no visually stimulating activities (e.g., computer or cell phone use, watching TV), no exercise or exertion, increased rest and sleep, and decreased social interactions that are highly demanding.[11] When planning return to activity, the patient's tolerance threshold for both cognitive and physical activity should also be considered. For example, while fatigue or other symptoms may be mildly elevated due to the activity, the temporarily increased symptoms should not incapacitate the patient or lead to decreased functioning the following day.

GENERAL CONSIDERATIONS REGARDING REST & RETURN TO ACTIVITY		
		GRADE
12.1	Immediately following any concussion/mTBI, individuals who present with and/or report post-injury symptoms should have a period of rest to facilitate a prompt recovery and should be provided with recommendations to avoid activities that would increase their risk for sustaining another concussion. This is particularly important during the recovery period. [a]	C
12.2	Bed rest exceeding 3 days is not recommended.	C
☆ 12.3	Individuals with mTBI should be encouraged to gradually return to normal activity (work, physical, school, duty, leisure) based upon their tolerance. [a]	A
12.4	If a person's normal activity involves significant physical activity, exertion testing can be conducted that includes stressing the body (e.g., graded treadmill exercise test). If exertion testing results in a return of symptoms, a monitored progressive return to normal activity as tolerated should be recommended. [a]	C
12.5*	*Low-level exercise for those who are slow to recover may be of benefit, although the optimal timing following injury for initiation of this treatment is currently unknown. However, 1 month post-injury has been proposed.*[5]	C

** THIS RECOMMENDATION IS DUPLICATED FROM SECTION 5 (SAME AS 5.6).*

Return-to-Work Considerations

When interviewed about work-related expectations and experiences following mild to moderate TBI, a group of workers in the UK reported that some of the important issues they faced were the invisibility of their injury, continuing symptoms affecting their ability to do their job, and lack of advice and guidance on returning to work. In addition, return-to-work support systems were considered to be poorly coordinated and managed.[12] This is not so surprising given that research on the management of return to work following mTBI is limited. Although management strategies have not been specifically studied, there is evidence regarding predictors and factors influencing the outcome of return to one's principal occupation. Factors associated with poor functional outcomes are shown in Table 12.1. When evaluating and managing a patient's ability to return to principal occupation, the practitioner should take these factors into consideration.

Table 12.1. Factors Associated with Poor Functional Outcomes

- Dizziness[13]
- Number of symptoms reported at follow-up[14]
- Post-traumatic stress[14,15]
- Cognitive impairments on tests of memory and executive functioning[16]
- Reduced social interaction (compared to pre-injury)[17]
- Financial compensation-seeking[18]
- Loss of consciousness[19]
- Pre-existing mental health difficulties (i.e., anxiety, depression, mania, psychotic symptoms)[19]
- Lower pre-morbid intelligence/cognitive ability[19]
- Pre-injury work history (i.e., prior work stability, earnings)[20]

Upon completion of the evaluation process, conclusions and recommendations should include whether the individual being evaluated is capable of attempting to return to a specific job at a particular workplace, and whether relevant supports, accommodations, or compensatory strategies are needed. Alternatively, for those individuals who continue to experience symptoms at the time of their return to principal occupation or who experience difficulty upon their return, modified job duties or alternative jobs or occupations may be more suitable. The evaluator should provide feedback, through written report to the individual being evaluated and relevant stakeholders, as per the consents established. Prescription of guidance should also take into consideration contextual work-related factors such as number of hours per work day/shift, opportunity for rest breaks, shift times (morning/afternoon/evening), pace of work, nature of work tasks (cognitive or physical, routine or variable, responsibility, support from supervisors or colleagues, operation of machinery), productivity demands, work environment (exposure to light, noise), and transport to and from work.

An assessment of an individual's psychosocial status is imperative to understanding his/her work abilities and ensuring that appropriate supports are instituted to facilitate success.[21] Studies show that mTBI can cause reorganization of a person's psychosocial identities, affecting his/her ability to perform. 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 mTBI may worsen due to poor job performance.[22] It is also important to note that mTBI impacts executive functions, affecting skills such as multitasking, prioritization, organization, prospective memory, and time management.[22] Variables that may be modified in order to improve return to work outcome include hours worked in the course of a day, shift, or week; intensity, quantity, or nature of tasks; and increased rest breaks. It is important to note that attempting to return to work prematurely can shift the focus away from the crucial first three to six months of rehabilitation

RETURN-TO-WORK CONSIDERATIONS: VOCATIONAL SCREENING		
		GRADE
12.6	In instances where there is high risk for injury/re-injury and/or there is a possibility that the individual may not be able to safely and competently complete specific work-related tasks and duties, a more in-depth assessment of symptoms should be conducted and necessary accommodations and work restrictions identified. [a]	C
12.7	Individually based work restriction should apply if: • There is a work-specific task that cannot be safely or competently completed based on symptoms • The work/duty environment cannot be adapted to the patient's symptom-based limitation • The deficits cannot be accommodated • Symptoms recur Examples of vocational modifications include: • Modification of the length of the work day • Gradual work re-entry (e.g., starting at 2 days/week and expanding to 3 days/week) • Additional time for task completion • Change of job • Environmental modifications (e.g., quieter work environment, enhanced level of supervision) [a]	C

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

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

and recovery effort, potentially resulting in long-term consequences on the patient's overall functions and employability.[22] See Algorithm 12.1, which outlines the key steps for managing return to work following mTBI. Readers interested in more thorough guidance on return to work following mTBI should consult the latest *Guideline for Vocational Evaluation following Traumatic Brain Injury: A Systematic and Evidence-based Approach.*[21]

RETURN-TO-WORK CONSIDERATIONS: VOCATIONAL EVALUATION		
		GRADE
12.8	Individuals who continue to experience persistent impairments following mTBI, or those who have not successfully resumed pre-injury work duties following injury, should be referred for a fuller in-depth vocational evaluation by clinical specialists and teams (e.g., occupational therapist, vocational rehabilitation counsellor, occupational medicine physician, neuropsychologist, speech language pathologist) with expertise in assessing and treating concussion/mTBI. This evaluation should include an assessment of the person, occupational and job demands, work environment, environmental supports, and facilitators and barriers to successful work/return to work (see Appendix 12.1).	**B**
RETURN-TO-WORK CONSIDERATIONS: COMMUNITY RE-INTEGRATION & FUTURE VOCATIONAL PLANNING		
		GRADE
12.9	A referral to a structured program that promotes community integration (e.g., volunteer work) may also be considered for individuals with persistent post-concussive symptoms that impede return to pre-injury participation in customary roles. [a]	**B**

RESOURCES	
APPENDICES	
1 Components of the Vocational Evaluation following mTBI	Appendix 12.1
TABLES	
1 Factors Associated with Poor Functional Outcomes	Table 12.1
ALGORITHMS	
1 Return-to-Work Considerations	Algorithm 12.1

Return-to-School (Post-Secondary) Considerations

There has been an increasing appreciation of the impact that 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 mTBI symptoms and affect recovery time from these injuries.[23] This has led to the development of specific academic management strategies for students who have sustained an 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 mTBI symptoms are exacerbated.[24] Many individuals who sustain mTBI injuries are students who require integration into elementary, secondary, or post-secondary institutions. Following an 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 school personnel on the symptoms and strategies for reintegration. It is recommended that the management strategies that are implemented should be highly individualized in the context of these guidelines because the manifestation of mTBI symptoms and their impact upon the student are as variable as is their recovery.[23,25-29] Contacting the school registrar immediately following mTBI is also important, even if symptoms are short-lived, to make sure that the student has as much support as possible.

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

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

and concessions that can be provided, which limits the applicability of the aforementioned guidelines. The following post-concussive 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 mTBI and/or have sustained an 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 mTBI.

Students, professors/instructors, and appropriate administrators may also require education regarding 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 persistent symptoms following mTBI.

ADDITIONAL RETURN-TO-SCHOOL (POST-SECONDARY) CONSIDERATIONS		
		GRADE
12.10	*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, cognitive screen, post-concussive symptom assessment, and review of mental health (see Table 1.2).**	**A**
12.11	If symptomatic within the first 72 hours, the student should refrain from attending school and from participating in all academic activities, including apprenticeship, practicum, and shop-related activities, in order to support cognitive rest and facilitate recovery.	**C**
12.12	If asymptomatic within the first 72 hours, the student can attend school but should not undergo evaluations (tests/exams) or should write with accommodations (such as separate space/breaks). The student should also be monitored for the emergence of potential symptoms.	**C**
12.13	After 72 hours post-injury, the individualized profile of the student's symptoms should be considered: • If the student is symptom-free, then he/she should go back to academic and/or program-related activities gradually as tolerated, as long as he/she remains asymptomatic. • If still experiencing symptoms after 72 hours post-injury, the student should refrain from attending academic and/or program-related activities for one full week. The health care provider (with permission) should also notify student services or the special needs department that a concussion has occurred (see Appendix 12.2) and that the student will require time off, and may require accommodations and support for reintegration.	**C**
12.14	If symptoms are still functionally debilitating at one week post-injury, the student should refrain from attending academic and/or program-related activities for another week. The health care provider should notify student services or the special needs department that the student is still symptomatic and accommodations and support for reintegration will be required.	**C**
12.15	After two weeks following an mTBI, the student should start attending school (non-physical activities) very gradually as tolerated and with accommodations, even if he/she is still experiencing symptoms. Student services or the special needs department should be identified to notify teachers/professors to subsequently monitor progress with the student and adjust the return-to-school plan, as necessary.	**C**
12.16	If reintegration into school is ineffective or unproductive at 4 weeks (i.e., symptoms plateau/continue to get worse), consider the following: • Greater Accommodations: 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 him/her 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 his/her grades and program participation.	**C**

** THIS RECOMMENDATION IS DUPLICATED FROM SECTION 1 (SAME AS 1.2).*

RESOURCES		
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 Persistent Symptoms following mTBI	Appendix 12.3
4	Managing Your Return to Post-Secondary Activities: Package Template and Activity Log	Appendix 12.4
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

References

1 Dikmen SS, Temkin NR, Machamer JE et al. Employment following traumatic head injuries. *Archives of Neurology*. 1994;51:177-186.

2 Nolin P, Heroux L. Relations Among Sociodemographic, Neurologic, Clinical, and Neuropsychologic Variables, and Vocational Status Following Mild Traumatic Brain Injury. A Follow-up Study. *Journal of Head Trauma Rehabilitation*. 2006;21:514-526.

3 Stambrook M, Moore AD, Peters LC, Deviaene C, Hawryluk GA. Effects of mild, moderate and severe closed head injury on long-term vocational status. *Brain Injury*. 1990;4:183-190.

4 Van der Naalt J, van Zomeren AH, Sluiter WJ, Minderhound JM. One year outcome in mild to moderate head injury: the predictive value of acute injury characteristics related to complaints and return to work. *Journal of Neurology, Neurosurgery and Psychiatry*. 1999;66:207-213.

5 Silverberg ND, Iverson GL. Is rest after concussion "the best medicine?": Recommendations for activity resumption following concussion in athletes, civilians, and military service members. *Journal of Head Trauma Rehabilitatio*n. 2013;28(4):250-259.

6 The Management of Concussion/mTBI Working Group. VA/DoD clinical practice guideline for management of concussion/ mild traumatic brain injury (mTBI). Vol 2010. Washington, DC:Department of Veterans Affairs and Department of Defense; 2009.

7 Willer B, Leddy JJ. Management of concussion and postconcussion syndrome. *Current Treatment Options in Neurology*. 2006;8:415–426.

8 Snell DL, Surgenor LJ, Hay-Smith EJ, Siegert RJ. A systematic review of psychological treatments for mild traumatic brain injury: an update on the evidence. *Journal of Clinical and Experimental Neuropsychology*. 2009;31:20–38.

9 Motor Accidents Authority New SouthWales. Guidelines for mild traumatic brain injury following closed head injury. Sydney, Australia: Motor Accidents Authority; 2008.

10 Valovich McLeod TC, Gioia GA. Cognitive rest: the often neglected aspect of concussion management. *Athletic Therapy Today*. 2010;15:1–3.

11 Moser RS, Schatz P. A case for mental and physical rest in youth sports concussion: it's never too late. *Frontiers in Neurology*. December 2012. Vol. 3, Article 171.

12 Gilworth G, Eyres S, Carey A, Bhakta B, Tennant A. Working with a brain injury: Personal experiences of returning to work following a mild or moderate brain injury. *Journal of Rehabilitation Medicine*. 2008;40:334-339.

13 Chamelian L, Feinstein A. Outcome after mild to moderate traumatic brain injury: the role of dizziness. *Archives of Physical Medicine and Rehabilitation*. 2004;85:1662-1666.

14 Nolin P, Heroux L. Relations among sociodemographic, neurologic, clinical, and neuropsychologic variables, and vocational status following mild traumatic brain injury. A follow-up study. *Journal of Head Trauma Rehabilitation*. 2006;21:514-526.

15 Friedland JF, Dawson DR. Function after motor vehicle accidents: a prospective study of mild head injury and posttraumatic stress. *The Journal of Nervous and Mental Disease*. 2001;189:426-434.

16 Drake AI, Gray N, Yoder S, Pramuka M, Llewellyn M. Factors predicting return to work following mild traumatic brain injury: A discriminant analysis. J*ournal of Head Trauma Rehabilitation*. 2000;15:1103-1112.

17 Ruffolo CF, Friedland JF, Dawson DR, Colantonio A, Lindsay PH. Mild traumatic brain injury from motor vehicle accidents: Factors associated with return to work. *Archives of Physical Medicine and Rehabilitation*. 1999;80:392-398.

18 Reynolds S, Paniak C, Toller-Lobe G, Nagy J. A longitudinal study of compensation-seeking and return to work in a treated mild traumatic brain injury sample. *Journal of Head Trauma Rehabilitation*. 2003;18:139-147.

19 Vanderploeg RD, Curtiss G, Duchnick J, Luis CA. Demographic, medical, and psychiatric factors in work and marital status after mild head injury. *Journal of Head Trauma Rehabilitation*. 2003;18:148-163.

20 Machamer J, Temkin N, Fraser R, Doctor JN, Dikment S. Stability of employment after traumatic brain injury. Journal of the International Neuropsychological Society. 2005;11:807-816.

21 Stergiou-Kita M. A guideline for vocational evaluation following traumatic brain injury: A systematic and evidence-based approach. Toronto: Graduate Department of Rehabilitation Science, University of Toronto; 2011.

22 Dodson, Matthew B. A model to guide the rehabilitation of high-functioning employees after mild brain injury. Journal of Prevention Assessment and Rehabilitation. 2010;36(4):449-457.

23 McGrath N. Supporting the student-athlete's return to the classroom after a sport-related concussion. Journal of Athletic Training. 2010;45(5):492-498. doi: 10.4085/1062-6050-45.5.492.

24 Sady MD, Vaughan CG, Gioia GA. School and the concussed youth: Recommendations for concussion education and management. Physical Medicine and Rehabilitation. 2011;22:701-719.

25 Gioia GA, Collins MW, Isquith PK. Improving identification and diagnosis of mild TBI with evidence: Psychometric support for the Acute Concussion Evaluation (ACE). Journal of Head Trauma Rehabilitation. 2008;23:230-242.

26 Wehman P, Targett P. Returning to school after TBI. Traumatic Brain Injury Model System Consumer Information. 2010. http://www.msktc.org/tbi/model-system-centers.

27 DeMatteo CA, Hanna SE, Mahoney WJ, Hollenberg RD, Scott LA, Law MC, Newman A, Lin CY, Xu L. My child doesn't have a brain injury, he only has a concussion. Pediatrics. 2010;125(7):327-335.

28 Gioia GA. Pediatric assessment and management of concussions. Pediatric Annals. 2012;41(5):198-203. doi: 10.3928/00904481-20120426-10.

29 U.S. Department of Health and Human Services Centers for Disease Control and Prevention. Returning to school after a concussion: A fact sheet for school professionals. http://www.cdc.gov/Concussion

Algorithm 12.1

Return-to-Work Considerations

< 72 Hours

- Immediate period of rest to prompt recovery.
- Avoid activities that increase the risk for another mTBI.
- No bed rest exceeding 3 days.

> 72 Hours

Gradual return to activity as tolerated.

Do the patient's normal work activities involve significant physical demands?

No → ***Is there a high risk of injury/re-injury or any other safety concerns regarding work?***

No → ***Return to work as tolerated.***

Is the individual experiencing persistent symptoms or is he/she unable to successfully resume pre-injury work duties?

No → Continue to monitor progressive return to work.

Yes → Consider referral to a structured program that promotes community integration (e.g., volunteer work).

Yes → Refer to specialists for in-depth vocational evaluation (Appendix 12.1) involving:

- Assessment of person
- Occupational and job demands
- Work environment
- Environmental supports
- Facilitators and barriers to successful return

Does the evaluation by specialists determine that return to work is possible?

Yes → Monitored progressive return to work is recommended.

- Low-level exercise may be of benefit.

A more in-depth assessment of symptoms and necessary work accommodations and restrictions should be identified (Sidebar 1).

Yes → Exertion testing can be done (e.g., graduated treadmill exercise test).

Does this cause a return of symptoms?

No → ***Return to work as tolerated.***

Yes → Monitored progressive return to work is recommended.

- Low-level exercise may be of benefit.

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

Evaluation by a primary care provider.

During the first 72 hours, is the student symptomatic?

No → Resume academic activities with accommodations but no tests. Continue monitoring symptoms.

Yes → No academic activity.

After 72 hours, is the student symptomatic?

No → Gradually resume academic activities under individualized plan unless symptoms return.

If symptoms return, reduce or stop academic activity.

Yes → One week: no academic activity.

Notify student services/special needs department that an mTBI has occurred (Appendix 12.2)

Are the student's symptoms still debilitating at 1 week post-injury?

No → Gradually resume academic activities under individualized plan unless symptoms return.

If symptoms return, reduce or stop academic activity.

Yes → Second week: no academic activity.

Communicate to student services/special needs department that the student is still symptomatic and will require support for re-integration.

Are the student's symptoms still debilitating at 2 weeks post-injury?

No → Gradually resume academic activities under individualized plan unless symptoms return.

If symptoms return, reduce or stop academic activity.

Yes → Start attending school (non-physical activities) very gradually and with accommodations.

Is re-integration ineffective (symptoms plateau or worsen) at 4 weeks post-injury?

No → Continue attending academic activities very gradually and monitor progress.

Yes →

- Greater Accommodations (Appendix 12.3)
- Move the student's courses to audit status
- Review whether the student should continue in their program for that semester

Throughout student assessment:
Symptoms of anxiety and/or depression should be monitored in students with persistent symptoms following mTBI.

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 process[1] 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 mTBI Project Team identified there was a need for evidence-based treatment guidelines for the assessment and management of symptoms persisting after mTBI. Although some guidance for the acute care of mild injuries is available, the mTBI project team identified the specific area of persistent symptoms as a priority, due to a lack of guidance for health care 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 health care providers.

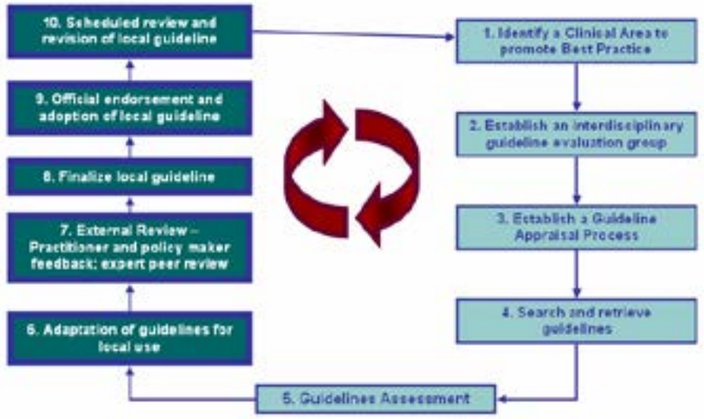


Figure A. Practice Guidelines Evaluation and Adaptation Cycle*

Establishment of the Expert Consensus Group

In the current update, the mTBI expert consensus group (Appendix A) was expanded to ensure greater representation of (1) the various health care professions servicing the mTBI patient population, (2) domain of expertise, and (3) geographic location. In regard to health care professions, a wide range of disciplines including emergency medicine, family medicine, sports medicine, neurology, physical medicine and rehabilitation, optometry, radiology, psychiatry, psychology, physical therapy, chiropractics, speech-language pathology, 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 the International Brain Injury Association, as well as consumers who had experienced persistent symptoms following 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 mTBI, quality of life, and outcomes or knowledge translation took part in the consensus group. In terms of the variety of injuries associated with mTBI, individuals with expertise in sports-related, motor vehicle accident, 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

Building upon the review conducted for the First Edition, a new search (2008 – June 2012) for existing clinical practice guidelines addressing mTBI and a systematic review of the literature evaluating treatment of persistent symptoms were conducted. First, a comprehensive search for existing clinical practice guidelines (CPGs) published in English between 2008 and 2012 that were relevant to TBI and included recommendations for the care of individuals with mild injuries was

* 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.

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 50 websites 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. In addition, articles related to mTBI were further reviewed for citations of CPGs addressing mTBI. Documents obtained via the search were excluded from further review if they: (1) were more than four years old, (2) did not address mTBI, (3) were found to be reviews only and did not include practice recommendations, (4) only addressed pre-hospital and/or acute care, or (5) only addressed pediatric care.

Two reviewers independently compiled a list of all guidelines they found related to mTBI. After applying the exclusion criteria, they considered 24 relevant documents containing recommendations. A third reviewer was consulted to finalize the list, from which 9 CPGs remained. Although released after the comprehensive search for guidelines was conducted, two additional CPGs for the management of sport-related concussion were also considered in the current guideline update, given their relevance to our target population: Concussion in Sport Group, 2013; and American Academy of Neurology, 2013.

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

Abbreviation	Group	Guideline Title	Year
AAN	American Academy of Neurology	Evaluation and Management of Concussion in Sport	2013
ACSM	American College of Sports Medicine	Concussion (Mild Traumatic Brain Injury) and the Team Physician: A Consensus Statement	2011
AANN/ARN	American Association of Neuroscience Nurses/Association of Rehabilitation Nurses	Care of the Patient with Mild Trauamtic Brain Injury	2011
CIS*	Concussion in Sport Group	Consensus Statement on Concussion in Sport: the 4th International Conference on Concussion in Sport, Zurich 2012	2013
NSW	NSW Ministry of Health	Adult Trauma Clinical Practice Guidelines: Initial Management of Closed Head Injury in Adults: 2nd Edition	2011
SIGN	Scottish Intercollegiate Guidelines Network	Early Management of Patients with a Head Injury: A National Clinical Guideline	2009
Silverberg	Silverberg & Iverson	Recommendations for Activity Resumption Following Concussion in Athletes, Civilians, and Military Service Members	2012
Stergiou-Kita	Stergiou-Kita, Dawson & Rappolt	A Guideline for Vocational Evaluation Following Traumatic Brain Injury: A Systematic and Evidence-Based Approach	2011
VA/DoD	Department of Veteran Affairs/ Department of Defense	Clinical Practice Guideline: Management of Concussion/Mild Trauamtic Brain Injury	2008
WSIB	Workplace Safety and Insurance Board of Ontario	Mild Traumatic Brain Injury Program of Care	2012

*NoteL The Summary and Agreement Statement of the 3rd International Conference on Concussion in Sport, Zurich 2008 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 4th International Conference on Concussion in Sport, Zurich 2012.

Next, an extensive search of the literature was conducted to capture all published research evaluating the effectiveness of treatments or interventions intended to manage persistent symptoms following 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, head injury, traumatic brain injury, and concussion. 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.

Results were included for further review if they were published in English and if at least 50% of the sample was composed of patients with mild injuries/persistent symptoms following mTBI. Efforts were made to identify results applicable specifically to mTBI, recognizing that much of the literature did not totally separate out severity of TBI; for analyses that were not stratified by TBI severity, it is assumed that interventions would be applicable across mTBI and other similar/related diagnoses. 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. Also, studies examining only acute symptoms (i.e., not persistent) resulting from mTBI, non-systematic review papers (i.e., narrative reviews), clinical review papers, 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): One reviewer screened through all of the article titles, following which two reviewers independently screened through the abstracts of those that remained. A third reviewer was consulted during the abstract and article screening stages to resolve any discrepancies between the original two reviewers’ decisions. The number of results obtained through the MEDLINE search was 16,092. After screening the titles and eliminating those which did not meet criteria (e.g., animal models, pediatrics, moderate-to-severe brain injury only), 554 results were retained. PubMed yielded 799 results, but only 37 were retained after screening by title. EMBASE yielded 5799 results, but only 75 results were retained after screening by title. PsycINFO yielded 2511 results, but only 69 were retained after screening by title. CINAHL yielded 1627 results, but only 73 were retained after screening by title. The Cochrane Library yielded 582 results, but only 31 were retained after screening by title. Figure B represents an overview of all of the articles screened at each step across all databases. In the end, 24 articles evaluating the effectiveness of treatments/interventions for persistent symptoms following mTBI were added to the evidence base for the current update (see Appendix G).

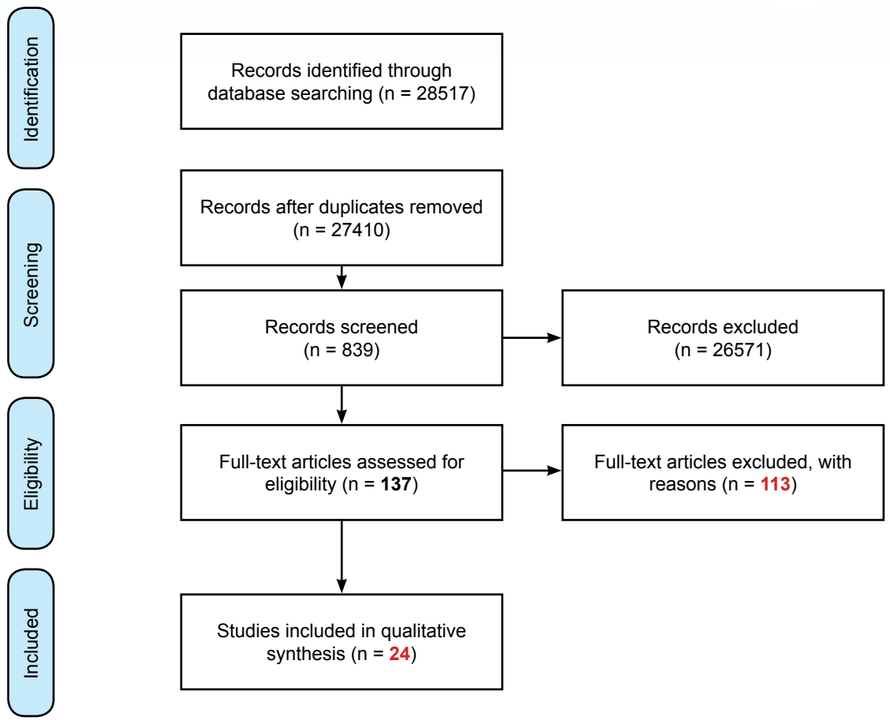


Figure B. PRISMA Flow Diagram:[2] Results from the Systematic Review of the Literature (2008 – June 2012) Evaluating Treatment of Persistent Symptoms.

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

Each TBI CPG that was retained (see Table E) was independently evaluated using the Appraisal of Guidelines for Research and Evaluation II instrument (AGREE II; www.agreetrust.org)[5] by at least four individuals from the expert consensus group. The AGREE II instrument assesses the quality of a CPG across 6 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 they would recommend use of the guideline. Each guideline was given 6 standardized domain scores ranging from 1-100 (100 representing a strong score) based on the ratings from the reviewing experts.

The Motor Accidents Authority of NSW, New Zealand Guidelines Group, and National Institute of Clinical Excellence CPGs consistently scored well across the various domains. One of the most important domains evaluated using the AGREE II tool is rigour of development, which evaluates characteristics such as whether systematic methods were used in the development process, the explicit link between recommendations and the supporting evidence, whether external review has taken place, etc. The scores obtained on this domain by the CPGs reviewed are presented in Figure C. Overall quality assessment results are available in Appendix E.

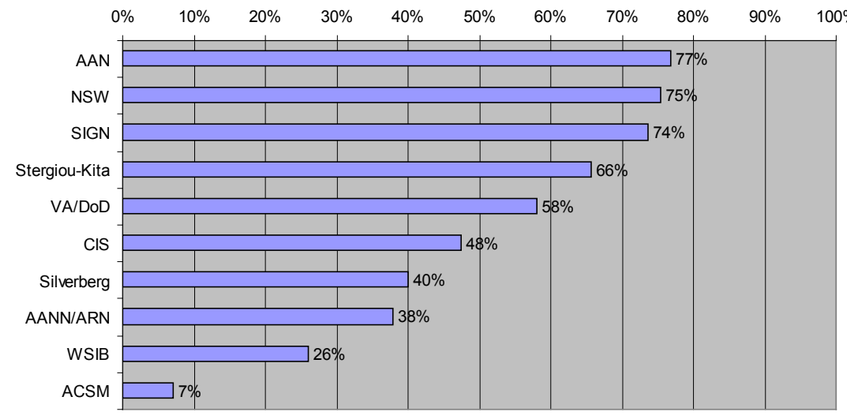


Figure C. AGREE Ratings for Rigour of Development Domain

Because the AGREE II instrument does not evaluate the clinical content of the recommendations made by each guideline, recommendations and their levels of evidence were extracted and organized into spreadsheets according to similarity with the guideline recommendations from the First Edition of the current guideline. These spreadsheets were created to simplify comparison of the specific recommendations on the same topic made by each existing guideline in terms of content and the level of evidence (see Appendix F, which outlines how information was organized in an example spreadsheet).

ii. Assessment of New Evidence

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

a. For randomized studies of health care interventions, the PEDro rating scale was used.[3]
b. For non-randomized studies of health care interventions, the Downs & Black rating scale was used.[4]
c. For systematic literature reviews/meta-analyses of health care interventions, the PRISMA rating checklist* was used.[2]

* Note: While there is currently no quality assessment instrument available for systematic reviews, we utilized the PRISMA checklist; however, it should be noted that the PRISMA statement cautions it was not developed as an assessment instrument to gauge the quality of a systematic review.

Scores from these rating scales were provided with the respective article summary to all experts before, during, and after the consensus conference in the same spreadsheets mentioned above under Assessment of Existing Guidelines. See Appendix G for the overall quality rating scores for all 24 articles that were added to the evidence base for the current update. Given that there were only 24 new articles, there were never two level A/B articles supporting the same recommendation; therefore, the project team never had to compare the methodological quality of two articles on the same topic. Thus, the quality assessments were conducted more so for transparency about the quality of evidence supporting our recommendations.

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., randomized controlled trials, systematic reviews) supporting many of the recommendations for the acute assessment and management of 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. The expert consensus panel for the current update was also expanded to increase consensus across the variety of symptoms commonly experienced following mTBI. However, recommendations for the management of persistent symptoms post-injury are primarily supported by expert consensus opinion, due to limited high-quality studies evaluating treatment for persistent symptoms following 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 mTBI. Further research is needed on the effectiveness of treatments or interventions intended to manage persistent symptoms following mTBI. Topic areas that require immediate attention include: persistent sleep/wake disturbances, vision dysfunction, and fatigue; post-traumatic headache; and return-to-activity/work/post-secondary school following mTBI.

Adaptation of Existing Recommendations and Development of Novel Recommendations

The expert consensus group convened for a one-day conference in November 2012 in Toronto, Ontario. Process information, data, and identified guideline recommendations for this meeting were available to consensus panel members in advance of the meeting through networking software (www.alfresco.com). All information (e.g., source documents, presentations, summary tables etc.) were directly available to all consensus panel members prior to, during and after the meeting. For the conference presentations, methodological factors critical to the development of evidence-based best practice care, AGREE II instrument scores, results of the systematic reviews of the literature, and the summary of recommendations and levels of evidence extracted from existing guidelines were provided. In addition, feedback received from various sources about the First Edition of the current guideline was also discussed.

The consensus group members broke out into four smaller groups, each given specific categories of recommendations to review matched (as much as possible) to their area of expertise. The groups worked to review the original guideline recommendations and update, when applicable, with recommendations extracted from other recent high-quality guidelines. Recommendations were also revised based on current evidence/consensus. New recommendations were generated by consensus based on current research and clinical expertise in areas of practice for which no guidance was available. For the final exercise of the conference, consensus members gathered to present working group findings and review any major suggested changes to the guideline (e.g., recommended deletions, additions, and major revisions).

Following the conference, comments, concerns, and suggested revisions to the updated guideline recommendations were gathered from consensus members in two 3-week feedback rounds using the Alfresco networking software. Following each round, the project team collated all revisions and comments before re-posting for the group. Following the consensus conference and post-conference feedback rounds, 137 updated guideline recommendations remained. The experts voted independently on these 137 recommendations using a modified Delphi voting technique[6] to narrow them down to the most important and relevant recommendations. Specifically, they were asked to endorse (keep vs. reject) those recommendations they supported including in the final guideline document. Experts were also asked to prioritize the top 20 most important recommendations for implementation. Specifically, experts were allowed to provide 4 priority votes for each of the 5 ranking categories (1 [high] to 5 [highest]) for a total of 20 prioritization votes. Guideline recommendations with a summed prioritization score greater than 20 are highlighted in the current guideline as key recommendations for implementation. This can help the treating health care provider with evaluation and implementation of the guideline recommendations because it can guide where and how efforts should be made to change practice, especially early on. See page 7 for the list of key guideline recommendations for implementation, which are also highlighted using a red helmet symbol throughout the full list of recommendations.

If a recommendation met at least one of the following criteria, it was retained: 1) based on level A evidence (see Table F); 2) received a minimum of 85% endorsement by the expert consensus group; or 3) represented an important care issue

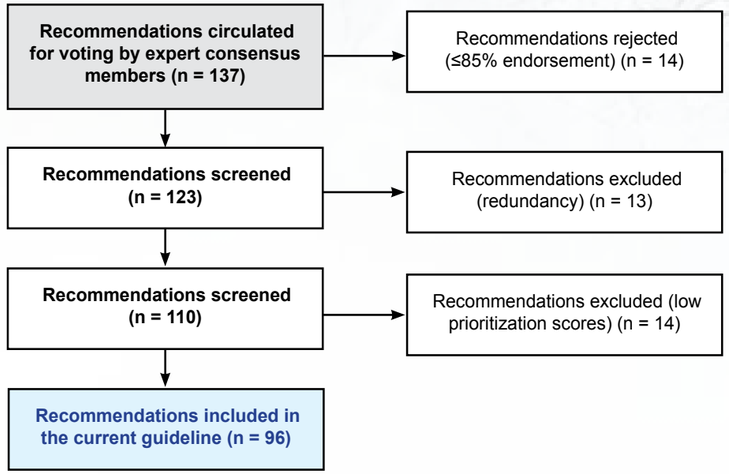


Figure D. Process Summary for Focusing Guideline Recommendations

(i.e., addressed a topic relevant to a large proportion of the mTBI population and clearly represented a current gap in treatment guidance). After application of these criteria, 123 recommendations remained. Based on comments received from experts during the voting process, the project team further reviewed this list and culled for redundancy, following which 110 guideline recommendations remained. The project team also reviewed the ranked list of recommendations according to the summed priority scores, in order to further reduce the number of recommendations to a more manageable list for health care providers. An additional 14 recommendations that received low priority scores were removed, resulting in a final total of 96 unique recommendations comprising the current guideline (see Figure D). It should also be noted that each section of recommendations in the current guideline has been written to stand alone to some extent; accordingly, 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 hyperlinked with the section where they were first mentioned to signal that they are not unique statements.

After identifying the recommendations to retain for the guideline, the project team reviewed them 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 that had been adapted from existing guidelines. Additional recommendations made by the expert consensus group that went beyond the original context have been referenced with the appropriate 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 F. It should be noted that scientific evidence (level A or B evidence) always superceded clinical opinion/expertise when revising the guideline recommendations.

Table F. 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.

It should also be noted that the project team piloted the Grading of Recommendations, Assessments, Development and Evidence (GRADE) scoring system as an alternative scoring scheme for the current guideline update. However, after piloting this scheme with the First Edition, the project team felt that the GRADE system would not provide benefit or clarity to the current guideline because it is more directed toward pharmaceutical intervention approaches and therefore highly subjective for all other types of evidence. Accordingly, the project team decided against adopting the GRADE system for the guideline update as it was not suitable for the body of evidence upon which the current guideline is based.

Evaluation of Resources/Indexing Tools

Before a draft of the guideline was sent out for external review, all expert members were also provided with an opportunity to evaluate a collection of 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) that were up for consideration in the current guideline. These resources were compiled during the search and retrieval of existing guidelines and new evidence, and were housed online through the networking software (www.alfresco.com). Expert members were also asked to indicate if any valuable resources and/or tools were missing from the collection. Resources that received positive feedback/approval were included and further evaluated by consensus members and external reviewers once the full draft was circulated. It should also be noted that the project team prioritized resources/tools that were non-proprietary.

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.

Pilot Implementation Phase

While the current update was beginning to take shape, another ONF-funded project simultaneously sought to evaluate the helpfulness and uptake of the First Edition of the current guidelines by sports medicine and military physicians. In order to accomplish this, educational forums using case examples of mTBI and persistent symptoms were developed in collaboration with participating sports and military physicians. The resulting 3-hour educational forums were offered twice in five Ontario communities and followed a pre-post test design to determine whether participating physicians changed their practice by piloting the First Edition of the current guidelines. Enablers and barriers during implementation were also identified.

The workshops were effective in increasing physicians' knowledge, as knowledge assessment scores were significantly different between pre-workshop scores and three-month follow-up scores ($p = .007$). The majority of participating physicians also reported increases in confidence in treating patients with mTBI. Following the workshop forums, more than half (51.2%) of physicians reported using the guidelines each time they treated a patient with a mTBI, and many more reported using the guidelines in certain circumstances (e.g., for more complicated cases). Other modifications and improvements suggested by the participating physicians have informed various improvements in the current update of the guideline, for example, additional information on return to activity (including work and school), hyperlinks, and a summarized (clinical) version. Notably, this project also broadened exposure and fostered formal linkages with military and sports medicine physicians.

It should also be noted that all expert consensus members were required to review the First Edition of the current guideline prior to attending the consensus conference in November, following which they were asked to complete an online questionnaire evaluating the content, structure, methodology, and usability of the First Edition. Comments/suggestions for improving the guideline, including presentation of recommendations and resources, were also welcomed. Feedback from this survey was collated for discussion at the consensus conference in November 2012 and considered in the current update of the 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 2016. 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 step-wise 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 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.

4 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.

5 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.

6 Linstone HA, Turoff M, eds. The Delphi Method. Techniques and Applications. Reading, MA: Wesley; 1975.

Methodology

Appendix 1.1

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

Acute Concussion Evaluation (ACE)
Physician/Clinician Office Version

Gerard Gioia, PhD[1] & Micky Collins, PhD[2]
[1]Children's National Medical Center
[2]University 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)**				
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)			_____			

Exertion: Do these symptoms worsen with:
Physical Activity __Yes __No __N/A
Cognitive Activity __Yes __No __N/A

Overall Rating: How different is the person acting compared to his/her usual self? (circle)
Normal 0 1 2 3 4 5 6 Very Different

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
						Sleep disorder
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____ Physiatrist____ Psychiatrist____ Other_____
___ Emergency Department

ACE Completed by:_____

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 premorbidly/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.[8-11]
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 Westmean 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: Time		T1	T2	T3	T4	T5
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	Spontaneously	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	☐	☐	☐	☐	☐
	Place	☐	☐	☐	☐	☐
	Why are you here	☐	☐	☐	☐	☐
	Month	☐	☐	☐	☐	☐
	Year	☐	☐	☐	☐	☐
	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**

** 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	SL	=	SLUGGISH
Size											C	=	CLOSED
Reaction											-	=	NIL

Comments

.....

.....

.....

.....

Pupil Size (mm)

2 3 4 5 6 7 8

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

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?'.

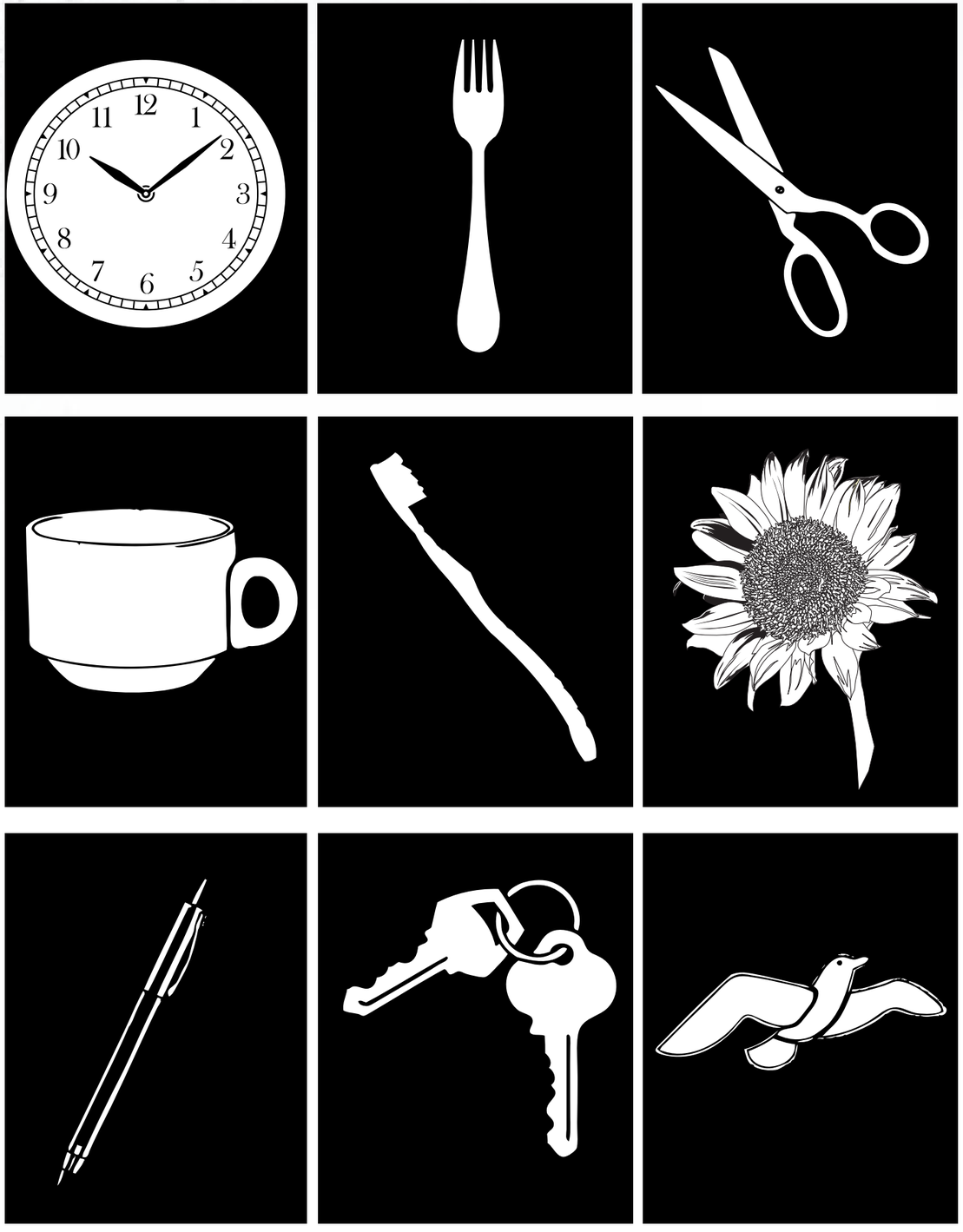
Question 5: WHAT YEAR ARE WE IN?
It is considered correct for patients to answer in the short form '08', instead of '2008'. Also, an acceptable alternative prompt (for the rest of the 2000's) is 'The year is 2000 and what?'

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 & Lammel (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 mild brain injury. 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, 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 your health care provider.

See your local doctor 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 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.

Post Concussion Symptoms

There are common symptoms after a mild brain injury. **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. 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 & 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.

» Balance problems

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 MildTraumatic 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

CDC SAFER·HEALTHIER·PEOPLE

American College of Emergency Physicians® ADVANCING EMERGENCY CARE

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. 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, 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 your health care provider.

See your local doctor 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 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 MildTraumatic 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.*

Taken with permission from the authors and the publisher.

Appendix 2.1

Specialized Brain Injury Clinics/Centres in Ontario

INSTITUTION	LOCATION AND CONTACT INFORMATION	SERVICES PROVIDED
Bridgepoint Health	**Mailing Address:** 14 St. Matthews Road Toronto, ON, M4M 2B5 Phone: 416-461-8252 Fax: 416-461-5696 **Information Contact:** Utilization Specialist, Neuro Rehab and Activation: ext. 2305; Case Manager, Day Treatment Extension: ext. 2371 **Website:** http://www.bridgepointhealth.ca/	In-patient active neuro-rehabiltation, Neuropsychology, Nursing, Occupational Therapy, Outpatient Rehabilitation, Physiotherapy, Social Work, Speech-Language Pathology
Hamilton Health Sciences: ABI Program	**Mailing Address:** Regional Rehabilitation Centre 300 Wellington Street North Hamilton, ON, L8L 8E7 Phone: 905-521-2100 ext. 74101 **Information Contact:** John Zsofcsin, Clinical Manager **Website:** http://www.hhsc.ca/body.cfm?xyzpdqabc=0&id=11&action=detail&ref=5	Behavioural, Cognitive, Communication, Community Reintegration, In-Patient Rehabilitation, Medical, Outpatient Rehabilitation, Physical, Psychological, Psychosocial, and Psychiatric components as necessary.
Hotel Dieu Grace Healthcare - Tayfour Campus ABI Outpatient Program, Rehabilitation Unit & Complex Care	**Mailing Address:** 1453 Prince Road Windsor,ON, N9C 3Z4 Phone: 519-257-5111 ext.75458 Fax: 519-257-5179 **Information Contact (for Brain Injury Clinical specifically):** Sara DeLuca (ext 72252) **Website:** http://www.hdgh.org	Inpatient rehabilitation, Outpatient rehabilitation, occupational therapy, social work, problem-solving group, neuropsychological assessment, acute concussion clinic, education and psychiatric consultation
Ottawa Hospital Rehabilitation Centre: ABI Program	**Mailing Address:** 505 Smyth Road Ottawa, ON, K1H 8M2 Phone: (613) 737-7350 Fax: (613) 733-8336 **Information Contact:** Admissions Triage Nurse for ABI Inpatient Program: ext. 75685; Nurse Clinician for ABI Outpatient Clinic: ext. 75406. **Website:** https://www.ottawahospital.on.ca/wps/portal/Base/TheHospital/ClinicalServices/DeptPgrmCS/Departments/RehabilitationCentre/OurProgramsAndServices/ABI	Anger Management, Behavioural Rehabilitation, Brain Injury Education, Cognitive Rehabilitation, Emotional Adjustment, Family Education, Financial Management, Hospital (In-Patient Rehab), Neuropsychological Assessment, Occupational Therapy, Outpatient Rehabilitation, Physiotherapy, Recreational Therapy, Social work, Stress Management, Vocational Preparation.

INSTITUTION	LOCATION AND CONTACT INFORMATION	SERVICES PROVIDED
Parkwood Hospital	**Mailing Address:** 801 Commissioners Road London, ON, N6C 5J1 Phone: 519-685-4000 ext. 44064 Fax: 516-685-4066 **Information Contact:** Omer Vandevyvere (Regional Co-ordinator): ext. 42988 or e-mail: omer.vandevyvere@sjhc.london.on.ca **Website:** http://www.sjhc.london.on.ca/rehabilitation	Cognitive Rehab, Community-based Outpatient Rehabilitation, Job Coaching, Job Placement Support, Neuropsychological Assessment, Nursing Care, Nursing Homes/ Long-term Care Facility, Nutritional, Occupational Therapy, Recreational Therapy, School Reintegration, Speech-Language Therapy
St. Joseph's Care Group: ABI Program	**Mailing Address:** St. Joseph's Hospital 35 Algoma Street North, Box 3251 Thunder Bay, ON, P7B 5G7 Phone: 807-343-2431 Fax: 807-343-0144 **Information Contact:** contact.sjcg@tbh.net **Website:** http://www.sjhh.guelph.on.ca/default.aspx	Community Outreach Services, Complex Continuing Care, Physiatry Services, Rehabilitation Services.
St. Mary's of the Lake Hospital: ABI Program	**Mailing Address:** 340 Union Street Kingston, ON, K7L 5A2 Phone: 613-544-5220 Fax: 613-544-8558 **Information Contact:** ABI Clinic Referrals - 613-544-1894 **Website:** http://www.pccchealth.org/cms/sitem.cfm/clinical_services/rehabilitation/physical_medicine_and_rehabilitation_clinics/	In-Patient Rehabilitation, Medical Assessment, Outpatient Rehabilitation, Regional Community Brain Injury Service, Referrals for treatment to therapists and other agencies as appropriate.
St. Michael's Hospital: Head Injury Clinic	**Mailing Address:** 30 Bond Street Toronto, ON, M5B 1W8 Phone: 416-864-5520 **Information Contact:** Alicja Michalak - Case Manager: 416-864-5520; Kristina Kennedy - Admin/Research: 416-864-6060 ext. 6359 **Website:** http://www.stmichaelshospital.com/programs/trauma/head-injury-clinic.php	Cognitive Services, Medical Services, Patient and Family Education and Support, Psychiatry Services, Psychosocial Services
(Sudbury) Health Sciences North	**Mailing Address:** 41 Ramsey Lake Road Sudbury, ON, P3E 5J1 Phone: 705-523-7100 **Information Contact:** Carol Di Salle (cdisalle@hsnsudbury.ca) **Website:** http://www.hsnsudbury.ca/portalen/	Aquatic Therapy, Case Management, Cognitive Rehab, Cognitive Therapy, Community Living Skills, Community Reintegration, Community-Based Outpatient Rehabilitation, Inpatient Rehabilitation, Occupational Therapy, Physiotherapy, Recreational Therapy, Social Work

INSTITUTION	LOCATION AND CONTACT INFORMATION	SERVICES PROVIDED
Sunnybrook Health Sciences Centre: Mild to Moderate TBI Clinic	**Mailing Address:** 2075 Bayview Avenue, Room FG15 North York, ON, M4N 3M5 Phone: 416-480-4095 Fax: 416-480-4613 **Information Contact:** Veronica Gershenzon (TBI Clinic Coordinator): veronica.gershenzon@sunnybrook.ca **Website:** http://sunnybrook.ca/content/?page=Focus_BSP_Home	Patients are seen within the first 3 months after injury. Brain Injury Education, Medical Services for Physical Symptoms, Neuropsychiatric Services for Cognitive, Emotional, or Behavioural Difficulties
Toronto Rehabilitation Institute	**Mailing Address:** 550 University Avenue Toronto, ON, M5G 2A2 Phone: 416 597 3422 Fax: 416 597 7021 **Information Contact:** Brain Injury Service Coordinators Neuro Cognitive - Carmen Volpe - Ext. 3593 Neuro Physical - Miranda Hong - Ext. 3441 Neuro Stroke - Isma Javed - Ext. 3618 **Website:** http://www.uhn.ca/TorontoRehab/PatientsFamilies/Clinics_Tests/Brain_Injury_Services	Behavioural Rehabilitation, Cognitive Rehabilitation, Inpatient Rehabilitation, Neuropsychological Assessment, Occupational Therapy, Outpatient Rehabilitation, Patient and Family Education, Recreational Therapy, Social Work, Speech-Language Therapy
Trillium Health Partners: Outpatient Neurorehab Services	**Mailing Address:** 100 Queensway West Mississauga, ON, L5B 1B8 Phone: 905-848-7100 **Information Contact:** 905-848-7533 **Website:** http://trilliumhealthpartners.ca/Pages/default.aspx	Nursing, Occupational Therapy, Physiotherapy, Speech Language Pathology, Social Work
University Health Network: Toronto Western Hospital	**Mailing Address:** 7th Floor, Main Pavilion 399 Bathurst Street Toronto, ON, M5T 2S8 Phone: 416-603-5801 **Information Contact:** Ms. Nithiya Paheerathan, (Administrative Assistant, ABI Clinic): 416-603-5009; nithiya.paheerathan@uhn.ca **Website:** http://www.uhn.ca/MCC/PatientsFamilies/Clinics_Tests/Acquired_Brain_Injury	Case Management, Neuropsychiatric Services, Patient and Family Support, Sleep Therapy.

Appendix 3.1

Sport Concussion Assessment Tool 3rd Edition (SCAT3)

SCAT3™

Sport Concussion Assessment Tool – 3rd Edition

For use by medical professionals only

Name Date/Time of Injury: Examiner:
Date of Assessment:

What is the SCAT3?[1]

The SCAT3 is a standardized tool for evaluating injured athletes for concussion and can be used in athletes aged from 13 years and older. It supersedes the original SCAT and the SCAT2 published in 2005 and 2009, respectively[2]. For younger persons, ages 12 and under, please use the Child SCAT3. The SCAT3 is designed for use by medical professionals. If you are not qualified, please use the Sport Concussion Recognition Tool[1]. Preseason baseline testing with the SCAT3 can be helpful for interpreting post-injury test scores.

Specific instructions for use of the SCAT3 are provided on page 3. If you are not familiar with the SCAT3, please read through these instructions carefully. This tool may be freely copied in its current form for distribution to individuals, teams, groups and organizations. Any revision or any reproduction in a digital form requires approval by the Concussion in Sport Group.

NOTE: The diagnosis of a concussion is a clinical judgment, ideally made by a medical professional. The SCAT3 should not be used solely to make, or exclude, the diagnosis of concussion in the absence of clinical judgement. An athlete may have a concussion even if their SCAT3 is "normal".

What is a concussion?

A concussion is a disturbance in brain function caused by a direct or indirect force to the head. It results in a variety of non-specific signs and/or symptoms (some examples listed below) and most often does not involve loss of consciousness. Concussion should be suspected in the presence of **any one or more** of the following:

- Symptoms (e.g., headache), or
- Physical signs (e.g., unsteadiness), or
- Impaired brain function (e.g. confusion) or
- Abnormal behaviour (e.g., change in personality).

SIDELINE ASSESSMENT

Indications for Emergency Management

NOTE: A hit to the head can sometimes be associated with a more serious brain injury. Any of the following warrants consideration of activating emergency procedures and urgent transportation to the nearest hospital:

- Glasgow Coma score less than 15
- Deteriorating mental status
- Potential spinal injury
- Progressive, worsening symptoms or new neurologic signs

Potential signs of concussion?

If any of the following signs are observed after a direct or indirect blow to the head, the athlete should stop participation, be evaluated by a medical professional and **should not be permitted to return to sport the same day** if a concussion is suspected.

Any loss of consciousness?	Y N
"If so, how long?"	
Balance or motor incoordination (stumbles, slow/laboured movements, etc.)?	Y N
Disorientation or confusion (inability to respond appropriately to questions)?	Y N
Loss of memory:	Y N
"If so, how long?"	
"Before or after the injury?"	
Blank or vacant look:	Y N
Visible facial injury in combination with any of the above:	Y N

1 Glasgow coma scale (GCS)

Best eye response (E)	
No eye opening	1
Eye opening in response to pain	2
Eye opening to speech	3
Eyes opening spontaneously	4
Best verbal response (V)	
No verbal response	1
Incomprehensible sounds	2
Inappropriate words	3
Confused	4
Oriented	5
Best motor response (M)	
No motor response	1
Extension to pain	2
Abnormal flexion to pain	3
Flexion/Withdrawal to pain	4
Localizes to pain	5
Obeys commands	6
Glasgow Coma score (E + V + M)	of 15

GCS should be recorded for all athletes in case of subsequent deterioration.

2 Maddocks Score[3]

"I am going to ask you a few questions, please listen carefully and give your best effort."

Modified Maddocks questions (1 point for each correct answer)

What venue are we at today?	0	1
Which half is it now?	0	1
Who scored last in this match?	0	1
What team did you play last week/game?	0	1
Did your team win the last game?	0	1
Maddocks score		of 5

Maddocks score is validated for sideline diagnosis of concussion only and is not used for serial testing.

Notes: Mechanism of Injury ("tell me what happened"?):

Any athlete with a suspected concussion should be REMOVED FROM PLAY, medically assessed, monitored for deterioration (i.e., should not be left alone) and should not drive a motor vehicle until cleared to do so by a medical professional. No athlete diagnosed with concussion should be returned to sports participation on the day of Injury.

McCrory P, Meeuwisse WH, Aubry M, Cantu B, Dvorák J, Echemendia RJ, 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.

BACKGROUND

Name: _____ Date: _____

Examiner: _____

Sport/team/school: _____ Date/time of injury: _____

Age: _____ Gender: ☐ M ☐ F

Years of education completed: _____

Dominant hand: ☐ right ☐ left ☐ neither

How many concussions do you think you have had in the past? _____

When was the most recent concussion? _____

How long was your recovery from the most recent concussion? _____

Have you ever been hospitalized or had medical imaging done for a head injury? ☐ Y ☐ N

Have you ever been diagnosed with headaches or migraines? ☐ Y ☐ N

Do you have a learning disability, dyslexia, ADD/ADHD? ☐ Y ☐ N

Have you ever been diagnosed with depression, anxiety or other psychiatric disorder? ☐ Y ☐ N

Has anyone in your family ever been diagnosed with any of these problems? ☐ Y ☐ N

Are you on any medications? If yes, please list: ☐ Y ☐ N

_____

SCAT3 to be done in resting state. Best done 10 or more minutes post excercise.

SYMPTOM EVALUATION

3 How do you feel?

"You should score yourself on the following symptoms, based on how you feel now".

	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
Trouble falling asleep	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

Total number of symptoms (Maximum possible 22) _____

Symptom severity score (Maximum possible 132) _____

Do the symptoms get worse with physical activity? ☐ Y ☐ N

Do the symptoms get worse with mental activity? ☐ Y ☐ N

☐ self rated ☐ self rated and clinician monitored

☐ clinician interview ☐ self rated with parent input

Overall rating: If you know the athlete well prior to the injury, how different is the athlete acting compared to his/her usual self?

Please circle one response:

no different	very different	unsure	N/A

Scoring on the SCAT3 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. Since signs and symptoms may evolve over time, it is important to consider repeat evaluation in the acute assessment of concussion.

COGNITIVE & PHYSICAL EVALUATION

4 Cognitive assessment

Standardized Assessment of Concussion (SAC)[4]

Orientation (1 point for each correct answer)

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

List	Trial 1		Trial 2		Trial 3		Alternative word list		
elbow	0	1	0	1	0	1	candle	baby	finger
apple	0	1	0	1	0	1	paper	monkey	penny
carpet	0	1	0	1	0	1	sugar	perfume	blanket
saddle	0	1	0	1	0	1	sandwich	sunset	lemon
bubble	0	1	0	1	0	1	wagon	iron	insect
Total									

Immediate memory score total of 15

Concentration: Digits Backward

List	Trial 1		Alternative digit list		
4-9-3	0	1	6-2-9	5-2-6	4-1-5
3-8-1-4	0	1	3-2-7-9	1-7-9-5	4-9-6-8
6-2-9-7-1	0	1	1-5-2-8-6	3-8-5-2-7	6-1-8-4-3
7-1-8-4-6-2	0	1	5-3-9-1-4-8	8-3-1-9-6-4	7-2-4-8-5-6
Total of 4					

Concentration: Month in Reverse Order (1 pt. for entire sequence correct)

Dec-Nov-Oct-Sept-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan	0	1
Concentration score		of 5

5 Neck Examination:

Range of motion Tenderness Upper and lower limb sensation & strength

Findings: _____

6 Balance examination

Do one or both of the following tests.

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

Modified Balance Error Scoring System (BESS) testing[5]

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

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

Condition

Double leg stance:	Errors
Single leg stance (non-dominant foot):	Errors
Tandem stance (non-dominant foot at back):	Errors

And / Or

Tandem gait[6,7]

Time (best of 4 trials): _____ seconds

7 Coordination examination

Upper limb coordination

Which arm was tested: ☐ Left ☐ Right

Coordination score of 1

8 SAC Delayed Recall[4]

Delayed recall score of 5

McCrory P, Meeuwisse WH, Aubry M, Cantu B, Dvorák J, Echemendia RJ, 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.

INSTRUCTIONS

Words in *Italics* throughout the SCAT3 are the instructions given to the athlete by the tester.

Symptom Scale

"You should score yourself on the following symptoms, based on how you feel now".

To be completed by the athlete. In situations where the symptom scale is being completed after exercise, it should still be done in a resting state, at least 10 minutes post exercise.

For total number of symptoms, maximum possible is 22.

For Symptom severity score, add all scores in table, maximum possible is 22 x 6 = 132.

SAC[4]

Immediate Memory

"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."

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."

Complete all 3 trials regardless of score on trial 1 & 2. Read the words at a rate of one per second. **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

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

If correct, go to next string length. If incorrect, read trial 2. **One point possible for each string length**. Stop after incorrect on both trials. 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 completion of the Balance and Coordination Examination.

"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

Balance Examination

Modified Balance Error Scoring System (BESS) testing[5]

This balance testing is based on a modified version of the Balance Error Scoring System (BESS)[5]. A stopwatch or watch with a second hand is required for this testing.

"I am now going to test your balance. Please take your shoes off, 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."

Balance testing – types of errors

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

Each of the 20-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the athlete. The examiner will begin counting errors only after the individual 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 total number of errors for any single condition is 10.** If a 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 subject is set. Subjects 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 50 cm x 40 cm x 6 cm).

Tandem Gait[6,7]

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 meter 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. A total of 4 trials are done and the best time is retained. Athletes should complete the test in 14 seconds. 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. In this case, the time is not recorded and the trial repeated, if appropriate.

Coordination Examination

Upper limb coordination

Finger-to-nose (FTN) task:

"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."

Scoring: 5 correct repetitions in < 4 seconds = 1

Note for testers: Athletes fail the test if they do not touch their nose, do not fully extend their elbow or do not perform five repetitions. **Failure should be scored as 0.**

References & Footnotes

1. This tool has been developed by a group of international experts at the 4th International Consensus meeting on Concussion in Sport held in Zurich, Switzerland in November 2012. The full details of the conference outcomes and the authors of the tool are published in The BJSM Injury Prevention and Health Protection, 2013, Volume 47, Issue 5. The outcome paper will also be simultaneously co-published in other leading biomedical journals with the copyright held by the Concussion in Sport Group, to allow unrestricted distribution, providing no alterations are made.

2. McCrory P et al., Consensus Statement on Concussion in Sport – the 3rd International Conference on Concussion in Sport held in Zurich, November 2008. British Journal of Sports Medicine 2009; 43: i76-89.

3. Maddocks, DL; Dicker, GD; Saling, MM. The assessment of orientation following concussion in athletes. Clinical Journal of Sport Medicine. 1995; 5(1): 32–3.

4. McCrea 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.

6. Schneiders, A.G., Sullivan, S.J., Gray, A., Hammond-Tooke, G. & McCrory, P. Normative values for 16-37 year old subjects for three clinical measures of motor performance used in the assessment of sports concussions. Journal of Science and Medicine in Sport. 2010; 13(2): 196–201.

7. Schneiders, A.G., Sullivan, S.J., Kvarnstrom. J.K., Olsson, M., Yden. T. & Marshall, S.W. The effect of footwear and sports-surface on dynamic neurological screening in sport-related concussion. Journal of Science and Medicine in Sport. 2010; 13(4): 382–386

McCrory P, Meeuwisse WH, Aubry M, Cantu B, Dvorák J, Echemendia RJ, 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.

ATHLETE INFORMATION

Any athlete suspected of having a concussion should be removed from play, and then 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:

- Have a headache that gets worse
- Are very drowsy or can't be awakened
- Can't recognize people or places
- Have repeated vomiting
- Behave unusually or seem confused; are very irritable
- Have seizures (arms and legs jerk uncontrollably)
- Have weak or numb arms or legs
- Are unsteady on their feet; have slurred speech

Remember, it is better to be safe.
Consult your doctor after a suspected concussion.

Return to play

Athletes should not be returned to play the same day of injury.
When returning athletes to play, they should be **medically cleared and then follow a stepwise supervised program,** with stages of progression.

For example:

Rehabilitation stage	Functional exercise at each stage of rehabilitation	Objective of each stage
No activity	Physical and cognitive rest	Recovery
Light aerobic exercise	Walking, swimming or stationary cycling keeping intensity, 70% maximum predicted heart rate. No resistance training	Increase heart rate
Sport-specific exercise	Skating drills in ice hockey, running drills in soccer. No head impact activities	Add movement
Non-contact training drills	Progression to more complex training drills, eg passing drills in football and ice hockey. May start progressive resistance training	Exercise, coordination, and cognitive load
Full contact practice	Following medical clearance participate in normal training activities	Restore confidence and assess functional skills by coaching staff
Return to play	Normal game play	

There should be at least 24 hours (or longer) for each stage and if symptoms recur the athlete should rest until they resolve once again and then resume the program at the previous asymptomatic stage. Resistance training should only be added in the later stages.

If the athlete is symptomatic for more than 10 days, then consultation by a medical practitioner who is expert in the management of concussion, is recommended.

Medical clearance should be given before return to play.

Scoring Summary:

Test Domain	Score		
	Date:	Date:	Date:
Number of Symptoms of 22			
Symptom Severity Score of 132			
Orientation of 5			
Immediate Memory of 15			
Concentration of 5			
Delayed Recall of 5			
SAC Total			
BESS (total errors)			
Tandem Gait (seconds)			
Coordination of 1			

Notes:

CONCUSSION INJURY ADVICE

(To be given to the **person monitoring** the concussed athlete)

This patient has received an injury to the head. A careful medical examination has been carried out and no sign of any serious complications has been found. Recovery time is variable across individuals and the patient will need monitoring for a further period by a responsible adult. Your treating physician will provide guidance as to this timeframe.

If you notice any change in behaviour, vomiting, dizziness, worsening headache, double vision or excessive drowsiness, please contact your doctor or the nearest hospital emergency department immediately.

Other important points:

- Rest (physically and mentally), including training or playing sports until symptoms resolve and you are medically cleared
- No alcohol
- No prescription or non-prescription drugs without medical supervision. Specifically:
  - No sleeping tablets
  - Do not use aspirin, anti-inflammatory medication or sedating pain killers
- Do not drive until medically cleared
- Do not train or play sport until medically cleared

Clinic phone number

Patient's name

Date/time of injury

Date/time of medical review

Treating physician

Contact details or stamp

McCrory P, Meeuwisse WH, Aubry M, Cantu B, Dvorák J, Echemendia RJ, 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.

Appendix 3.2

Pocket Concussion Recognition Tool (Pocket CRT)

3. Memory function

Failure to answer any of these questions 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?"

Any athlete with a suspected concussion should be IMMEDIATELY REMOVED FROM PLAY, and should not be returned to activity until they are assessed medically. Athletes with a suspected concussion should not be left alone and should not drive a motor vehicle.

It is recommended that, in all cases of suspected concussion, the player is referred to a medical professional for diagnosis and guidance as well as return to play decisions, even if the symptoms resolve.

RED FLAGS

If ANY of the following are reported then the player should be safely and immediately removed from the field. If no qualified medical professional is available, consider transporting by ambulance for urgent medical assessment:

- Athlete complains of neck pain
- Increasing confusion or irritability
- Repeated vomiting
- Seizure or convulsion
- Weakness or tingling/burning in arms or legs
- Deteriorating conscious state
- Severe or increasing headache
- Unusual behaviour change
- Double vision

Remember:

- In all cases, the basic principles of first aid (danger, response, airway, breathing, circulation) should be followed.
- Do not attempt to move the player (other than required for airway support) unless trained to so do
- Do not remove helmet (if present) unless trained to do so.

from McCrory et. al, Consensus Statement on Concussion in Sport. Br J Sports Med 47 (5), 2013

Pocket CONCUSSION RECOGNITION TOOL™

To help identify concussion in children, youth and adults

RECOGNIZE & REMOVE

Concussion should be suspected **if one or more** of the following visible clues, signs, symptoms or errors in memory questions are present.

1. Visible clues of suspected concussion

Any one or more of the following visual clues can indicate a possible concussion:

Loss of consciousness or responsiveness
Lying motionless on ground/Slow to get up
Unsteady on feet / Balance problems or falling over/Incoordination
Grabbing/Clutching of head
Dazed, blank or vacant look
Confused/Not aware of plays or events

2. Signs and symptoms of suspected concussion

Presence of any one or more of the following signs & symptoms may suggest a concussion:

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

McCrory P, Meeuwisse WH, Aubry M, Cantu B, Dvorák J, Echemendia RJ, 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.

Appendix 4.1

ICD-10 Definitions for Differential Diagnoses Related to mTBI

Depressive Episode (F32)	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. *Includes:* Single episodes of: • Depressive reaction • Psychogenic depression • Reactive depression *Excludes:* • Adjustment disorder • Recurrent depressive disorder • When associated with conduct
Organic Anxiety Disorder (F06.4)	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. *Excludes*: Anxiety disorders, nonorganic or unspecified
Generalized Anxiety Disorder (F41.1)	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. *Anxiety* (Neurosis, Reaction, State) *Excludes*: Neurasthenia
Panic Disorder (F41.0)	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. *Panic* (Attack, State) *Excludes*: Panic with agoraphobia
Post Traumatic Stress Disorder (F43.1)	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.

Persistent Somatoform Pain Disorder (F45.4)	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. Psychalgia; Psychogenic (Backache, Headache); Somatoform pain disorder *Excludes*: • Backache NOS • Pain (NOS, Acute, Chronic, Intractable) • Tension headache
Whiplash Associated Disorder (S13.4)	**Sprain and Strain of Cervical Spine** Anterior longitudinal (ligament), cervical Atlanto-axial (joints) Atlanto-occipital (joints) Whiplash injury
Substance Dependence Syndrome (F19.2)	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. 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. *Excludes*: • Backache NOS • Pain (NOS, Acute, Chronic, Intractable) • Tension headache
Factitious Disorder (F68.1)	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. Hospital hopper syndrome; Münchhausen's syndrome; Peregrinating patient *Excludes*: • Factitial dermatitis • Person feigning illness (with obvious motivation)
Malingering (Z76.5)	Person feigning illness (with obvious motivation). *Excludes*: • Factitious disorder • Peregrinating patient
Somatoform Disorder (F45.0)	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. *Excludes*: • Dissociative disorders • Hair-plucking • Lalling • Lisping • 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 (ICHD-II): Acute Post-Traumatic Headache Attributed to Mild Head Injury

IHS	Diagnosis	ICD-10
5.1.2.	Acute post-traumatic headache attributed to mild head injury [S09.9].	G44.880

Diagnostic Criteria:

A. Headache, no typical characteristics known, fulfilling criteria C and D

B. Head trauma with all of the following
   1. Either no loss of consciousness, or loss consciousness of < 30 minutes' duration
   2. Glasgow Coma Scale (GCS) ≥ 13
   3. Symptoms and/or signs diagnostic of concussion

C. Headache develops within 7 days after head trauma

D. One or other of the following:
   1. Headache resolves within 3 months after head trauma
   2. Headache persists but 3 months have not yet passed since head trauma

Comment:
Mild head injury may give rise to a symptom complex of cognitive, behavioural and consciousness abnormalities and a GCS of ≥13. It can occur with or without abnormalities in the neurological examination, neuroimaging (CT scan, MRI), EEG, evoked potentials, CSF examination, vestibular function tests and neuropsychological testing. There is no evidence that an abnormality in any of these changes the prognosis or contributes to treatment. These studies should not be considered routine for patients with ongoing post-traumatic headache. They may be considered on a case-by-case basis, or for research purposes.

Appendix 6.2

International Classification of Headache Disorders (ICHD-II): Chronic Post-Traumatic Headache Attributed to Mild Head Injury

IHS	Diagnosis	ICD-10
5.2.2.	Chronic post-traumatic headache attributed to mild head injury [S09.9].	G44.31

Diagnostic Criteria:

A. Headache, no typical characteristics known, fulfilling criteria C and D

B. Head trauma with all of the following
   1. Either no loss of consciousness, or loss consciousness of < 30 minutes' duration
   2. Glasgow Coma Scale (GCS) ≥ 13
   3. Symptoms and/or signs diagnostic of concussion

C. Headache develops within 7 days after head trauma

D. Headache persists for > 3 months after head trauma

Comment:
Mild head injury may give rise to a symptom complex of cognitive, behavioural and consciousness abnormalities and a GCS of ≥13. It can occur with or without abnormalities in the neurological examination, neuroimaging (CT scan, MRI), EEG, evoked potentials, CSF examination, vestibular function tests and neuropsychological testing. There is no evidence that an abnormality in any of these changes the prognosis or contributes to treatment. These studies should not be considered routine for patients with ongoing post-traumatic headache. They may be considered on a case-by-case basis, or for research purposes.

Appendix 6.3

Diagnostic Criteria for Selected Primary Headache Types from the International Classification of Headache Disorders (ICHD-II)

1.1 Migraine without aura

Diagnostic criteria:
A. At least 5 attacks fulfilling criteria B-D
B. Headache attacks lasting 4-72 hours (untreated or unsuccessfully treated)
C. Headache has at least two of the following characteristics:
    1. Unilateral location
    2. Pulsating quality
    3. Moderate or severe pain intensity
    4. Aggravation by or causing avoidance of routine physical activity (e.g., walking or climbing stairs)
D. During headache, at least one of the following:
    1. Nausea and/or vomiting
    2. Photophobia and phonophobia
E. Not attributed to another disorder

2.2 Frequent episodic tension-type headache

Diagnostic criteria:
A. At least 10 episodes occurring on ≥ 1 but < 15 days per month for at least 3 months (≥ 12 and < 180 days per year) and fulfilling criteria B-D
B. Headache lasting from 30 minutes to 7 days
C. Headache has at least two of the following characteristics:
    1. Bilateral location
    2. Pressing/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 (anorexia may occur)
    2. No more than one of photophobia or phonophobia
E. Not attributed to another disorder

4.1 Primary stabbing headache

Diagnostic criteria:
A. Head pain occurring as a single stab or a series of stabs and fulfilling criteria B-D
B. Exclusively or predominantly felt in the distribution of the first division of the trigeminal nerve (orbit, temple and parietal area)
C. Stabs last for up to a few seconds and recur with irregular frequency ranging from one to many per day
D. No accompanying symptoms
E. Not attributed to another disorder

13.8 Occipital neuralgia

Diagnostic criteria:
A. Paroxysmal stabbing pain, with out without persistent aching between paroxysms, in the distribution(s) of the greater, lesser and/or third occipital nerves
B. Tenderness over the affected nerve
C. Pain is eased temporarily by local anaesthetic block of the nerve

Appendix 6.4

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

IHS	Diagnosis	ICD-10
8.2.	Medication-overuse headache [MOH]	G44.41 or G44.83

Diagnostic Criteria:

A. Headache[1] present on ≥ 15 days/month fulfilling criteria C and D
B. Regular overuse[2] for ≥ 3 months of one or more drugs that can be taken for acute and/or symptomatic treatment of headache[3]
C. Headache has developed or markedly worsened during medication overuse
D. Headache resolves or reverts to its previous pattern within 2 months after discontinuation of overused medication[4]

Notes:
1. The headache associated with medication overuse is variable and often has a peculiar pattern with characteristics shifting, even within the same day, from migraine-like to those of tension-type headache.
2. Overuse is defined in terms of duration and treatment days per week. What is crucial is that treatment occurs both frequently and regularly, i.e., on 2 or more days each week. Bunching of treatment days with long periods without medication intake, practiced by some patients, is much less likely to cause medication overuse headache and does not fulfill criterion B.
3. MOH can occur in headache-prone patients when acute headache medications are taken for other indications.
4. A period of 2 months after cessation of overuse is stipulated in which improvement (resolution of headache, or reversion to its previous pattern) must occur if the diagnosis is to be definite. Prior to cessation, or pending improvement within 2 months after cessation, the diagnosis 8.2.8 Probable medication-overuse headache should be applied. If such improvement does not then occur within 2 months, this diagnosis must be discarded.

Comments:
Medication-overuse headache is an interaction between a therapeutic agent used excessively and a susceptible patient. The best example is overuse of symptomatic headache drugs causing headache in the headache-prone patient. By far the most common cause of migraine-like headache occurring on -15 days per month and of a mixed picture of migraine-like and tension-type-like headaches on -15 days per month is overuse of symptomatic migraine drugs and/or analgesics. Chronic tension-type headache is less often associated with medication overuse but, especially amongst patients seen in headache centres, episodic tension-type headache has commonly become a chronic headache through overuse of analgesics.

Patients with a pre-existing primary headache who develop a new type of headache or whose migraine or tension-type headache is made markedly worse during medication overuse should be given both the diagnosis of the pre-existing headache and the diagnosis of 8.2 Medication-overuse headache.

The diagnosis of medication-overuse headache is clinically extremely important because patients rarely respond to preventative medications whilst overusing acute medications.

Appendix 6.5

Headache Impact Test 6 (HIT-6)

HIT-6™ HEADACHE IMPACT TEST

This questionnaire was designed to help you describe and communicate the way you feel and what you cannot do because of headaches.

To complete, please check one box for each question.

1. When you have headaches, how often is the pain severe?

☐ Never ☐ Rarely ☐ Sometimes ☐ Very Often ☐ Always

2. How often do headaches limit your ability to do usual daily activities including household work, work, school, or social activities?

☐ Never ☐ Rarely ☐ Sometimes ☐ Very Often ☐ Always

3. When you have a headache, how often do you wish you could lie down?

☐ Never ☐ Rarely ☐ Sometimes ☐ Very Often ☐ Always

4. In the past 4 weeks, how often have you felt too tired to do work or daily activities because of your headaches?

☐ Never ☐ Rarely ☐ Sometimes ☐ Very Often ☐ Always

5. In the past 4 weeks, how often have you felt fed up or irritated because of your headaches?

☐ Never ☐ Rarely ☐ Sometimes ☐ Very Often ☐ Always

6. In the past 4 weeks, how often did headaches limit your ability to concentrate on work or daily activities?

☐ Never ☐ Rarely ☐ Sometimes ☐ Very Often ☐ Always

Kosinski M, Bayliss MS, Bjorner JB, Ware JE Jr, Garber WH, Batenhorst A, et al. A six-item short-form survey for measuring headache impact: the HIT-6. *Quality of Life Research*, 2003; 12: 963–974.

Appendix 6.6

Important Components to Include in the Neurologic and Musculoskeletal Exam

Perform a neurologic exam and musculoskeletal exam including cervical spine examination:

- Examine the site of injury.
- Examine the cervical spine exam for range of motion and focal areas of tenderness, spasm, hypertonicity.
- Examine the temporomandibular joint (TMJ) for range of opening, tenderness, dislocation.
- Brief cognitive and language screen.
- Examine cranial nerve 2 (i.e. assess pupil symmetry and reactivity, visual fields to confrontation, and ensure that there is no optic edema).
- Examine cranial nerves 3, 4, 6 (screen for abnormalities in eye movements, diplopia, nystagmus).
- Conduct a motor screen to check for pronator drift, asymmetrical weakness and symmetry of reflexes.
- Conduct a sensory exam to check that there is no extinction to bilateral tactile stimuli.
- Assess coordination by evaluation finger-to-nose movements, gait and tandem gait.

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

See Appendix H for links to video demonstrations of neck and neurological examinations.

Appendix 6.7

Self-Regulated Intervention and Lifestyle Strategies to Minimize Headache Occurrence

Simple Self-regulated Intervention Strategies*

- Apply a cold or hot back 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

a) 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

b) 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.

c) 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.

d) 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.

e) 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 6.8

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 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)

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 (stating 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).

Appendix 7.1

Brief Definitions of Sleep Disorders Most Frequency Reported following mTBI*

Insomnia

Main feature	Dissatisfaction with the quality or quantity of sleep.
Common symptoms	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.
Additional criteria	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

Main feature	Altered respiration during sleep.
Main subtypes	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.
Common symptoms	Daytime sleepiness, frequent awakenings to restart breathing, restless and nonrestorative sleep, snoring.
Additional criteria	Presence of at least 5 polysomnography-documented apneas or hypopneas per hour of sleep.

Narcolepsy

Main feature	Rare disorder characterized by recurrent unplanned daytime napping or sleep episodes.
Common 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. 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

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

Circadian rhythm sleep disorders

Main feature	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.
Common symptoms	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
Additional criteria	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

IDENTIFICATION:
DATE:
Notes:

SCREENING FOR INSOMNIA, EXCESSIVE DAYTIME SLEEPINESS AND SYMPTOMS OF OTHER SLEEP DISORDERS

- 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?
  - ☐ ☐ Loud snoring
  - ☐ ☐ Gasping, choking, breathing interruptions or holding your breath while sleeping
  - ☐ ☐ Urge to move your legs or inability to keep your legs still
  - ☐ ☐ Leg cramps while sleeping
  - ☐ ☐ Twitches or jerks in your legs or arms while sleeping
  - ☐ ☐ Inability to move while in bed
  - ☐ ☐ Grinding your teeth while sleeping
  - ☐ ☐ Confusion or strange sensory experiences when falling asleep or waking up
  - ☐ ☐ Recurrent nightmares or disturbing dreams. Are these related to the accident ?

EXPLORE EVOLUTION OF SLEEP-WAKE DISTURBANCE

- 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)?

ASSESS LIFE HABITS, MEDICATION AND SUBSTANCE USE

- 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. Advanced sleep phase disorder: advance 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. Zasler, 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. Zasler 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*

Name: _____ **Date**: _____

1a) Has your sleep changed since your injury? Yes _____ No _____

No change since my injury (0) _____
Yes (1: Mild change) _____
Yes (2: Moderate change) _____
Yes (3: Significant change) _____

1b) *If you answered yes to the above*, please indicate the type of change:

I sleep more than before my injury (1) _____
I sleep less than before my injury (1) _____
I sleep the same amount but am less restful (1) _____

2) Please rate the severity of the changes to your sleep *since your injury or the last time you completed this questionnaire:*

	Not a problem	Mild	Moderate	Severe
2a) I fall asleep earlier than usual	_____	_____	_____	_____
2b) I have difficulty falling asleep	_____	_____	_____	_____
2c) I have difficulty staying asleep	_____	_____	_____	_____
2d) I have difficulty waking in the morning	_____	_____	_____	_____
2e) I have a problem with waking up too early	_____	_____	_____	_____

3) My sleep is affected by: (Check all that apply)

Nothing (0) ____ Pain (1) ____ Mood (1) ___ Feeling restless (1) ____ Worrying (1) ___ Other (1)____

If other, please explain: _____

4. Please rate the severity of changes to your day-time function *since your injury:*

4a) I feel more tired during the day: Never (0) _____ Mild (1) _____ Moderate (2) _____ Severe (3) _____
4b) I need to nap during the day: Never (0) _____ Sometimes (1) _____ Often (2) _____ Always (3) _____

5. If you have filled out this form before, has your sleep changed *since the last time you completed it*?

Yes _____ No _____

Yes (0: My sleep improved) _____
Yes (1: My sleep is worse) _____
No (0: My sleep is the same as last time) _____

* Taken with permission from the authors.

Guidelines for Scoring/Interpretation and Suggested Action

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

Add scores for all 10 items (1a + 1b + 2a + 2b +2c + 2d + 2e+ 3+ 4a +4b + 5: if completed) = _____
Total score ranges from 0 - 31

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 – 31 = Clinically severe changes in sleep or wakefulness (Further assessment of precipitating factors, referral to specialist may be indicated and intervention may be indicated).

 It was designed to assess changes in sleep quality following a concussion or mTBI. The guidelines for scoring are inspired by the Insomnia Severity Index (Morin, 1993) but have yet to be validated. For a specific measure of insomnia severity, the Insomnia Severity Index may be used, although it has also not been validated specifically with this population.

* Taken with permission from the authors.

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 & 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.

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.

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 health-care provider.

* 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*

Sleep Diary

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

		Example	Date: ___/___	Date: ___/___	Date: ___/___	Date: ___/___	Date: ___/___	Date: ___/___	Date: ___/___	Date: ___/___
		TUESDAY 25/03								
	Evening questions (before going to bed)									
A.	In general today, I felt…(choose a number from the scale) 0 1 2 3 4 5 6 7 8 9 10 0: I was not tired at all 10: I felt extremely tired	4								
B.	In general today, I…(choose a number from the scale) 0 1 2 3 4 5 6 7 8 9 10 0: I did not accomplish anything at all 10: I took full advantage of my day	7								
	Morning questions (after getting up)									
1.	Yesterday, I napped from ___ to ___ (Note the times of all naps). Did you fall asleep during this nap (YES/NO)?	**1:50–2 :30 (YES)**								
2.	Yesterday, I took ___mg of medication and/or ___ oz of alcohol as a sleeping aid	**ATIVAN 1 MG**								
3.	Last night, I went to bed at _____ I turned the lights off at _____	**10:45 PM 11:15 PM**								
4.	After turning the lights off, I fell asleep in ___ minutes	**40 MIN**								
5.	My sleep was interrupted _____ times (Specify number of nighttime awakenings)	**2**								
6.	Each time, my sleep was interrupted for____minutes (Specify duration of each awakening)	**5 45**								
7.	Last night, I got out of bed _____times (specify number of times your got out of bed)	**3**								
8.	This morning, I woke up at _____(note time of **last** awakening without falling back asleep afterwards)	**6 :15 AM**								
9.	This morning, I got out of bed at _____	**7:00 AM**								
	TIB= Time spent in bed (from lights out to getting out of bed)	TIB: **465** min	TIB:	TIB:	TIB:	TIB:	TIB:	TIB:	TIB:	TIB:
	TWT= Time spent awake after lights out up until getting out of bed questions 4+ &(all wake episodes) and time between question 6 and 7)	TWT: **135** min	TWT:	TWT:	TWT:	TWT:	TWT:	TWT:	TWT:	TWT:
	TST= total sleep time (TIB-TWT)	TST: **330** min	TST:	TST:	TST:	TST:	TST:	TST:	TST:	TST:
	SE=Sleep efficiency (TST/TIB)	SE: **71%**	SE:	SE:	SE:	SE:	SE:	SE:	SE:	SE:

* Adapted with permission from Morin CM (1993) by Ouellet M-C, Beaulieu-Bonneau S, & Morin CM. In Eds. Zasler ND, Katz DI, Zafonte RD. Brain Injury Medicine: Principles and Practice. New York; Demos Medical Publishing LLC; 2012.

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 figety 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:				

(Health care 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	Mild major depressive disorder. Physician uses clinical judgment about treatment, based on patient's duration of symptoms and functional impairment.
15 - 19	Moderate major depressive disorder. Warrants treatment for depression, using antidepressant, psychotherapy or a combination of treatment.
20 or higher	Severe major depressive disorder. 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:				

(Health care 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*

Name: _____ **Date**: _____

In your life, have you ever had any experience that was so frightening, horrible or upsetting that, in the past month, you...

1. Have had nightmares about it or thought about it when you did not want to?
   Yes _____
   No _____
2. Tried hard not to think about it or went out of your way to avoid situations that reminded you of it?
   Yes _____
   No _____
3. Were constantly on guard, watchful, or easily startled?
   Yes _____
   No _____
4. Felt numb or detached from others, activities, or your surroundings?
   Yes _____
   No _____

Total = _____ / 4

Scoring Instructions

A cut-off score of 3 on the PC-PTSD has been shown to be optimally efficient in distinguishing patients with and without a PTSD diagnosis. However, in primary care settings, it is recommended that patients with a score of 2 or greater should be further assessed.

* Adapted from Prins A, Ouimette P, Kimerling P, Cameron RP, Hugelshofer DS, Shaw-Hegwer J, et al. The primary care PTSD screen (PC-PTSD): Development and operating characteristics. *Primary Care Psychiatry*. 2003;9:9-14.

Appendix 8.4

PCL-CV*

Name: _____ **Date**: _____

*Instructions: Below is a list of problems and complaints that people sometimes have in response to stressful life experiences. Please read each one carefully, put an "X" in the box to indicate how much you have been bothered by that problem **in the past month**.*

The event you experienced was _____ on _____(date).

	Not at all (1)	A little bit (2)	Moderately (3)	Quite a bit (4)	Extremely (5)
1. Repeated, disturbing memories, thoughts, or images of a stressful experience from the past?					
2. Repeated, disturbing dreams of a stressful experience from the past?					
3. Suddenly acting or feeling as if a stressful experience were happening again (as if you were reliving it)?					
4. Feeling very upset when something reminded you of a stressful experience from the past?					
5. Having physical reactions (e.g., heart pounding, trouble breathing, or sweating) when something reminded you of a stressful experience from the past?					
6. Avoid thinking about or talking about a stressful experience from the past or avoid having feelings related to it?					
7. Avoid activities or situations because they remind you of a stressful experience from the past?					
8. Trouble remembering important parts of a stressful experience from the past?					
9. Loss of interest in things that you used to enjoy?					
10. Feeling distant or cut off from other people?					
11. Feeling emotionally numb or being unable to have loving feelings for those close to you?					
12. Feeling as if your future will somehow be cut short?					
13. Trouble falling or staying asleep?					
14. Feeling irritable or having angry outbursts?					
15. Having difficulty concentrating?					
16. Being "super alert" or watchful on guard?					
17. Feeling jumpy or easily startled?					
Add Columns:					

TOTAL Severity Score: _____

* This is a government document in the public domain. Weathers, F.W., Huska, J.A., Keane, T.M. PCL-C for DSM-IV. Boston: National Center for PTSD – Behavioral Science Division, 1991.

Scoring Instructions

There are several ways in which to score the PTSD Check List (PCL). Perhaps the easiest way to score the PCL is to add up all the items for a total severity score. Possible scores range from 17 to 85. A total score of 30 or above is considered to be PTSD positive for the general population as well as military populations (Bliese, et al., 2008 JCCP). A second way to score the PCL is to treat "moderately" (1 and 2) as non-symptomatic. Then use the DSM-IV scoring rules to make your diagnosis.

- You need an endorsement of at least 1 B item (questions 1-5)
- You need an endorsement of at least 3 C items (questions 6-12)
- You need an endorsement of at least 2 D items (questions 13-17)

However, please note, it is then possible to get a PTSD diagnosis with a total score of 18, which would be very low. It may therefore be best to use a combination of the two approaches. That is, the requisite number of items within each cluster is met at a 3 or above AND the total score is above the specified cut point.

References

Bliese PD, Wright KM, Adler AB, Cabrera O, Castro CA, Hoge, CW. Validating the Primary Care Posttraumatic Stress Disorder Screen and the Posttraumatic Stress Disorder Checklist with soldiers returning from combat. *Journal of Consulting and Clinical Psychology*. 2008;76:272–281.

* This is a government document in the public domain. Weathers, F.W., Huska, J.A., Keane, T.M. PCL-C for DSM-IV. Boston: National Center for PTSD – Behavioral Science Division, 1991.

Appendix 8.5

CAGE Questionnaire*

Name: _____ **Date**: _____

Please check the one response to each item that best describes how you have felt and behaved over your whole life.

1. Have you ever felt you should ***cut*** down on your drinking?

   Yes _____
   No _____

2. Have people ***annoyed*** you by criticizing your drinking?

   Yes _____
   No _____

3. Have you ever felt bad or ***guilty*** about your drinking?

   Yes _____
   No _____

4. Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover (***eye***-opener)?

   Yes _____
   No _____

Total = _____ / 4

Additional Information

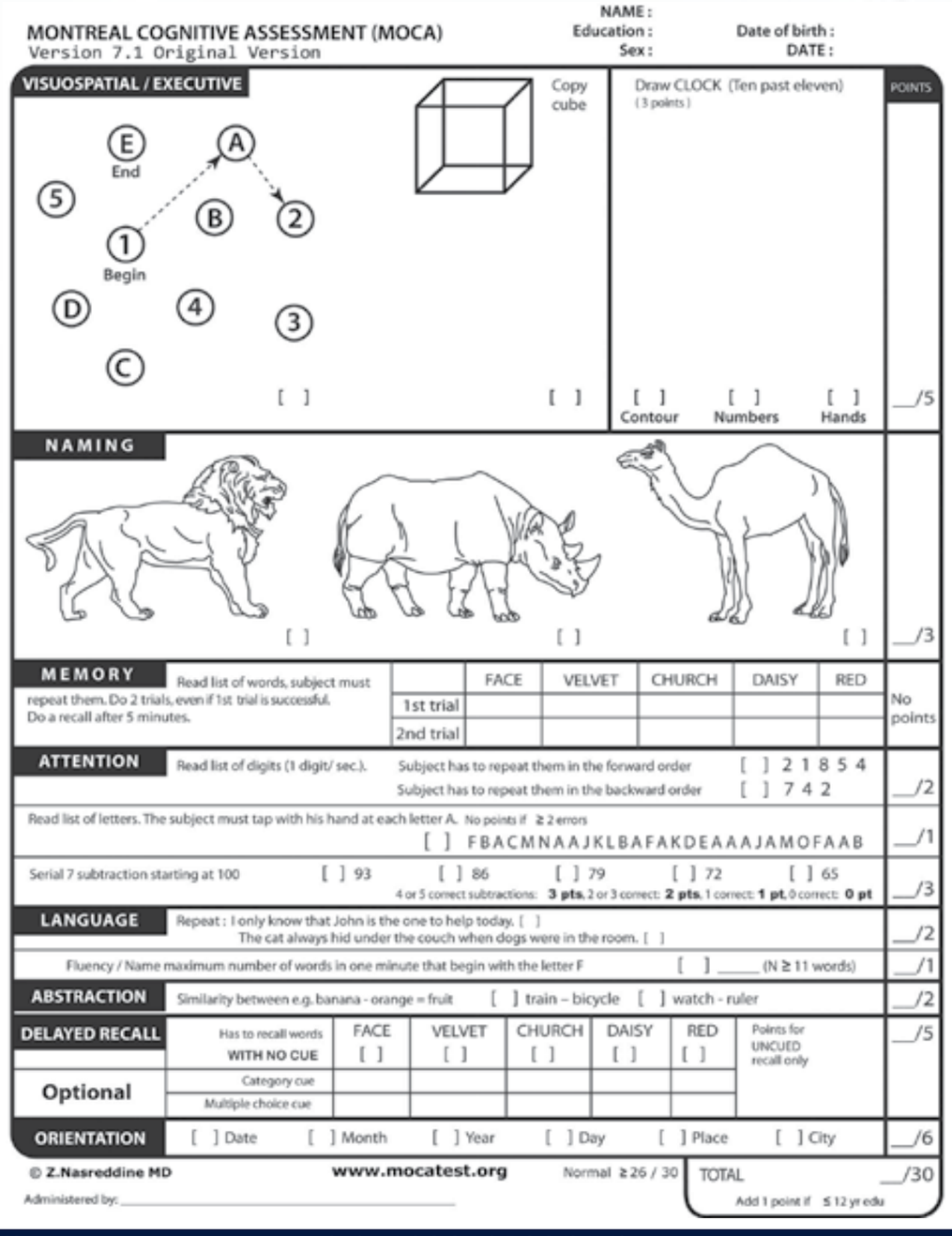
The CAGE questionnaire was developed by Dr. John Ewing, founding director of the Bowles Center for Alcohol Studies, University of North Carolina at Chapel Hill. CAGE is an internationally used assessment instrument for identifying problems with alcohol. 'CAGE' is an acronym formed from the italicised letters in the questionnaire (cut-annoyed-guilty-eye).

Score of 2 or more warrants seeking professional help.

* May be printed without permission, unless it is used in any profit-making endeavour.
Ewing, JA. Detecting alcoholism: The CAGE questionaire. *Journal of the American Medical Association*. 1984;252:1905-1907.

Appendix 9.1

Montreal Cognitive Assessment (MoCA)



Administration & Scoring Instructions

The Montreal Cognitive Assessment (MoCA) was designed as a rapid screening instrument for mild cognitive dysfunction. It assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation. Time to administer the MoCA is approximately 10 minutes. The total possible score is 30 points; a score of 26 or above is considered normal.

1. Alternating Trail Making

Administration: The examiner instructs the subject: "*Please draw a line, going from a number to a letter in ascending order. Begin here [point to (1)] and draw a line from 1 then to A then to 2 and so on. End here [point to (E)*]."

Scoring: Allocate one point if the subject successfully draws the following pattern: 1 −A- 2- B- 3- C- 4- D- 5- E, without drawing any lines that cross. Any error that is not immediately self-corrected earns a score of 0.

2. Visuoconstructional Skills (Cube)

Administration: The examiner gives the following instructions, pointing to the cube: "*Copy this drawing as accurately as you can, in the space below*".

Scoring: One point is allocated for a correctly executed drawing.

- Drawing must be three-dimensional;
- All lines are drawn;
- No line is added;
- Lines are relatively parallel and their length is similar (rectangular prisms are accepted).

A point is not assigned if any of the above-criteria are not met.

3. Visuoconstructional Skills (Clock)

Administration: Indicate the right third of the space and give the following instructions: "*Draw a clock. Put in all the numbers and set the time to 10 past 11*".

Scoring: One point is allocated for each of the following three criteria:

- Contour (1 pt.): the clock face must be a circle with only minor distortion acceptable (e.g., slight imperfection on closing the circle);
- Numbers (1 pt.): all clock numbers must be present with no additional numbers; numbers must be in the correct order and placed in the approximate quadrants on the clock face; Roman numerals are acceptable; numbers can be placed outside the circle contour;
- Hands (1 pt.): there must be two hands jointly indicating the correct time; the hour hand must be clearly shorter than the minute hand; hands must be centred within the clock face with their junction close to the clock centre.

A point is not assigned for a given element if any of the above-criteria are not met.

4. Naming

Administration: Beginning on the left, point to each figure and say: "*Tell me the name of this animal*".

Scoring: One point each is given for the following responses: (1) lion (2) rhinoceros or rhino (3) camel or dromedary.

5. Memory

Administration: The examiner reads a list of 5 words at a rate of one per second, giving the following instructions: "T*his is a memory test. I am going to read a list of words that you will have to remember now and later on. Listen carefully. When I am through, tell me as many words as you can remember. It doesn't matter in what order you say them*". Mark a check in the allocated space for each word the subject produces on this first trial. When the subject indicates that (s)he has finished (has recalled all words), or can recall no more words, read the list a second time with the following instructions: "*I am going to read the same list for a second time. Try to remember and tell me as many words as you can, including words you said the first time*." Put a check in the allocated space for each word the subject recalls after the second trial. At the end of the

second trial, inform the subject that (s)he will be asked to recall these words again by saying, "*I will ask you to recall those words again at the end of the test*."

Scoring: No points are given for trials one and two.

6. Attention

Forward Digit Span: Administration: Give the following instruction: "*I am going to say some numbers and when I am through, repeat them to me exactly as I said them*". Read the five number sequence at a rate of one digit per second.

Backward Digit Span: Administration: Give the following instruction: "*Now I am going to say some more numbers, but when I am through you must repeat them to me in the backwards order*." Read the three number sequence at a rate of one digit per second.

Scoring: Allocate one point for each sequence correctly repeated. (N.B.: the correct response for the backwards trial is 2-4-7).

Vigilance: Administration: The examiner reads the list of letters at a rate of one per second, after giving the following instruction: "*I am going to read a sequence of letters. Every time I say the letter A, tap your hand once. If I say a different letter, do not tap your hand*".

Scoring: Give one point if there is zero to one errors (an error is a tap on a wrong letter or a failure to tap on letter A).

Serial 7s: Administration: The examiner gives the following instruction: "*Now, I will ask you to count by subtracting seven from 100, and then, keep subtracting seven from your answer until I tell you to stop*." Give this instruction twice if necessary.

Scoring: This item is scored out of 3 points. Give no (0) points for no correct subtractions, 1 point for one correction subtraction, 2 points for two-to-three correct subtractions, and 3 points if the participant successfully makes four or five correct subtractions. Count each correct subtraction of 7 beginning at 100. Each subtraction is evaluated independently; that is, if the participant responds with an incorrect number but continues to correctly subtract 7 from it, give a point for each correct subtraction. For example, a participant may respond "92 – 85 – 78 – 71 – 64" where the "92" is incorrect, but all subsequent numbers are subtracted correctly. This is one error and the item would be given a score of 3.

7. Sentence Repetition

Administration: The examiner gives the following instructions: "*I am going to read you a sentence. Repeat it after me, exactly as I say it [pause]:* **I only know that John is the one to help today**.*"* Following the response, say: *"Now I am going to read you another sentence. Repeat it after me, exactly as I say it [pause]:* **The cat always hid under the couch when dogs were in the room**."

Scoring: Allocate 1 point for each sentence correctly repeated. Repetition must be exact. Be alert for errors that are omissions (e.g., omitting "only", "always") and substitutions/additions (e.g., "John is the one who helped today;" substituting "hides" for "hid", altering plurals, etc.).

8. Verbal Fluency

Administration: The examiner gives the following instruction: "*Tell me as many words as you can think of that begin with a certain letter of the alphabet that I will tell you in a moment. You can say any kind of word you want, except for proper nouns (like Bob or Boston), numbers, or words that begin with the same sound but have a different suffix, for example, love, lover, loving. I will tell you to stop after one minute. Are you ready? [Pause] Now, tell me as many words as you can think of that begin with the letter F.* [Time for 60 sec]. *Stop*."

Scoring: Allocate one point if the subject generates 11 words or more in 60 sec. Record the subject's response in the bottom or side margins.

9. Abstraction

Administration: The examiner asks the subject to explain what each pair of words has in common, starting with the example: "*Tell me how an orange and a banana are alike*". If the subject answers in a concrete manner, then say only one additional time: "*Tell me another way in which those items are alike*". If the subject does not give the appropriate response (fruit), say, "*Yes, and they are also both fruit*." Do not give any additional instructions or clarification. After the practice trial, say: "*Now, tell me how a train and a bicycle are alike*". Following the response, administer the second trial, saying: "*Now tell me how a ruler and a watch are alike*". Do not give any additional instructions or prompts.

Scoring: Only the last two item pairs are scored. Give 1 point to each item pair correctly answered. The following responses are acceptable: Train-bicycle = means of transportation, means of travelling, you take trips in both; Ruler-watch = measuring instruments, used to measure. The following responses are not acceptable: Train-bicycle = they have wheels; Ruler-watch = they have numbers.

10. Delayed Recall

Administration: The examiner gives the following instruction: "*I read some words to you earlier, which I asked you to remember. Tell me as many of those words as you can remember*." Make a check mark (√) for each of the words correctly recalled spontaneously without any cues, in the allocated space.

Scoring: Allocate 1 point for each word recalled freely without any cues.

Optional: Following the delayed free recall trial, prompt the subject with the semantic category cue provided below for any word not recalled. Make a check mark (√) in the allocated space if the subject remembered the word with the help of a category or multiple-choice cue. Prompt all non-recalled words in this manner. If the subject does not recall the word after the category cue, give him/her a multiple choice trial, using the following example instruction, "*Which of the following words do you think it was, NOSE, FACE, or HAND?*" Use the following category and/or multiple-choice cues for each word, when appropriate:

FACE:	**category cue: part of the body**	**multiple choice: nose, face, hand**
VELVET:	**category cue: type of fabric**	**multiple choice: denim, cotton, velvet**
CHURCH:	**category cue: type of building**	**multiple choice: church, school, hospital**
DAISY:	**category cue: type of flower**	**multiple choice: rose, daisy, tulip**
RED:	**category cue: a colour**	**multiple choice: red, blue, green**

Scoring: No points are allocated for words recalled with a cue. A cue is used for clinical information purposes only and can give the test interpreter additional information about the type of memory disorder. For memory deficits due to retrieval failures, performance can be improved with a cue. For memory deficits due to encoding failures, performance does not improve with a cue.

11. Orientation

Administration: The examiner gives the following instructions: "*Tell me the date today*". If the subject does not give a complete answer, then prompt accordingly by saying: "*Tell me the [year, month, exact date, and day of the week].*" Then say: "*Now, tell me the name of this place, and which city it is in.*".

Scoring: Give one point for each item correctly answered. The subject must tell the exact date and the exact place (name of hospital, clinic, office). No points are allocated if subject makes an error of one day for the day and date.

TOTAL SCORE: Sum all subscores listed on the right-hand side. Add one point for an individual who has 12 years or fewer of formal education, for a possible maximum of 30 points. A final total score of 26 and above is considered normal.

Appendix 10.1

Dix-Hallpike Manoeuvre and Particle Repositioning Manoeuvre (PRM)*

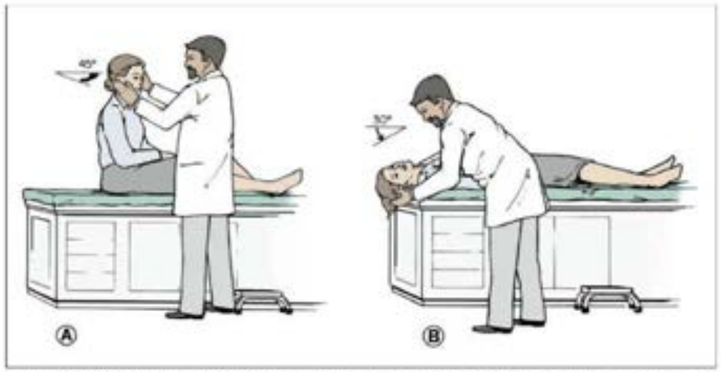


Fig. 6: Dix-Hallpike manoeuvre (right ear). The patient is seated and positioned so that the patient's head will extend over the top edge of the table when supine. The head is turned 45° toward the ear being tested (position A). The patient is quickly lowered into the supine position with the head extending 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 position (position A) and the eyes are observed for reversal nystagmus, in this case a fast-phase clockwise nystagmus.

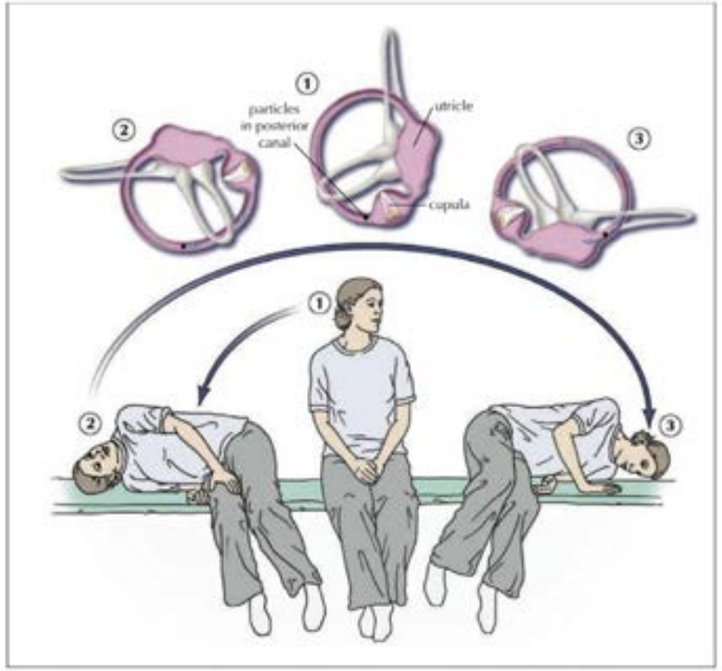


Fig. 7: Liberatory manoeuvre of Semont (right ear). The top panel shows the effect of the manoeuvre on the labyrinth as viewed from the front and the induced movement of the canaliths (from blue to black). This manoeuvre relies on inertia, so that the transition from position 2 to 3 must be made very quickly.

* 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 H.

Appendix 10.2

Screening Techniques for Vision Dysfunction

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 chose only ONE number from 0–7 on the scale below when making your response.

0	1	2	3	4	5	6	7
Rarely a problem		*Occasional problem but not frequent*		*A frequent problem*		*A problem most of the time*	

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
No problem										*Severe problem*

* 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 are cited that cause symptoms in > 5% of patients	
Analgesics	
Butalbital	■
Butorphanol (Stadol NS)	●
Dihydrocodeine	■
Fentanyl (Duragesic transdermal)	●
Hydrocodone (Vicoprofen)	●
Morphine	■
Oxycodone (Oxycontin)	●
Tramadol (Ultram)	●
Anticonvulsants	
Carbamazepine (Tegretol)	◆
Clorazepate (Tranxene)	■
Divalproex (Depakote)	●
Felbamate (Felbatol)	●
Gabapentin (Neurontin)	●
Lamotrigine (Lamictal)	●
Phenobarbital	▲
Primidone (Mysoline)	▲
Antidepressants	
Buspirone (Buspar)	●
Clomipramine (Anafranil)	■
Doxepin (Sinequan)	◆
Fluoxetine (Prozac)	●
Fluvoxamine (Luvox)	●
Mirtazapine (Remeron)	■
Nefazodone (Serzone)	●
Paroxetine (Paxil)	●
Sertraline (Zoloft)	●
Trazodone (Desyrel)	●
Tricyclic agents	■
Venlafaxine (Effexor)	●
Antihistamines	
Astemizole (Hismanal)	●
Azatadine (Trinalin)	■
Azelastine (Astelin)	●
Cetirizine (Zyrtec)	●
Chlorpheniramine	◆
Diphenhydramine	■
Loratadine (Claritin)	●
Phenylephrine	◆
Terfenadine (Seldane)	●
Antihypertensive	
Acebutolol (Sectral)	●
Amiloride (Moduretic)	●
Atenolol (Tenoretic, Tenormin)	●
Benazepril (Lotensin)	●
Betaxolol (Kerlone)	●
Carteolol (Cartrol)	●
Clonidine (Catapres, Combipress)	●
Diltiazem (Tiazac)	●
Doxazosin (Cardura)	●
Guanadrel (Hylorel)	●
Guanfacine (Tenex)	●
Labetalol (Normodyne, Trandate)	●
Metoprolol (Lopressor, Toprol)	●
Nifedipine (Adalat)	●
Perindopril (Aceon)	●
Prazosin (Minipress, Minizide)	●
Anti-Inflammatory	
Fenoprofen (Nalfon)	●
Ketorolac (Toradol)	●
Naproxen (Anaprox, Naprelan, Naprosyn)	
Tolmetin (Tolectin)	●
Antipsychotic	
Clozapine (Clozaril)	●
Mesoridazine (Serentil)	■
Molindone (Moban)	■
Olanzapine (Zyprexa)	●
Risperidone (Risperdal)	●
Asthma Drugs	
Fluticasone (Flovent)	●
Terbutaline	●
Carbonic Anhydrase Inhibitors	
Dichlorphenamide (Daranide)	◆
Cardiac	
Bepridil (Vascor)	●
Amiodarone (Cordarone)	●
Disopyramide (Norpace)	●
Flecainide (Tambocor)	●
Nifedipine (Procardia)	●
Quinine (Cardioquin, Quinidex)	●
Sotalol (Betapace)	●

Legend

● >50% ● 25-50% ● 10-25% ● 5-10%
■ Most Frequent ■ Among Most Frequent ■ Among Frequent ▲ Can Develop During Therapy
◆ Most Common ◆ Among Most Common ▲ Occasional

* Adapted from the Multiple Sclerosis Council (MSC) Guideline.

MEDICATIONS	RATE OF SYMPTOMS	MEDICATIONS	RATE OF SYMPTOMS
Medications are cited that cause symptoms in > 5% of patients			
Diabetic Agents		**Nicotine Agents**	
Glipizide (Glucotrol)	●	Habitrol	●
Troglitazone (Rezulin)	●	Nicotrol nasal spray	●
		Prostep	●
Gastrointestinal			
Dicyclomine (Bentyl)	●	**Sedative Hypnotics**	
Granisetron (Kytril)	●	Alprazolam (Xanax)	◆
Metoclopramide (Reglan)	●	Clonazepam (Klonopin)	●
		Diazepam (Valium)	◆
Genitourinary		Estazolam (ProSom)	●
Terazosin (Hytrin)	●	Quazepam (Doral)	●
		Secobarbital (Seconal)	◆
Hormone Replacement		Temazepam (Restoril)	●
Depo-Provera (medroxyprogesterone)	●	Triazolam (Halcion)	●
Progesterone cream (Crinone)	●	Zolpidem (Ambien)	●
Leuprolide (Lupron)	●		
(Lupron depot preparation)	●	**Other**	
		Dexfenfluramine (Redux)	●
Immune Modulators		Fenfluramine (Pondimin)	◆
Interferon beta-1a (Avonex)	●	Scopolamine (Transderm Scop)	●
Interferon beta-1b (Betaseron)	●		
Muscle Relaxants			
Carisoprodol (Soma)	■		
Cyclobenzaprine (Flexeril)	●		
Dantrolene (Dantrium)	■		
Diazepam (Valium)	◆		
Tizanidine (Zanaflex)	●		

Legend

● >50% ● 25-50% ● 10-25% ● 5-10%
■ Most Frequent ■ Among Most Frequent ■ Among Frequent ▲ Can Develop During Therapy
◆ Most Common ◆ Among Most Common ▲ Occasional

* 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.

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).

* 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*).

* 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*).

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 his/her 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	• 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	• 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	• 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	• 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	• 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	• 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

3. The evaluator should complete an assessment of the ***occupational requirements*** through the completion of a ***job analysis***. This should include:
   a. Identification of the occupational/job title/category/classification (e.g. National Occupational Classification, O'Net; Dictionary of Occupational Titles, DOT)
   b. A description of the job
   c. A description of job demands (See Table II below for summary of categories of job demands)

Table II. Job Demand Categories

Category	Examples
Physical	• Lifting, carrying, pushing, stamina
Neuropsychological/ Cognitive	• Initiation, problem-solving, decision-making, flexibility, adaptability
Psychological/ Emotional	• Emotional stability
Behavioural Demands	• Self-monitoring, changes in behaviours required
Communication	• Verbal, non-verbal, written
Responsibilities and Expectations	• Responsibilities related to own job, supervision of others, working with the public, customers, clients, level of independence required to complete job tasks
Work Time	• Work hours, shifts, breaks, overtime
Safety Requirements	• 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.**

4. An assessment of the physical workplace environment should be completed.
5. 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.

6. 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	• 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	• Tolerances for differences amongst employees • Positive attitudes towards individuals with disabilities (e.g. an environment free of harassment & 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 Intake Form – Concussion/Head Injury
Confidential Information Form

Date: _____

Last name: _____

First name: _____

Student Number: _____ Age: _____ Gender: _____

Permanent/Sessional Address: _____

City: _____ Postal Code: _____

E-mail Address: _____

Telephone:

Type:	Phone Number:	Session(s):	May we leave a message?
Primary O Home O Work O Cell O Pager	(_____) _____	O Sessional O Permanent	O Yes O No O Name & phone # only.

Have you used special student services before?
O Yes O No If yes, who was your primary contact _____
and when were you here? _____

What is your current status at (enter University, College or other Post Secondary Institution)?
O Part-Time Student (0.5 to 2.5 courses)
O Full-Time Student (3.0 or more courses)
O Visiting or Foreign Student

Undergraduate students: How many credits have you earned to date?
O 0 - 3.5 O 4.0 - 8.5 O 9.0 -13.5 O 14 or more

Program:	Enter Faculty and Degree:	Graduate Studies:
O Academic Bridging Program O Transitional Year Program O Regular Program	_____ _____	**Degree:** _____ **Program:** _____ **Stage in program:** O Course work O Comprehensive O Thesis

* Adapted from the Concussion Intake Guidelines for the University of Toronto.

With which areas do you need assistance?

O Chronic Health Problem (e.g. epilepsy/MS/MD/IBD/Cancer)
O Mobility/Functional Disability (e.g. CP/Polio/RSI)
O Mental Health Condition (e.g. Depression/Bipolar/Anxiety Disorder/OCD)
O Learning Disability or ADHD
O Head Injury
O Sensory Disability (e.g. Hearing/Vision)
O Temporary (Please describe):

_____

_____

O Other (Please describe):

_____

_____

THE INFORMATION ON THIS FORM IS CONFIDENTIAL.
IF YOU NEED ASSISTANCE COMPLETING THIS FORM, PLEASE ASK AT THE FRONT DESK.

Accessibility Services
Initial Questionnaire for Students with a Concussion

If you require assistance completing this form or need it in alternative format, please ask at the front desk.

Please answer the following questions as completely as possible. The information you provide will help us to develop an accommodation plan that meets your individual needs.

1. When did you receive your concussion? (Date) _____

2. How did your concussion occur? (Please check one)
   O while playing/practicing sports
   O from a fall
   O from a motorcycle/car or bike accident
   O pedestrian accident
   O assault
   O other (please specify)_____

3. Did you see a doctor/attend a clinic or hospital after your injury? O Yes O No

   If yes, indicate who you saw:

   _____

4. Were x-rays, CT of the brain or MRI of head undertaken? _____

5. Are you undergoing any treatment for your concussion? O Yes O No

   If yes, please describe:

   _____

   _____

6. Have you been referred to/seen a specialist? O Yes O No

* Adapted from the Concussion Intake Guidelines for the University of Toronto.

If yes, please describe:

_____

_____

7. Do you currently have accommodations related to your concussion? O Yes O No

8. Have you missed class as a result of your injury? O Yes O No

9. Have you missed a test(s) as a result of your injury? O Yes O No

10. Have you spoken to your course coordinator/Registrar about your injury? O Yes O No

11. Since the date of your concussion, you may have experienced a number of physical and/or cognitive symptoms. Please check all the boxes that apply as they relate to the LAST WEEK only.
    O headaches
    O sensitivity to light
    O neck pain
    O noise sensitivity
    O blurred vision
    O ringing/buzzing in ears
    O sleep disturbance
    O reduced or lost sense of smell/taste
    O difficulty concentrating
    O difficulty paying attention
    O difficulty organizing work
    O difficulty remembering old information
    O difficulty reading
    O difficulty generating the right words
    O feeling “foggy”
    O more irritable
    O lowered mood/crying

12. Have you ever been told you have?
    A learning disability O Yes O No
    Attention Deficit Disorder O Yes O No
    Mental health condition O Yes O No

13. Have you had any prior concussions/head injuries? O Yes O No

14. If you answered yes above, please provide details of prior head injuries:

    Date: _____

    Symptoms: _____

    _____

15. Have you ever been on academic probation or suspension? O Yes O No

16. Do you have student funding? O Yes O No

    If yes, are you eligible for student funding? O Yes O No

* Adapted from the Concussion Intake Guidelines for the University of Toronto.

Appendix 12.3

Greater Accommodations for Students with Persistent Symptoms following mTBI

Activities	• Students should not participate in any physical education or other classes with physical or safety demands (e.g., music, woodworking, automotive, welding) until cleared by a physician or a neuropsychologist. • However, to decrease social isolation and or anxiety/ depression and to support inclusion and optimism, efforts could be made to allow the student to audit or participate in non-competitive/contact activities with their peers/classmates (e.g. scorekeeping at a game, sit with classmates who may be using machinery, other tasks). • Students should have limited computer (and tablet) demands initially as screens are often a trigger for cognitive fatigue and headaches.

Curriculum	• A reduced course load may be beneficial and or necessary, if the student is experiencing ongoing cognitive symptoms.
	• Upon initial return the student should refrain from taking tests and exams, and have limited to no assignments. These should be re-implemented in close consultation with the instructor/professor, student and possibly a neuropsychologist and or speech language pathologist. Consider also the involvement of occupational therapists/academic coaching services.
	• The student may also benefit from accommodations for testing to reduce the memory load, such as:
	  • 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 room
	  • Allowing testing in natural light situations (light sensitivity)
	  • Extra time/no time limits and regular breaks
	  • 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)
	  • Provision of formula and data sheets to reduce memory load
	  • Use of a computer to type answers with screen shield on computer,
	  • Use of reduced contrast coloured paper for exams
	  • Return to class but deferral of examinations to next exam period
	• Consideration should also be given to the following:
	  • 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.

Environment	• 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).
Timetable	• 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 though 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-ooperative 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 participant 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:							

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 A

Project Members

PROJECT TEAM MEMBERS

Project Team Leader

Shawn Marshall, MD, MSc, FRCPC
Ottawa Hospital Research Institute

Project Investigators

Mark Bayley, MD, FRCPC
Toronto Rehabilitation Institute, University Health Network

Lindsay Berrigan, PhD
Dalhousie University

Scott McCullagh, MD, FRCPC
Sunnybrook Health Science Center

Donna Ouchterlony MD, CCFP
St. Michael's Hospital

Diana Velikonja, PhD, CPsych
Hamilton Health Sciences

Project Coordinator

Kelly Weegar, PhD (Candidate)
Ottawa Hospital Research Institute

Student Research Assistants

Andrew Bayne, BSc (Candidate)
McGill University

Natalie Fersht, BSocSc (Candidate)
University of Ottawa

Hayley MacLeay, BA & Sc (Candidate)
McGill University

Chantal Rockwell, BA (Hons)
Ottawa Hospital Research Institute

Kelsey Scheier, BSc (Candidate)
University of Waterloo

EXPERT CONSENSUS GROUP

Robert Brison MD, MPH, FRCP
Queen's University

Carol Cancelliere DC, MPH
Toronto Western Research Institute, University Health Network

Angela Colantonio PhD, OT
University of Toronto, Toronto Rehabilitation Institute

Victor Coronado, MD, MPH
*Centers for Disease Control and Prevention (USA)**

Nora Cullen, MD, MSc, FRCPC
Toronto Rehabilitation Institute, University Health Network

Lisa Fischer MD, CCFP, DipSportMed
Western University

Anne Forrest, PhD
mTBI Survivor

Bryan Garber, MD
National Defence, Government of Canada

Jonathan Gladstone, MD, FRCPC
University of Toronto

Wayne Gordon, PhD, ABPP/Cn
Mount Sinai School of Medicine

Robin Green, PhD, CPsych
Toronto Rehabilitation Institute, University Health Network

Grant Iverson, PhD, RPsych
University of British Columbia

Corinne Kagan BA, BPS Cert
Ontario Neurotrauma Foundation

Vicki Kristman, PhD
Lakehead University

Andrea Laborde, MD
Royal Hobart Hospital (Australia)

* 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.

Patricia McCord, DC

Willie Miller, MD, FRCPC
University of Ottawa

Gregory O'Shanick, MD
Center for Neurorehabilitation Services (USA)

Marie-Christine Ouellet, PhD
Université Laval

Angela Peddle, OD, FCOVD
University of Waterloo

Laura Rees, PhD, CPsych
The Ottawa Hospital Rehabilitation Center

Wendy Shama MSW, RSW
mTBI Survivor

Mary Stergiou-Kita, PhD
University of Toronto

Rob van Reekum, MD, FRCPC
University of Toronto

Catherine Wiseman-Hakes, PhD, Reg CASLPO
Hôpital du Sacré-Coeur de Montréal

Mark Rapoport, MD, FRCPC
Sunnybrook Health Sciences Center, University of Toronto

Noah Silverberg, PhD, RPsych, ABPP
University of British Columbia

Bonnie Swaine, PT, PhD
Université de Montréal

Charles Tator, PhD, MD
University of Toronto

STAKEHOLDERS/AUDITORS

Humberto Laranjo
Emergency Nurses Association of Ontario

Ruth Wilcock
Ontario Brain Injury Association

Roger Zemek
Children's Hospital of Eastern Ontario

Injury Claims Managers from the Property and Casualty Insurance Industry

EXTERNAL REVIEWERS

Markus Besemann, LCol, BSc, MD, FRCP, DipSportMed
Canadian Forces Health Services - Rehabilitation Medicine

Pierre Côté, DC, PhD
University of Ontario Institute of Technology

David Cifu, MD
Virginia Commonwealth University, US Department of Veterans Affairs

Appendix B

Formal Schema Used in the Establishment of the mTBI Expert Consensus Group

DOMAIN OF EXPERTISE																GEOGRAPHIC LOCATION						
																ONTARIO				OTHER		
ACTIVITY	BEHAVIOUR	COGNITION	COMMUNICATION	HEADACHE	LITERATURE REVIEW	MOOD/AFFECTIVE	NEURORADIOLOGY	OBJECTIVE EVIDENCE MTBI	OUTCOMES OR KT	PHYSICAL	POLICY/SYSTEMS	QUALITY OF LIFE	RETURN TO WORK	SLEEP/FATIGUE	SPORTS	TORONTO	OTTAWA	HAMILTON	OTHER	CANADA	USA	ABROAD
																X						
X	X	X							X	X						X						
		X							X											X		
										X									X			
					X											X						
X	X								X			X				X						
								X	X		X										X	
X	X	X				X		X	X	X						X						
																X						
X										X					X				X			
																					X	
	X	X				X							X		X	X						
	X	X			X	X	X	X	X				X		X					X		
											X					X						
					X			X					X						X			
X	X									X												X
										X									X			
X		X			X				X	X												
		X								X						X						
	X	X				X		X	X											X		
							X															
	X	X				X			X							X						
X	X	X				X		X	X	X		X				X						
	X	X				X								X						X		
X	X	X										X	X			X						
																X						
X	X	X											X			X						
	X	X				X											X					
X	X	X			X	X			X	X						X						
	X	X				X			X				X	X					X			
		X				X							X	X								
X	X	X	X			X			X	X			X		X	X						
11	17	18	1	1	5	13	2	11	11	11	2	7	7	2	7	16	4	2	4	4	4	1

HEALTH DISCIPLINE BACKGROUND																			STAKEHOLDER GROUP											
CHIROPRACTOR	EPIDEMIOLOGY	MD - EMERGENCY MEDICINE	MD - FAMILY MEDICINE	MD - GENERAL SURGERY	MD - NEUROLOGY	MD - NEUROPSYCHIATRY	MD - NEUROSURGERY	MD - PHYSICAL MEDICINE & REHAB	MD - PSYCHIATRY	OCCUPATIONAL THERAPY	OPTOMETRIST/ VISION REHAB	RADIOLOGY	REGISTERED NURSE	PSYCHOLOGY	SLEEP NEUROSCIENCE	SOCIAL WORK	SPEECH-LANGUAGE PATHOLOGY	CONSUMER	BIAA	CDC	CMA	DND/CF	ENAO	IBIA	INSURANCE	ONF	OBIA	OCFP	REPAR
																									X				
								X																		X			
														X															
	X	X																											
X																													
										X																			
	X	X																		X									
								X																	X				
			X																X										
				X																	X								
					X																								
									X																				
								X																		X			
	X																									X			
								X																					
													X																	
X																													
									X																				
							X														X								
			X				X													X					X		X		
														X																X
												X																		
											X					X			X											
									X					X																
														X													X			
														X														X		
															X			X												X
2	3	2	2	1	1	1	1	4	3	2	1	1	1	7	1	1	1	2	1	1	1	1	1	1	2	7	1	1	2

Abbreviations

BIAA	Brain Injury Association of America
CDC	Centers for Disease Control and Prevention (USA)
CMA	Canadian Medical Association
DND/CF	National Defence and Canadian Forces
ENAO	Emergency Nurses Association of Ontario
IBIA	International Brain Injury Association
ONF	Ontario Neurotrauma Foundation
OBIA	Ontario Brain Injury Association
OCFP	Ontario Chapter of the College of Family Physicians
REPAR	Réseau Provincial de Recherche en Adaptation-Réadaptation (Québec Rehabilitation Research Network)

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.

One member of the expert consensus group reported they have received honorariums for speaking engagements regarding mTBI, they have received funding from several test publishing companies to act a consultant, and they are involved as an investigator in clinical trials on research projects related to TBI rehabilitation topics.

Another member of the expert consensus group reported receiving royalties from a publishing company for a psychological test (Computerized Test for Information Processing) used in TBI assessment.

One of the other expert consensus group members stated they are an investigator on research projects focused on treatment relating to sport concussion and they have been a paid medical educator (Clinical Medical Research Group Ltd.) for sport concussion management and use of neuropsychological testing.

Three other members of the expert consensus group declared they are involved as investigators in clinical trials on research projects related to TBI rehabilitation topics.

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.

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/
2. craniocerebral trauma/ or head injuries, closed/
3. concussion.tw.
4. postconcuss$.tw.
5. post-concuss$.tw.
6. 1 or 2 or 3 or 4 or 5
7. limit 6 to yr=”2008 - 2012”
8. head injur$.tw.
9. brain injur$.tw.
10. craniocerebral trauma.tw.
11. 8 or 9 or 10
12. limit 11 to yr=”2008 -Current”
13. 12 not 7

EMBASE (Ovid)

1. *brain concussion/
2. *brain injury/
3. *concussion/
4. *head injury/
5. *postconcussion syndrome/
6. concuss$.tw.
7. post-concuss$.tw.
8. brain injur$.tw.
9. head injur$.tw.
10. *traumatic brain injury/
11. traumatic brain injury.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=”2008 -Current”
14. limit 13 to human
15. limit 14 to (adult <18 to 64 years> or aged <65+ years>)
16. 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 ((“2008/01/01”[PDat] : “2012/12/31”[PDat]))

1. postconcussion[Title/Abstract] OR
2. diffuse axonal injury[Title/Abstract] OR
3. mild brain injury[Title/Abstract] OR
4. minor brain injury[Title/Abstract] OR
5. post concussion[Title/Abstract] OR
6. brain injury[Title/Abstract] OR
7. head injury[Title/Abstract] OR
8. brain injuries[Title/Abstract] OR

9. head injuries[Title/Abstract] OR
10. brain concussion[Title/Abstract] OR
11. concussion[Title/Abstract] AND
12. publisher[sb] AND
13. "2008/01/01"[PDat]: "2012/12/31"[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="2008 - 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 2008 to 2012

Appendix E

AGREE II Overall Quality Ratings: Mild TBI Clinical Practice Guidelines

Clinical Practice Guideline	Number of Raters	Overall Quality	Overall Recommendation (%)			
			Recommend	Recommend with Modifications	Do Not Recommend	Unsure
1. Evidence-based Guideline for Clinicians: Evaluation and Management of Concussion in Sports, American Academy of Neurology, 2013 [AAN]	6	6/7	100	0	0	0
2. Team Physician Consensus Statement: Concussion (Mild Traumatic Brain Injury) and the Team Physician, American College of Sports Medicine, 2011 [ACSM]	6	3/7	0	50	50	0
3. Care of the Patient with Mild Traumatic Brain Injury, American Association of Neuroscience Nurses and Association of Rehabilitation Nurses Clinical Practice Guideline Series, 2011 [AANN/ARN]	6	4/7	0	33	67	0
4. Consensus Statement on Concussion in Sport, The 4th International Conference on Concussion in Sport, McCrory et al., 2012 [CIS]	5	5/7	20	80	0	0
5. Adult Trauma Clinical Practice Guidelines, Initial Management of Closed Head Injury in Adults: 2nd Edition, New South Wales Ministry of Health, 2011 [NSW]	6	5/7	83	0	17	0
6. Early Management of Patients with a Head Injury: A National Clinical Guideline, Scottish Intercollegiate Guidelines Network, 2009 [SIGN]	6	6/7	83	17	0	0
7. Is Rest After Concussion "The Best Medicine?": Recommendations for Activity Resumption Following Concussion in Athletes, Civilians, and Military Service Members, Silverberg & Iverson, 2012 [Silverberg]	6	4/7	33	33	17	17
8. A Guideline for Vocational Evaluation Following Traumatic Brain Injury: A Systematic and Evidence-Based Approach, Stergiou-Kita et al., Dawson, & Rappolt, 2011 [Stergiou-Kita]	6	5/7	50	33	17	0
9. Clinical Practice Guideline: Management of Concussion/Mild Traumatic Brain Injury, US Department of Veteran Affairs & Department of Defense, 2009 [VA/DoD]	6	5/7	50	33	17	0
10. Mild Traumatic Brain Injury Program of Care, Workplace Safety and Insurance Board of Ontario, 2012 [WSIB]	6	4/7	17	0	83	0

References

1 Giza CG, Kutcher JS, Ashwal S, Barth J, Getchius TSD, Gioia GA, et al. Summary of evidence-based guideline update: Evaluation and management of concussion in sports. *Neurology*. 2013. [Epub ahead of print].

2 Herring SA, Cantu RC, Guskiewicz KM, Putukian M, Kibler WB, Bergfeld JA, et al. Concussion (mild traumatic brain injury) and the team physician: A consensus statement—2011 update. *Medicine & Science in Sports & Exercise*. 2011;43(12):2412-2422.

3 Clinical practice guideline series: Care of the patient with mild traumatic brain injury. Illinois: American Association of Neuroscience Nurses and the Association of Rehabilitation Nurses; 2011.

4 McCrory P, Meeuwisse WH, Aubry M, Cantu B, Dvorák J, Echemendia RJ, 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):250-258.

5 Adult trauma clinical practice guidelines: Initial management of closed head injury in adults: 2nd Edition. New South Wales: NSW Ministry of Health; 2011.

6 Early management of patients with a head injury: A national clinical guideline. Edinburgh: Scottish Intercollegiate Guidelines Network; 2009.

7 Silverberg ND, Iverson GL. Is rest after concussion "the best medicine?": Recommendations for activity resumption following concussion in athletes, civilians, and military service members. *Journal of Head Trauma Rehabilitatio*n. 2013;28(4):250-259.

8 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.

9 Management of Concussion/mTBI Working Group. VA/DoD clinical practice guideline for management of concussion/mild traumatic brain injury. *Journal of Rehabilitation Research and Development*. 2009;46(6):CP1-68.

10 Mild traumatic brain injury program of care. Toronto: Workplace Safety and Insurance Board Ontario; 2012.

Appendix F

Example Spreadsheet Summary of New Guidance & Evidence (Provided to the Working Groups at the Expert Consensus Conference)

For the expert consensus conference in November, recommendations from other existing guidelines, new treatment/ intervention articles and details regarding potential resources were extracted and organized into spreadsheets according to their similarity with the guideline recommendations from the First 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. In the last tab of the spreadsheet, experts were asked to complete a decision summary with their working group detailing whether or not they suggested keeping the recommendation, as well as any changes to wording, level of evidence, and resources. All spreadsheets were made available to all experts before, during and after the consensus meeting.

Spreadsheet Tab 1

Original Guideline Recommendation (from 1st Edition)

7. Persistent Sleep Disturbances	
7.4	Pharmacotherapy is generally recommended at the lowest effective dose as short-term treatment lasting less than 7 days. Although long-term use of hypnotic agents is discouraged due to the potential for tolerance and dependence, there are specific situations and circumstances under which long-term use of hypnotics may be appropriate. Refer to the Therapeutic Options Table taken from the Alberta TOP guideline (Appendix 7.2) for suggestions on useful medications.

Evidence Cited in 1st Edition

Level of Evidence	Source of Recommendation (i.e., pre-existing guideline, literature, expert consensus)	Population Addressed by Source (TBI or other)
C	Alberta Medical Association Toward Optimized Practice, Clinical Practice Guideline Adult Primary Insomnia: Diagnosis to Management	Adults experiencing primary insomnia

Primary Sources Cited in Pre-Existing Guidelines

None.

Spreadsheet Tab 2

New Guideline Recommendations

Original Guideline Recommendation (from 1st Edition)

7. Persistent Sleep Disturbances	
7.4	Pharmacotherapy is generally recommended at the lowest effective dose as short-term treatment lasting less than 7 days. Although long-term use of hypnotic agents is discouraged due to the potential for tolerance and dependence, there are specific situations and circumstances under which long-term use of hypnotics may be appropriate. Refer to the Therapeutic Options Table taken from the Alberta TOP guideline (Appendix 7.2) for suggestions on useful medications.

List of New Recommendations from Other Existing Guidelines:

#	Guideline
1	When prescribing any medication for patients who have sustained a concussion/mTBI, the following should be considered: a. Review and minimize all medication and over-the-counter supplements that may exacerbate or maintain symptoms b. Use caution when initiating new pharmacologic interventions to avoid the sedating properties that may have an impact upon a person's attention, cognition, and motor performance. c. Recognize the risk of overdose with therapy of many medication classes (e.g., tricyclics). Initial quantities dispensed should reflect this concern. d. Initiate therapy with the lowest effective dose, allow adequate time for any drug trials, and titrate dosage slowly based on tolerability and clinical response. e. Document and inform all those who are treating the person of current medications and any medication changes.
2	Pharmacological approaches to sleep regulation may prove beneficial.

Spreadsheet Tab 2 (Continued)

Detailed Summary (List of New Guidelines)

1

[Section 5.4] Page 45

When prescribing any medication for patients who have sustained a concussion/mTBI, the following should be considered:

a. **Review and minimize all medication and over-the-counter supplements that may exacerbate or maintain symptoms**
b. **Use caution when initiating new pharmacologic interventions to avoid the sedating properties that may have an impact upon a person's attention, cognition, and motor performance.**
c. **Recognize the risk of overdose with therapy of many medication classes (e.g., tricyclics). Initial quantities dispensed should reflect this concern.**
d. **Initiate therapy with the lowest effective dose, allow adequate time for any drug trials, and titrate dosage slowly based on tolerability and clinical response.**
e. **Document and inform all those who are treating the person of current medications and any medication changes.**

Level of Evidence	AGREE II Quality Rating	Year	Source of Recommendation	Population Addressed (TBI or other)	Comments
Not indicated	5	2009	VA/DoD Clinical Practice Guideline For Management of Concussion/mTBI	TBI	None.

Primary Sources Cited

None.

2

[Appendix D-4] Page 84

Pharmacological approaches to sleep regulation may prove beneficial.

Level of Evidence	AGREE II Quality Rating	Year	Source of Recommendation	Population Addressed (TBI or other)	Comments
Not indicated	5	2009	VA/DoD Clinical Practice Guideline For Management of Concussion/mTBI	TBI	See Pharmacotherapy Chart: Appendix E

Primary Sources Cited

None.

Spreadsheet Tab 3

New Evidence

Original Guideline Recommendation (from 1st Edition)

7. Persistent Sleep Disturbances	
7.4	Pharmacotherapy is generally recommended at the lowest effective dose as short-term treatment lasting less than 7 days. Although long-term use of hypnotic agents is discouraged due to the potential for tolerance and dependence, there are specific situations and circumstances under which long-term use of hypnotics may be appropriate. Refer to the Therapeutic Options Table taken from the Alberta TOP guideline (Appendix 7.2) for suggestions on useful medications.

#	Title	Author(s)	Year	Summary	Quality Rating
1	Improving sleep: Initial headache treatment in OIF/OEF veterans with blast-induced mild traumatic brain injury	Ruff, Ruff & Wang	2009	**Objective/Hypotheses:** The objective of this study was to determine whether treating impaired sleep would reduce headache frequency and severity. Three hypotheses: (1) OIF/OEF veterans would tolerate prazosin with a low incidence of side effects, (2) prazosin combined with sleep hygiene counseling would improve sleep among OIF/OEF veterans with mTBI, and (3) veterans who took prazosin and received sleep hygiene counseling would have less severe headache pain and fewer headaches. **Methods:** We drew the cohort of 74 veterans described in this study from a study group that consisted of 126 OIF/OEF veterans with mild TBI due to exposure to a combat-associated explosion. Each of the 126 veterans had a detailed neurological examination, neuropsychological testing, and an assessment for PTSD. We used the Montreal Cognitive Assessment (MoCA) to repeatedly assess cognitive function. In addition, we used the Epworth Sleepiness Scale (ESS) to assess daytime sleepiness. **Results:** Nine weeks after providing sleep counseling and initiating an increasing dosage schedule of prazosin at bedtime, 65 veterans reported restful sleep. Peak headache pain (0-10 scale) decreased from 7.28 +/- 0.27 to 4.08 +/- 0.19 (values presented as mean +/- standard deviation). The number of headaches per month decreased from 12.40 +/- 0.94 to 4.77 +/- 0.34. MoCA scores improved from 24.50 +/- 0.49 to 28.60 +/- 0.59. We found these gains maintained 6 months later.	DOWNS & BLACK: 17/32* *1 of the sections were not applicable

Spreadsheet Tab 3 (Continued)

				Conclusion: We found that prazosin combined with sleep hygiene counseling was an effective initial treatment for a group of OIF/OEF veterans with headaches associated with histories of mild TBI from exposure to an explosion in combat. Prazosin was well tolerated. We believe that the prazosin and sleep hygiene counseling improved sleep by reducing the amount of time it took to fall asleep and preventing nocturnal arousals due to nightmares.	

Reference List

Ruff, R.L., Ruff, S.S., & Wang, X-F. Improving sleep: Initial headache treatment in OIF/OEF veterans with blast-induced mild traumatic brain injury. J Rehabil Res Dev. 2009;46(9):1071-1084.

Spreadsheet Tab 4

Resources / Appendices / Tools

Resources from First Edition:

#	Title	Author(s)	Year	Summary
1	Therapeutic Options from the Alberta Top Clinical Practice Guideline for Adult Primary Insomnia: Diagnosis to Management	TOP Clinical Practice Guideline	2010	Contains a list of medications that can be used to induce sleep, as well as a list of their side effects.

Reference List

Toward Optimized Practice (TOP) Working Group for Insomnia. Guideline for adult primary insomnia: diagnosis to management. Edmonton, AB: Toward Optimized Practice. 2010.

New Resources:

#	Title	Author(s)	Year	Summary
1	Table 3. Pharmacotherapy for Sleep Disturbances	Petraglia et al.	2012	Narrative review to provide an organized, comprehensive overview of the available pharmacological treatment options and strategies for concussion management based on the most current available medical literature. **See Table 3 for pharmacotherapy options for sleep disturbances.**

Reference List

Petraglia AL, Maroon JC, Bailes JE. (2012). From the Field of Play to the Field of Combat: A Review of the Pharmacological Management of Concussion. Neurosurgery 70:1520–1533.

Spreadsheet Tab 5

Decision Summary – TO BE COMPLETED BY EXPERT CONSENSUS MEMBERS

Original Guideline Recommendation (from 1st Edition)

7. Persistent Sleep Disturbances	
7.4	Pharmacotherapy is generally recommended at the lowest effective dose as short-term treatment lasting less than 7 days. Although long-term use of hypnotic agents is discouraged due to the potential for tolerance and dependence, there are specific situations and circumstances under which long-term use of hypnotics may be appropriate. Refer to the Therapeutic Options Table taken from the Alberta TOP guideline (Appendix 7.2) for suggestions on useful medications.

	Keep
	Delete

Spreadsheet Tab 5 (Continued)

If keep:

Modifications:

- Unchanged
- Edited (minor)
- Edited (major)

If edited, enter the updated guideline recommendation:

Review Level of Evidence:

- Unchanged
- Changed to ____

Comments:

Resources:

- None available
- Original resource - unmodified
- Original resource - modified
- New resource - unmodified
- New resource - modified

Comments:

If new resources, list and describe here:

#	Title	Author(s)	Year	Summary
1				
2				

Appendix G

Results of the mTBI Systematic Review of the Literature (2008 - June 2012)

Cognitive Behavioral Therapy & Cognitive Therapy

Reference	Year	Country	Design	Quality Rating
1. Al Sayegh A, Sandford D, Carson AJ. Psychological approaches to treatment of postconcussion syndrome: a systematic review. *Journal of Neurology, Neurosurgery and Psychiatry*. 2010;81(10):1128-1134.	2009	UK	Systematic Review	PRISMA: 13/27*
Overview (Background, Objective, Methods)				
BACKGROUND: Postconcussion syndrome (PCS) is a term used to describe the complex and controversial constellation of physical, cognitive and emotional symptoms associated with mild brain injury. At the current time, there is a lack of clear, evidence-based treatment strategies. AIM: In this systematic review, the authors aimed to evaluate the potential efficacy of cognitive behavioural therapy (CBT) and other psychological treatments in postconcussion symptoms. METHODS: Four electronic databases were searched up to November 2008 for studies of psychological approaches to treatment or prevention of postconcussion syndrome or symptoms.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: This paper reports the results of 17 randomized controlled trials for psychological interventions which fell into four categories: CBT for PCS or specific PCS symptoms; information, reassurance and education; rehabilitation with a psychotherapeutic element and mindfulness/relaxation. Due to heterogeneity of methodology and outcome measures, a meta-analysis was not possible. The largest limitation to our findings was the lack of high-quality studies (all RCTs included were assessed the 22-item CONSORT statement 2001 checklist). CONCLUSION: There was promising evidence that CBT may be effective in the treatment of PCS. Information, education and reassurance alone may not be as beneficial as previously thought. There was limited evidence that multi-faceted rehabilitation programs that include a psychotherapeutic element or mindfulness/relaxation benefit those with persisting symptoms. Further, more rigorous trials of CBT for PCS are required.				

* Additional analyses were not undertaken (i.e., meta-analyses), so 5 of the items were not applicable.

Reference	Year	Country	Design	Quality Rating
2. Topolovec-Vranic J, Cullen N, Michalak A, Ouchterlony D, Bhalerao S, Masanic C, Cusimano MD. Evaluation of an online cognitive behavioural therapy program by patients with traumatic brain injury and depression. *Brain Injury*. 2010;24(5):761-772.	2010	Canada	Observational Study	DOWNS & BLACK: 18/32*
Overview (Background, Objective, Methods)				
BACKGROUND: The MoodGYM program (http://moodgym.anu.edu.au) is an internet-delivered CBT program that was developed to treat and prevent depression in young people with access to the internet. It consists of 5 cognitive behaviour training modules, a personal workbook (containing 29 exercises and assessments), an interactive game and a feedback evaluation form. Several studies have been published which demonstrate the effectiveness of the MoodGYM website in treating depression. OBJECTIVE: The most frequently reported psychiatric symptom after traumatic brain injury (TBI) is depression. This study examined whether internet-delivered cognitive behaviour therapy (CBT) could be appropriate and effective for patients with mild or moderate TBI and depression. METHODS: Patients were recruited for an at-home, 6-week internet-based CBT program (MoodGYM). Participants were assessed during this period by weekly telephone calls and at 12 months post-enrolment. Intervention completion rates, predictors of adherence, user feedback and changes in scores on validated depression scales were assessed.				

* 4 of the sections were not applicable.

Outcome (Results, Discussion, Conclusion)
RESULTS: Twenty-one patients were recruited: 64% and 43% completed the 6-week intervention and the 12-month follow-up, respectively. Adherence rates were not predicted by demographic or injury characteristics in this small sample. Patients identified reading, memory and comprehension requirements as limitations of the program. Scores on the depression scales were significantly decreased upon completion of the intervention and at the 12-month follow-up. DISCUSSION: Due to the small sample size the ability to identify demographic and injury variables associated with program adherence was limited. In this sample, completion rates did not differ by age, gender, marital status, education level, employment status, injury severity or time since injury. A limitation to the study was the absence of a control group. CONCLUSION: The MoodGYM program may be effective for treating symptoms of depression in patients with TBI. While adherence rates were not predicted by age, education level or injury severity, demands upon memory and concentration which may already be compromised in these patients need to be considered.

Depression/Psychological

Reference	Year	Country	Design	Quality Rating
3. Fann JR, Hart T, Schomer KG. Treatment for depression after traumatic brain injury: a systematic review. *Journal of Neurotrauma*. 2009;26(12):2383-2402.	2009	US	Systematic Review	PRISMA: 13/27*
Overview (Background, Objective, Methods)				
BACKGROUND: Depressed survivors of TBI with MDD lasting more than 6 months exhibit deterioration in social functioning and performance of activities of daily living. Depression may result in part from direct or secondary injury to brain tissue. Psychosocial factors are important to consider, and multiple causes of depression may interact in ways that are poorly understood. OBJECTIVE: The aim of this systematic review was to critically evaluate the evidence on interventions for depression following TBI and provide recommendations for clinical practice and future research. Methods: The systematic review included peer-reviewed studies investigating depression and depressive symptomatology, in an adult population (including those with TBI), published since 1980, and written in English. Searches were conducted in PubMed, CINAHL, PsycINFO, ProQuest, Web of Science, and Google Scholar. 57 articles appeared to meet the inclusion criteria.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: The largest pharmacological study enrolled 54 patients, and none of the psychotherapeutic/rehabilitation interventions prospectively targeted depression. This systematic review documents that there is a paucity (small amount) of randomized controlled trials for depression following TBI. Serotonergic antidepressants and cognitive behavioural interventions appear to have the best preliminary evidence for treating depression following TBI. More research is needed to provide evidence-based treatment recommendations for depression following TBI. CONCLUSION: A combination of multidisciplinary brain injury rehabilitation plus psychiatric and psychological treatment modalities may offer the greatest potential for maximizing outcomes in the majority of people with TBI and depression.				

* Additional analyses were not undertaken (i.e., meta-analyses), so 5 of the items were not applicable.

Reference	Year	Country	Design	Quality Rating
4. Hoffman JM, Bell KR, Powell JM, Behr J, Dunn EC, Dikmen S, Bombardier CH. A randomized controlled trial of exercise to improve mood after traumatic brain injury. *PM & R*. 2010;2(10):911-919.	2010	US	RCT	PEDRO SCALE: 8/11*
Overview (Background, Objective, Methods)				
BACKGROUND: Depression is not a transient phenomenon for those with TBI. The risk for depression remains elevated for decades after the TBI. Mild TBI is associated with depression at comparably high levels to more severe TBI. OBJECTIVE: To test the hypothesis that a structured aerobic exercise regimen would decrease the severity of depressive symptoms in people with traumatic brain injury (TBI) who reported at least mild depression severity at baseline. METHODS: Weekly supervised exercise sessions over a 10-week period consisted of education, warm-up, 30 minutes of aerobic exercise, and cool down. The exercise intensity was adjusted to reach a heart rate goal of 60% of the participant's estimated maximal heart rate.				

* 1 of the sections was not applicable.

Outcome (Results, Discussion, Conclusion)
RESULTS: Between-group comparisons at 10 weeks revealed no difference between groups on the BDI ($p < .250$). For the groups divided by minutes exercised per week, the high-activity group had significantly better depression scores than those in the low-activity group ($p < .033$). The exercise group did perceive a decrease in fatigue and impact of pain as compared to the control group. CONCLUSION: Although there was no statistically significant difference between the treated and the control group on mood after intervention, those persons with TBI who recounted higher levels of exercise per week also reported less depression and improved sleep, community participation, and overall quality of life.

Reference	Year	Country	Design	Quality Rating
5. Rapoport MJ, Chan F, Lanctot K, Herrmann N, McCullagh S, Feinstein A. An open-label study of citalopram for major depression following traumatic brain injury. *Journal of Psychopharmacology*. 2008;22(8):860-864.	2008	Canada	Open-Label Study	DOWNS & BLACK: 21/32*
Overview (Background, Objective, Methods)				
BACKGROUND: Major depression is associated with substantial psychosocial dysfunction and post-concussive symptomatology following traumatic brain injury (TBI). Studies to date of anti–depressant treatment for major depression post-TBI have been limited by small sample size. OBJECTIVE: The goal of the present study is to examine the rates of response and remission associated with citalopram treatment for major depression following TBI. METHODS: Of all the subjects, 54 patients met DSM-IV criteria for 'Major Depression due to TBI, with a Major Depressive-like episode' (i.e., at least 5/9 symptoms, one of which must be either depressed mood or anhedonia), and the remaining 11 subjects met criteria for 'depressive features' (i.e., 'full criteria not met'), all within one year of their TBI. Subjects with major depression following mild- to moderate TBI were treated with open-label citalopram with a starting dose of 20 mg/day to a maximum of 50 mg/day for either 6 weeks (n = 54) or 10 weeks (n = 26). The Hamilton Depression Rating Scale (HAMD) was used to assess depression severity. Response was defined by a 50% reduction in HAMD score, and remission was defined by a HAMD score of ≤ 7.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: The mean HAMD at baseline and 6 weeks were 23.66 (SD 6.8) and 16.30 (SD 9.3), respectively ($t[53] = 7.157$, $p < 0.0001$). The mean HAMD at 10 weeks was 12.96 (SD 7.9) ($t[25] = 7.323$, $p < 0.0001$). At 6 weeks, 54 subjects were assessed and 27.7% responded with 24.1% in remission. At 10 weeks, 26 subjects were assessed and 46.2% responded with 26.9% in remission. The response rate in the present sample was substantially lower than previously reported for patients with TBI, but comparable to the results of the largest effectiveness trial of citalopram for general out-patients with major depression in the absence of TBI. DISCUSSION & CONCLUSION: The fact that four of the patients who had responded at six weeks were worse when reassessed at 10 weeks highlights the importance of a longer outcome window for the determination of antidepressant response in this population. Referral bias is a potential limitation of the study, in that those who participated in the treatment study may have been more ill than those who declined. In a large clinical sample of patients with symptoms of major depression, SSRI treatment has been shown to be insufficient for most patients, and other multi-disciplinary treatment modalities will likely be needed to achieve adequate control of symptoms.				

* 6 of the sections were not applicable.

Reference	Year	Country	Design	Quality Rating
6. Rapoport MJ, Mitchell RA, McCullagh S, Herrmann N, Chan F, Kiss A, et al. A randomized controlled trial of anti depressant continuation for major depression following traumatic brain injury. *Journal of Clinical Psychiatry*. 2010;71(9):1125-1130.	2010	Canada	RCT	PEDRO SCALE: 11/11
Overview (Background, Objective, Methods)				
BACKGROUND: Despite the heightened morbidity among TBI patients who develop depression, there is a paucity of research concerning its treatment. At present, there are no studies examining the role of continuation or maintenance antidepressants in preventing relapse of depression following TBI, once remission has been achieved. OBJECTIVE: This study examines whether continuation therapy with citalopram can prevent a relapse following remission of major depression due to TBI.				

Overview (Background, Objective, Methods)
METHODS: After 65 subjects with DSM-IV-diagnosed major depression following TBI were treated with open-label citalopram (20 mg to 50 mg/d), 25 subjects (38.5%) met criteria for remission. Of those, 21 (84.0%) were randomly assigned to either same-dose citalopram or placebo and followed monthly over 40 weeks. Remission was defined as a Hamilton Depression Rating Scale (HDRS) score of ≤ 7 or a Clinical Global Impressions-Improvement rating of “much improved” or better. The main outcome variable was the presence of relapse, as defined by meeting criteria for major depressive episode according to the DSM-IV and an HDRS score ≥ 16.
Outcome (Results, Discussion, Conclusion)
RESULTS: Ten subjects were randomly assigned to citalopram and 11 to placebo. There were 3 drop-outs, including 1 for adverse drug effects (diarrhea). Relapse occurred in 11 subjects (52.4%), with a mean ± SD time to relapse of 23.52 ± 16.6 weeks. The groups did not differ in relapse rates (drug: 50.0% [5/10] vs placebo: 54.5% [6/11], Fisher exact test, P = .835) or time to relapse (log rank test X^2 = 0.148, p = .700). DISCUSSION: Our principal finding was a relatively high rate of relapse in both the placebo and active treatment conditions, despite adequate compliance. Nonetheless, SSRIs are recommended by a number of sources as a first-line treatment option for depression following TBI. Future studies should compare various antidepressant agents, assess risk factors for persistent depressive symptoms, and attempt to determine the optimum duration of continuation treatment. CONCLUSION: The present study suggests important limitations of continuation pharmacotherapy in the prevention of relapse of major depression following TBI.

Dizziness/Vertigo/Balance

Reference	Year	Country	Design	Quality Rating
7. Alsalaheen BA, Mucha A, Morris LO, Whitney SL, Furman JM, Camiolo-Reddy CE, et al. Vestibular rehabilitation for dizziness and balance disorders after concussion. *Journal of Neurological Physical Therapy.* 2010;34(2):87-93.	2010	US	Retrospective Chart Review	DOWNS & BLACK: 11/27*
Overview (Background, Objective, Methods)				
BACKGROUND & OBJECTIVE: Management of dizziness and balance dysfunction is a major challenge after concussion. The purpose of this study was to examine the effect of vestibular rehabilitation in reducing dizziness and to improve gait and balance function in people after concussion. METHODS: A retrospective chart review of 114 patients referred for vestibular rehabilitation after concussion was performed. The vestibular rehabilitation intervention consisted of a customized program that was tailored to each patient’s impairments and functional limitations that related to dizziness, ocular motor function, and gait and balance function. Exercises were prescribed to be done daily. At the time of initial evaluation and discharge, recordings were made of outcome measures of self-report (eg, dizziness severity, Activities-specific Balance Confidence Scale, and Dizziness Handicap Inventory) and gait and balance performance (e.g., Dynamic Gait Index, gait speed, and the Sensory Organization Test). A mixed-factor repeated-measures analysis of variance was used to test whether there was an effect of vestibular rehabilitation therapy and age on the outcome measures.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: Of the 114 patients who were referred, 84 returned for at least 1 visit, and the median number of visits was 4 visits (range, 2–13 visits), occurring over a median duration of 33 days (range, 7–181 days). For patients who had received vestibular rehabilitation therapy, there was a significant treatment effect for all the self-report and performance measures (Table 2). Namely, in these patients, improvements were observed in all self-report, gait, and balance performance measures at the time of discharge (P < .05). DISCUSSION: Vestibular rehabilitation should be considered in the management of individuals post-concussion who experience dizziness and gait and balance dysfunction that do not resolve with rest.				

* 5 of the sections were not applicable.

Medication

Reference	Year	Country	Design	Quality Rating
8. Ballesteros J, Güemes I, Ibarra N, Quemada JI. The effectiveness of donepezil for cognitive rehabilitation after traumatic brain injury: a systematic review. *Journal of Head Trauma Rehabilitation*. 2008;23(3):171-180.	2008	Spain	Systematic Review	PRISMA: 9/27*

* Additional analyses were not undertaken (i.e., meta-analyses), so 5 of the items were not applicable.

Overview (Background, Objective, Methods)
BACKGROUND: Several studies have shown the important role acetylcholine pathways and transmission play for improving cognitive functions after sustained injuries. These results opened the way to test the efficacy of acetylcholinesterase inhibitors (AChEIs), among other drugs, for cognitive rehabilitation after traumatic brain injury (TBI). The evidence supporting the off-label use of AChEIs for the rehabilitation of cognitive impairments sustained after TBI is scarce. OBJECTIVE: To systematically review all the published evidence concerning the efficacy and safety of AChEIs for the rehabilitation of cognitive impairments after TBI. We chose to focus on donepezil, as it is the only new AChEI for which such information was available. METHODS: Three electronic databases were searched: PubMed, PsycINFO, and CENTRAL (part of the Cochrane Library). The search strategy included both free text and appropriate thesaurus terms for the key words “traumatic brain injury” and “donepezil.” The search was not restricted by language or design.
Outcome (Results, Discussion, Conclusion)
RESULTS: Our electronic searches recovered 39 potential articles. After reading their titles and abstracts, we retrieved 14 articles for assessment. No ongoing RCT assessing the effect of donepezil on TBI was found. Overall, when applied within 3 months of injury, donepezil showed a moderate-sized effect for the improvement of general cognition outcomes. The individual results from the study of Zhang et al10 also showed a significant and important improvement in short-term memory and attention. However, it is worth noting that these outcomes were assessed only for the first period of the crossover trial. The authors suggested a carry-over effect in the second period, and the article did not report enough data to calculate a corrected effect size for the whole trial. This RCT was performed on subjects within 1 year of TBI. CONCLUSION: The bottom line is that the effectiveness of donepezil on cognitive rehabilitation after TBI remains uncertain owing to the scarce evidence so far obtained, and the poor methodological quality of the studies. Additional larger RCTs of good quality are needed to substantiate beyond any reasonable doubt the offlabel indication of donepezil (and other AChEIs) in the treatment of cognitive impairments following TBI.

Reference	Year	Country	Design	Quality Rating
9. Wheaton P, Mathias JL, Vink R. Impact of early pharmacological treatments on cognitive and behavioral outcomes after traumatic brain injury in adults. *Journal of Clinical Psychopharmacology*. 2009;29:468-477.	2009	Australia	Meta-Analysis	PRISMA: 12/27*
Overview (Background, Objective, Methods)				
BACKGROUND: Early pharmacological treatment has the potential to reduce some of the disabling cognitive and behavioral problems that result from TBI. Although a large number of treatments have been developed, clinical research has yielded inconsistent findings with respect to the effectiveness of these pharmacological treatments on cognitive and behavioral outcomes. Furthermore, their relative efficacy has not been evaluated, thereby hindering advances in the treatment of TBI. METHODS: A meta-analysis of research that examined the impact of pharmacological treatments on cognitive and behavioral outcomes in the early stages after TBI between January 1980 and May 2008 was therefore undertaken. The PubMed and PsycINFO databases were searched using 35 terms. All articles were screened using detailed inclusion criteria. Weighted Cohen’s d effect sizes, percent overlap statistics, and fail-safe N statistics were calculated for each pharmacological agent. Studies that used different experimental designs were examined separately.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: Eleven pharmacological treatments were investigated by 22 clinical studies, comprising 6472 TBI patients in the treatment groups and 6460 TBI controls. One dopamine agonist (amantadine) and 1 bradykinin antagonist (CP-0127 [Bradycor]) produced marked treatment benefits (d ≥ 0.8) for a single measure of arousal (Glasgow Coma Scale). Notably, drug dosage and the measure chosen to assess outcome influenced the probability of finding a treatment benefit. CONCLUSION: A range of different pharmacological treatments have been used in the early phase after an injury to treat cognitive and behavioral problems caused by TBI. Only 2 of these treatments, the dopamine agonist amantadine (Symmetrel) and the bradykinin B2 antagonist CP-0127 (Bradycor), improved outcome after TBI. Importantly, these findings indicate that different drug dosages may have varying outcomes and that different cognitive and behavioral measures may be differentially sensitive to the effects of these treatments, highlighting the importance of examining multiple doses and a range of treatment outcomes.				

* 2 of the sections were not applicable.

Reference	Year	Country	Design	Quality Rating
10. Wheaton P, Mathias JL, Vink R. Impact of pharmacological treatments on cognitive and behavioral outcome in the postacute stages of adult traumatic brain injury. *Journal of Clinical Psychopharmacology*. 2011;31:745-757.	2011	Australia	Meta-Analysis	PRISMA: 15/27*
Overview (Background, Objective, Methods)				
BACKGROUND: Pharmacological treatments that are administered to adults in the postacute stage after a traumatic brain injury (TBI) (4 weeks after injury) have the potential to reduce persistent cognitive and behavioral problems. While a variety of treatments have been examined, the findings have yet to be consolidated, hampering advances in the treatment of TBI. METHODS: The PsycINFO and PubMed electronic databases were searched from January 1980 to April 2010 to identify all studies that examined pharmacological treatments for cognitive and behavioral problems after TBI, and Cohen d effect sizes, percent overlap, and failsafe N statistics were calculated for each treatment. Both randomized controlled trials and open-label studies (prospective and retrospective) were included.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: Nineteen treatments were investigated by 30 independent studies, comprising 395 participants with TBI in the treatment groups and 137 control subjects. When treated in the postacute period, 1 dopaminergic agent (methylphenidate) improved behavior (anger/aggression, psychosocial function) and 1 cholinergic agent (donepezil) improved cognition (memory, attention). In addition, when the injury-to-treatment interval was broadened to include studies that administered treatment just before the postacute period, 2 dopaminergic agents (methylphenidate, amantadine) showed clinically useful treatment benefits for behavior, whereas 1 serotonergic agent (sertraline) markedly impaired cognition and psychomotor speed. CONCLUSION: In the current analysis, 4 treatments were associated with moderate to large treatment effects (sertraline, methylphenidate, donepezil, and amantadine). Specifically, methylphenidate reduced combativeness and also improved psychosocial outcome, and improvements in memory and attention were found with donepezil. Although promising, these findings require further evaluation using adequately powered randomized controlled trials to substantiate the findings of this meta-analysis.				

* 2 of the sections were not applicable.

Sleep

Reference	Year	Country	Design	Quality Rating
11. 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. *Journal of Head Trauma Rehabilitation*. 2012;27(2):135-142.	2012	US	Pilot Intervention Study	DOWNS & BLACK: 18/32*
Overview (Background, Objective, Methods)				
BACKGROUND: There is clearly a need to address sleep disturbance, given its potentially significant impact on the course of recovery from TBI. Although acupuncture has been shown to be beneficial in treating insomnia, this modality has been minimally studied in adults with acquired brain injury. OBJECTIVES: To assess the efficacy of acupuncture in treating insomnia in TBI survivors as compared to medication, to determine whether acupuncture has fewer cognitive and affective adverse effects than does medication. METHODS: Twenty-four adult TBI survivors, randomized to acupuncture or control arms were included. Degree of insomnia was rated by each participant utilizing the Insomnia Severity Index (ISI), sleep was measured objectively via the use of actigraphy, depression was monitored with the Hamilton Depression Rating Scale, cognitive impairment was evaluated with the Repeatable Battery for the Assessment of Neuropsychological Status, and the Paced Auditory Serial Addition Test (cognitive function) was administered at baseline and post-intervention.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: Insomnia Sleep Index scores did not significantly differ between the treatment and control groups at baseline (Z=−0.78; p =.47), at posttreatment (Z=−1.51, p = .14), or at 1-month follow-up (Z = −1.78; p = .08). Divided attention (cognition) as measured by the PASAT improved for the treatment group (Z=−2.50; p = .01) but not in the control group (Z = −1.47; p = .14). DISCUSSION & CONCLUSION: Although our subject enrollment was sufficient only to perform nonparametric statistics for bivariate comparisons, our results do support our hypotheses. Despite the fact that total sleep time had not significantly changed from pre intervention to post, perception of sleep (as measured via the ISI) improved in the treatment group versus the control group. This suggests that, in addition to providing equal efficacy in sleep time achieved, acupuncture offers a sustained benefit in perception of sleep time/quality, a benefit not seen in those undergoing conventional treatment for insomnia. Further studies of this treatment modality are warranted to validate these findings and to explore factors that contribute to treatment efficacy.				

* 5 of the sections were not applicable.

Vision

Reference	Year	Country	Design	Quality Rating
12. Ciuffreda KJ, Rutner D, Kapoor N, Suchoff IB, Craig S, Han ME. Vision therapy for oculomotor dysfunctions in acquired brain injury: a retrospective analysis. *Optometry*. 2008;79(1):18-22.	2008	US	Retrospective Analysis	DOWNS & BLACK: 10/32*
Overview (Background, Objective, Methods)				
BACKGROUND: Oculomotor dysfunctions are among the most common abnormalities found in the brain-injured population. PURPOSE: The purpose of the current study was to determine retrospectively the effectiveness of conventional optometric vision therapy for oculomotor disorders of vergence and version in a sample of ambulatory, visually symptomatic, predominantly adult outpatients who had either mild traumatic brain injury (TBI) or cerebrovascular accident (CVA). METHODS: A computer-based query for acquired brain injury patients examined between the years of 2000 and 2003 was conducted in our clinic. This yielded 160 individuals with mild TBI and 60 with CVA. Of these patients, only those for whom vision therapy was prescribed and who completed an optometric vision therapy program for remediation of their oculomotor dysfunctions were selected. This included 33 with TBI and 7 with CVA. The criterion for treatment success was denoted by marked/total improvement in at least 1 primary symptom and at least 1 primary sign.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: Ninety percent of those with TBI and 100% of those with CVA were deemed to have treatment success. These improvements remained stable at retesting 2 to 3 months later. CONCLUSION: Nearly all patients in the current clinic sample exhibited either complete or marked reduction in their oculomotor-based symptoms and improvement in related clinical signs, with maintenance of the symptom reduction and sign improvements at the 2- to 3-month follow-up. These findings show the efficacy of optometric vision therapy for a range of oculomotor abnormalities in the primarily adult, mild brain-injured population. Furthermore, it shows considerable residual neural plasticity despite the presence of documented brain injury.				

* 7 of the sections were not applicable.

Other TBI

Reference	Year	Country	Design	Quality Rating
13. Andersson EE, Bedics BK, Falkmer T. Mild traumatic brain injuries: a 10-year follow-up. *Journal of Rehabilitation Medicine*. 2011;43(4):322-329.	2011	Sweden	RCT 10-year follow-up	PEDRO SCALE: 7/11*
Overview (Background, Objective, Methods)				
BACKGROUND: Previous studies have demonstrated that insufficient attention has been paid to the role of psychological distress or pain from associated injuries contributing to post-concussion symptoms (PCS). OBJECTIVE: Long-term consequences of mild traumatic brain injuries were investigated based on a 10-year follow-up of patients from a previously-published randomized controlled study of mild traumatic brain injuries. One aim was to describe changes over time after mild traumatic brain injuries in terms of the extent of persisting post-concussion symptoms, life satisfaction, perceived health, activities of daily living, changes in life roles and sick leave. Another aim was to identify differences between the intervention and control groups. METHODS: Responses on postal questionnaires were used to make comparisons within the groups between baseline (i.e., the injured person's self-rated measurement on the following instruments: LiSat-11, IAM, Role Checklist) and the 10-year follow-up.				

* 4 of the sections were not applicable.

Outcome (Results, Discussion, Conclusion)
RESULTS: No differences over time were found for the intervention and control groups in terms of post-concussion symptoms. In the intervention group some variables in life satisfaction, perceived health and daily life were decreased. Some roles had changed over the years for both groups. No other differences between the intervention and control groups were found. However, in both groups sick leave decreased. DISCUSSION: It is plausible that those with few PCS recovered spontaneously within a period of two weeks up to two months after MTBI, while persons with more PCS and other problems approximately 2–8 weeks after injury did not improve after 1 year, nor after 10 years. The fact that the intervention group had poorer outcomes was also reflected by the fact that they drove less and more often encountered problems in preparing a meal at the 10-year follow-up. Both of these activities require executive functions and simultaneous capacity. CONCLUSION: Early individual intervention by a qualified rehabilitation team does not appear to impact on the long-term outcome for persons with symptoms related to mild traumatic brain injuries. The status after approximately 3 weeks is indicative of the status after 10 years.

Reference	Year	Country	Design	Quality Rating
14. Azulay J, Smart CM, Mott T, Cicerone KD. A pilot study examining the effect of mindfulness-based stress reduction on symptoms of chronic mild traumatic brain injury/postconcussive syndrome. *Journal of Head Trauma Rehabilitation*. 2013;28(4):323-331.	2012	US	Pilot Intervention Study	DOWNS & BLACK: 11/32*
Overview (Background, Objective, Methods)				
BACKGROUND: The mindfulness-based-stress reduction (MBSR) program is a group-based intervention that was developed by Jon Kabat-Zinn in 1979. Initially designed for patients with chronic pain, it has now been widely implemented in a variety of medical and psychiatric populations such as those with chronic fatigue, pain, psoriasis, anxiety, and cancer. OBJECTIVE: To evaluate the effectiveness of the mindfulness-based stress reduction (MBSR) program tailored to individuals with mild traumatic brain injury (mTBI). METHODS: Twenty-two individuals with mTBI and a time postinjury more than 7 months. Eleven participants were men and 11 were women, ranging in age from 18 to 62 years. A 10-week group (with weekly 2-hour sessions) modeled after the MBSR program of Kabat-Zinn, but with modifications designed to facilitate implementation in a population of individuals with brain injury. Methods used: Perceived Quality of Life Scale, Perceived Self-Efficacy Scale, and the Neurobehavioral Symptom Inventory. Secondary measures included neuropsychological tests, a self-report problem-solving inventory, and a self-report measure of mindfulness.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: Clinically meaningful improvements were noted on measures of quality of life (Cohen d = 0.43) and perceived self-efficacy (Cohen d = 0.50) with smaller but still significant effects on measures of central executive aspects of working memory and regulation of attention. CONCLUSION: The MBSR program can be adapted for participants with mTBI. Improved performance on measures associated with improved quality of life and self-efficacy may be related to treatment directed at improving awareness and acceptance, thereby minimizing the catastrophic assessment of symptoms associated with mTBI and chronic disability. Additional research on the comparative effectiveness of the MBSR program for people with mTBI is warranted.				

* 4 of the sections were not applicable.

Reference	Year	Country	Design	Quality Rating
15. Bell KR, Hoffman JM, Temkin NR, Powell JM, Fraser RT, Esselman PC, et al. The effect of telephone counselling on reducing post-traumatic symptoms after mild traumatic brain injury: a randomised trial. Journal of Neurology, *Neurosurgery and Psychiatry*. 2008;79(11):1275-1281.	2008	US	RCT	PEDRO SCALE: 10/11

Overview (Background, Objective, Methods)
BACKGROUND: Mild TBI is a significant public health problem affecting approximately 1 million people annually in the USA. A total of 10–15% of individuals are estimated to have persistent posttraumatic symptoms. This study aimed to determine whether focused, scheduled telephone counselling during the first 3 months after MTBI decreases symptoms and improves functioning at 6 months. METHODS: This was a two-group, parallel, randomized clinical trial with the outcome assessed by blinded examiner at 6 months after injury. 366 of 389 eligible subjects aged 16 years or older with MTBI were enrolled in the emergency department, with an 85% follow-up completion rate. Five telephone calls were completed, individualised for patient concerns and scripted to address education, reassurance and reactivation. Two composites were analysed, one relating to post-traumatic symptoms that developed or worsened after injury and their impact on functioning, the other related to general health status.
Outcome (Results, Discussion, Conclusion)
RESULTS: The telephone counselling group had a significantly better outcome for symptoms (6.6 difference in adjusted mean symptom score, 95% confidence interval (CI) 1.2 to 12.0), but no difference in general health outcome (1.5 difference in adjusted mean functional score, 95% CI 2.2 to 5.2). A smaller proportion of the treatment group had each individual symptom (except anxiety) at assessment. Similarly, fewer of the treatment group had daily functioning negatively impacted by symptoms with the largest differences in work, leisure activities, memory and concentration and financial independence. CONCLUSION: Telephone counselling, focusing on symptom management, was successful in reducing chronic symptoms after MTBI.

Reference	Year	Country	Design	Quality Rating
16. Erickson JC. Treatment outcomes of chronic post-traumatic headaches after mild head trauma in US soldiers: an observational study. *Headache*. 2011;51(6):932-44.	2011	US	Observational Study	DOWNS & BLACK: 15/32*
Overview (Background, Objective, Methods)				
BACKGROUND: The effectiveness of medical therapies for chronic post-traumatic headaches (PTHs) attributable to mild head trauma in military troops has not been established. OBJECTIVE: To determine the treatment outcomes of acute and prophylactic medical therapies prescribed for chronic PTHs after mild head trauma in US Army soldiers. METHODS: A retrospective cohort study was conducted with 100 soldiers undergoing treatment for chronic PTH at a single US Army neurology clinic. Headache frequency and Migraine Disability Assessment (MIDAS) scores were determined at the initial clinic visit and then again by phone 3 months after starting headache prophylactic medication. Response rates of headache abortive medications were also determined. Treatment outcomes were compared between subjects with blast-related PTH and non-blast PTH.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: 77/100 subjects had blast PTH and 23/100 subjects had non-blast PTH. Headache characteristics were similar for blast PTH and non-blast PTH with 96% and 95%, respectively, resembling migraine. Headache frequency among all PTH subjects decreased from 17.1 days/month at baseline to 14.5 days/month at follow-up (P = .009). Headache frequency decreased by 41% among non-blast PTH compared to 9% among blast PTH. 57% of non-blast PTH subjects had a 50% or greater decline in headache frequency compared to 29% of blast PTH subjects (P = .023). A significant decline in headache frequency occurred in subjects treated with topiramate (n = 29, -23%, P = .02) but not among those treated with a low-dose tricyclic antidepressant (n = 48, -12%, P = .23). 70% of PTH subjects who used a triptan class medication experienced reliable headache relief within 2 hours compared to 42% of subjects using other headache abortive medications (P = .01). Triptan medications were effective for both blast PTH and non-blast PTH (66% response rate vs 86% response rate, respectively; P = .20). Headache-related disability, as measured by mean MIDAS scores, declined by 57% among all PTH subjects with no significant difference between blast PTH (-56%) and non-blast PTH (-61%). CONCLUSION: Triptan class medications are usually effective for aborting headaches in military troops with chronic PTH attributed to a concussion from a blast injury or non-blast injury. Topiramate appears to be an effective headache prophylactic therapy in military troops with chronic PTH, whereas low doses of tricyclic antidepressants appear to have little efficacy. Chronic PTH triggered by a blast injury may be less responsive to commonly prescribed headache prophylactic medications compared to non-blast PTH. These conclusions require validation by prospective, controlled clinical trials.				

* 1 of the sections was not applicable.

Reference	Year	Country	Design	Quality Rating
17. Harch PG, Andrews SR, Fogarty EF, Amen D, Pezzullo JC, Lucarini J, et al. A phase I study of low-pressure hyperbaric oxygen therapy for blast-induced post-concussion syndrome and post-traumatic stress disorder. *Journal of Neurotrauma*. 2012;29(1):168-185.	2012	US	Preliminary Report (Phase I Study)	DOWNS & BLACK: 13/32*
Overview (Background, Objective, Methods)				
BACKGROUND: This is a preliminary report on the safety and efficacy of 1.5 ATA hyperbaric oxygen therapy (HBOT) in military subjects with chronic blast-induced mild to moderate traumatic brain injury (TBI)/post-concussion syndrome (PCS) and post-traumatic stress disorder (PTSD). METHODS: The design is a pilot proof-of-concept study with pre- and post-testing and no control group. Subjects completed a history and physical exam by the P.I., clinical interview by the neuropsychologist, psychometric testing, symptom and quality-of-life questionnaires, baseline single photon emission computed tomography (SPECT), first HBOT the following day, and repeat SPECT 3 h after the first HBOT.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: All subjects were male and averaged: 30 years old, 2.8 years post-TBI, loss of consciousness of 2 min (excluding 2 subjects with 4.5 and 9 h), 6 years of service, 2.7 blast TBIs, Rivermead Post Concussion Symptoms Questionnaire (RPCSQ) score 39, PTSD Checklist-Military (PCL-M) score 67, MAST 2.1, DAST .6, Disability Rating Score (DRS) 1.6, and 39 HBOTs in 29 days. Twelve of 16 subjects had normal MRIs of the brain. Twelve of 15 subjects (80%) reported improvement in a majority of their symptoms on their prioritized symptom list after HBOT. On physical exam all 15 subjects were found to have improved on a majority of their abnormal findings. Imbalance and incoordination were the most common abnormal physical exam findings. CONCLUSION: Application of a lower-pressure protocol of 40 HBOTs at 1.5 ATA to a 16-subject cohort of military subjects with blast-induced chronic PCS and PTSD was found to be safe. The symptomatic improvements were present at 6-month phone follow-up in 92% of subjects who reported improvement after 40 HBOTs. More objective psychometric testing and SPECT imaging were not performed to confirm the durability of the HBOT treatment effect. 64% of the patients on psychoactive and narcotic prescription medications were able to decrease or eliminate use of these medications. These data are preliminary and need confirmation with larger numbers of subjects or with a stronger design such as a randomized or Bayesian study.				

* 1 of the sections was not applicable.

Reference	Year	Country	Design	Quality Rating
18. Heskestad B, Waterloo K, Baardsen R, Helseth E, Romner B, Ingebrigtsen T. No impact of early intervention on late outcome after minimal, mild and moderate head injury. *Scandinavian Journal of Trauma, Resuscitation, and Emergency Medicine*. 2010;18:10.	2010	Norway	Observational Study	DOWNS & BLACK: 12/32*
Overview (Background, Objective, Methods)				
BACKGROUND: Minimal, mild and moderate head injuries are common and many patients suffer from post-concussion symptoms after the head injury. A number of treatments, including medication for headache, bed rest, and different educational and reassuring strategies, have been suggested as possible preventive measures in observational studies. OBJECTIVE: To evaluate the effect of an educational intervention on outcome after minimal, mild and moderate head injury. METHODS: Three hundred and twenty six patients underwent stratified randomization to an intervention group (n = 163) or a control group (n = 163). Every second patient was allocated to the intervention group. Participants in this group were offered a cognitive oriented consultation two weeks after the injury, while subjects allocated to the control group were not. Both groups were invited to follow up 3 and 12 months after injury.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: A total of 50 (15%) patients completed the study (intervention group n = 22 (13%), control group n = 28 (17%), not significant). There were no statistically significant differences between the intervention group and the control group. DISCUSSION: This study shows that a significant proportion of the patients suffered from post concussion symptoms 3 months after the head injury, and that the symptoms improved from three to twelve months follow up. CONCLUSION: The main finding in the present study is that there was no effect on outcomes from an educational intervention two weeks after the injury. It has been suggested that a more extensive intervention may be more effective, but the evidence on this is conflicting.				

* 2 of the sections were not applicable.

Reference	Year	Country	Design	Quality Rating
19. Kendrick D, Silverberg ND, Barlow S, Miller WC, Moffat J. Acquired brain injury self-management programme: a pilot study. *Brain Injury*. 2012;26(10):1243-1249.	2012	Canada	Pilot Intervention Study	DOWNS & BLACK: 13/32*
Overview (Background, Objective, Methods)				
BACKGROUND: Positive outcomes from self-management programmes (SMPs) clinical trials include greater use of coping strategies, higher self-efficacy in participants' ability to manage their disease and its symptoms, lessened perceived disease burden on daily living, decreased objective disability, fewer depressive symptoms and improved energy levels. OBJECTIVE: Traditional rehabilitation is not well suited to individuals with chronic mild symptoms following an acquired brain injury. The aim of this study was to evaluate the potential effectiveness of this novel self-management programmes (SMPs). METHODS: Fifty-three participants with chronic mild symptoms following an acquired brain injury (primarily mTBI) completed an SMP. The intervention involved eight coaching sessions with each an occupational therapist and psychologist, carried out in the community and based on SMP principles. The Canadian Occupational Performance Measure was administered at baseline, discharge and 3- and 9-month follow-up. This measure yielded scores for performance and satisfaction with daily functioning, covering the domains of self-care, productivity and leisure.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: A complete case analysis of programme completers revealed that participants' ratings of their occupational performance and satisfaction improved markedly between baseline and discharge from the SMP. This set of outcome measures remained stable between discharge and the two follow-up points. CONCLUSION: This pilot study suggests that SMPs may improve daily functioning in individuals with chronic mild ABI symptoms. More methodologically robust clinical trials are warranted.				

* 4 of the sections were not applicable.

Reference	Year	Country	Design	Quality Rating
20. Leddy JJ, Kozlowski K, Donnelly JP, Pendergast DR, Epstein LH, Willer B. A preliminary study of subsymptom threshold exercise training for refractory post-concussion syndrome. *Clinical Journal of Sports Medicine*. 2010;20(1):21-27.	2010	US	Preliminary Study	DOWNS & BLACK: 18/32*
Overview (Background, Objective, Methods)				
BACKGROUND: The primary forms of PCS treatment have traditionally included rest, education, neurocognitive rehabilitation, and antidepressants, with little evidence of success. OBJECTIVE: To evaluate the safety and effectiveness of sub symptom threshold exercise training for the treatment of post-concussion syndrome (PCS). METHODS: Twelve refractory patients with PCS (6 athletes and 6 non-athletes) - Treadmill test to symptom exacerbation threshold (ST) before and after 2 to 3 weeks of baseline. Subjects then exercised 5 to 6 days per week at 80% ST heart rate (HR) until voluntary peak exertion without symptom exacerbation. Treadmill testing was repeated every 3 weeks.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: Pre-treatment, ST occurred at low exercise HR (147 ± 27 bpm) and SBP (142 ± 6 mm Hg). After treatment, subjects exercised longer (9.75 ± 6.38 minutes to 18.67 ± 2.53 minutes, p = .001) and achieved peak HR (179 ± 17 bpm) and SBP (156 ± 13 mm Hg), both p = .001 versus pre-treatment, without symptom exacerbation. Time series analysis showed significant change in rate of symptom reduction for all subjects and reduced mean symptom number in 8/11. Rate of PCS symptom improvement was related to peak exercise HR (r = 20.55, p = .04). Athletes recovered faster than non-athletes (25 ± 8.7 vs. 74.8 ± 27.2 days, p = .01). No adverse events were reported. Athletes returned to sport and non-athletes to work. CONCLUSION: Treatment with controlled exercise is a safe program that appears to improve PCS symptoms when compared with a no-treatment baseline. A randomized controlled study is warranted.				

* 2 of the sections were not applicable.

Reference	Year	Country	Design	Quality Rating
21. McFadden KL, Healy KM, Dettmann ML, Kaye JT, Ito TA, Hernandez TD. Acupressure as a non-pharmacological intervention for traumatic brain injury. *Journal of Neurotrauma*. 2011;28 :21-34.	2011	US	Randomized Placebo-Controlled Design	PEDRO SCALE: 9/11

Overview (Background, Objective, Methods)
BACKGROUND: Acupressure is a complementary and alternative medicine (CAM) treatment using fingertips to stimulate acupoints on the skin. Although suggested to improve cognitive function, acupressure has not been previously investigated with a controlled design in TBI survivors, who could particularly benefit from a non-pharmacological intervention for cognitive impairment. METHODS: A randomized, placebo-controlled, single-blind design assessed the effects of acupressure (8 treatments over 4 weeks) on cognitive impairment and state of being following TBI, including assessment of event-related potentials (ERPs) during Stroop and auditory oddball tasks. It was hypothesized that active acupressure treatments would confer greater cognitive improvement than placebo treatments, perhaps because of enhanced relaxation response induction and resulting stress reduction.
Outcome (Results, Discussion, Conclusion)
RESULTS: Significant treatment effects were found comparing pre- and post-treatment change between groups. During the Stroop task, the active-treatment group showed greater reduction in both P300 latency ($p = 0.010$, partial $n^2 = 0.26$) and amplitude ($p = 0.011$, partial $n^2 = 0.26$), as well as a reduced Stroop effect on accuracy ($p = 0.008$, partial $n^2 = 0.21$) than did the placebo group. Additionally, the active-treatment group improved more than did the placebo group on the digit span test ($p = 0.043$, Cohen's $d = 0.68$). Together, these results suggest an enhancement in working memory function associated with active treatments. DISCUSSION & CONCLUSION: Acupressure may confer a functional benefit in TBI survivors above and beyond that seen with placebo acupressure, specifically by improving cognitive, neuro-physiological, and neuropsychological function. Given the adverse consequences of stress following TBI, it is valuable to show that an enhanced relaxation response in this population can lead to a reduction in stress as well as to cognitive benefit. Additionally, since it is highly accessible, can be taught to the novice individual, and has no apparent side effects, acupressure warrants further study as an adjunct treatment following TBI.

Reference	Year	Country	Design	Quality Rating
22. Ruff RL, Ruff SS, Wang X-F. Improving sleep: Initial headache treatment in OIF/OEF veterans with blast-induced mild traumatic brain injury. *Journal of Rehabilitation Research and Development.* 2009;46(9):1071-1084.	2009	US	Observational Study	DOWNS & BLACK: 17/32*
Overview (Background, Objective, Methods)				
BACKGROUND: TBI is an important health issue for military personnel serving in Operation Iraqi Freedom/Operation Enduring Freedom. Frequent veteran complaints included headaches, impaired memory, poor attention, low frustration tolerance, and impaired sleep with nightmares. OBJECTIVE: The aim of this study was to determine whether treating impaired sleep would reduce headache frequency and severity. METHODS: We drew the cohort of 74 veterans described in this study from a study group that consisted of 126 OIF/OEF veterans with mild TBI due to exposure to a combat-associated explosion, usually produced by an improvised explosive device. Each of the 126 veterans had a detailed neurological examination, neuropsychological testing, and an assessment for PTSD. We used the Montreal Cognitive Assessment (MoCA) to repeatedly assess cognitive function. In addition, we used the Epworth Sleepiness Scale (ESS) to assess daytime sleepiness.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: Nine weeks after providing sleep counseling and initiating an increasing dosage schedule of prazosin at bedtime, 65 veterans reported restful sleep. Peak headache pain (0-10 scale) decreased from 7.28 +/- 0.27 to 4.08 +/- 0.19 (values presented as mean +/- standard deviation). The number of headaches per month decreased from 12.40 +/- 0.94 to 4.77 +/- 0.34. MoCA scores improved from 24.50 +/- 0.49 to 28.60 +/- 0.59. We found these gains maintained 6 months later. This pilot study suggests that addressing sleep is a good first step in treating posttraumatic headaches in OIF/OEF veterans. DISCUSSION: Several potential biases exist that may have influenced the findings: this is not a random sample of soldiers who sustained mild TBI during deployment; the history of TBI was based on self-report of a remote event; and data were not collected in a blinded manner. We feel that the prolonged symptoms seen in veterans with mild TBI due to combat exposure to explosions can be amenable to treatment, provided that the neurological, psychological, and sleep issues are simultaneously addressed in a manner that engages the veterans in their treatment. CONCLUSION: We found that prazosin combined with sleep hygiene counseling was an effective initial treatment for a group of OIF/OEF veterans with headaches associated with histories of mild TBI from exposure to an explosion in combat. Prazosin was well tolerated. In association with prazosin treatment, veterans had reduced headache intensity and frequency, reduced daytime sleepiness, and improved performance on the MOCA. We believe that the prazosin and sleep hygiene counseling improved sleep by reducing the amount of time it took to fall asleep and preventing nocturnal arousals due to nightmares. We must consider the findings in this study with caution until they are supported in a controlled clinical trial.				

* 1 of the sections was not applicable.

Reference	Year	Country	Design	Quality Rating
23. Wolf GK, Strom TQ, Kehle SM, Eftekhari A. A preliminary examination of prolonged exposure therapy with Iraq and Afghanistan veterans with a diagnosis of posttraumatic stress disorder and mild to moderate traumatic brain injury. *Journal of Head Trauma Rehabilitation*. 2012;27(1):26-32.	2012	US	Preliminary Study	DOWNS & BLACK: 10/32*
Overview (Background, Objective, Methods)				
BACKGROUND: Despite concerns that cognitive deficits and behavioral disturbances associated with TBI may limit the effectiveness of treatment outcomes, we hypothesized that with minimal modifications, PE would result in clinically significant reductions in symptoms of PTSD and depression for Veterans with a diagnosis of PTSD and comorbid mild to moderate TBI. OBJECTIVE: Preliminary examination of the effectiveness of prolonged exposure (PE) therapy for the treatment of PTSD with Operation Enduring Freedom and Operation Iraqi Freedom Veterans who have experienced TBI. METHODS: Comprehensive evaluation that included clinical interview, neuropsychologic evaluation, and/or neuroimaging; Posttraumatic Stress Disorder Checklist and Beck Depression Inventory–Second Edition. Standard implementation of the PE manual was used in all cases with slight adjustments to account for Veterans' residual cognitive deficits. Veterans completed between 8 and 18 sessions.				
Outcome (Results, Discussion, Conclusion)				
RESULTS: Post-treatment scores below 14.9 were clinically significant. In this sample, 40% of Veterans demonstrated clinically significant reduction in depression from pre- to posttreatment. The small sample size in this study does not allow for comparison of Veterans based on TBI severity. However, both severity groups demonstrated significant reductions in PTSD symptoms from pre- to posttreatment. DISCUSSION: Prolonged exposure was highly effective in reducing the symptoms of PTSD with this sample of 10 Veterans who had prior histories of mild to moderate TBIs. Reductions in PTSD symptoms were significant, and the within-group effect sizes for PTSD (overall $d = 3.64$) and depression (overall $d = 1.82$) were large. Consistent with treatment guidelines, it would be beneficial to address psychiatric symptoms early in the recovery process, which could assist with differential diagnosis of symptoms with successful treatment of PTSD. CONCLUSION: These findings suggest that PE can be safely and effectively implemented with Veterans with PTSD, a history of mild to moderate TBI, and current cognitive impairment.				

* 8 of the sections were not applicable.

Reference	Year	Country	Design	Quality Rating
24. Zoccolotti P, Cantagallo A, De Luca M, Guariglia C, Serino A, Trojano L. Selective and integrated rehabilitation programs for disturbances of visual/spatial attention and executive dysfunction after brain damage: A neuropsychological evidence-based review. *European Journal of Physical and Rehabilitation Medicine*. 2011;47:123-147.	2011	Italy	Systematic Review	DOWNS & BLACK: 10/32*
Overview (Background, Objective, Methods)				
BACKGROUND: Attentional and dysexecutive disturbances are sequelae of brain lesions that have important consequences on the relational life of patients and on their job recovery. OBJECTIVE: The aim of this review was to systematically examine literature adopting the evidence-based medicine approach. We focused on evaluating the effectiveness of rehabilitation programs for visual-spatial attentional disturbances and executive dysfunctions in patients with brain lesions. METHODS: Search and selection of papers were performed on four areas: 1) neuro psychological rehabilitation of attentional disorders, 2) neuropsychological rehabilitation of neglect disorders, 3) neuro psychological rehabilitation of dysexecutive disorders, and 4) rehabilitation trainings for patients with mTBI. In each area, search and selection of papers were performed on several databases (e.g., PubMed, PsycINFO, etc.) and integrated by crosschecking references from relevant and recent reviews. Literature was examined up to 2007 (some cases from 2000-2007). Class of evidence for each selected study was evaluated according to the SPREAD (2010) criteria.				

* Additional analyses were not undertaken (i.e., meta-analyses), so 5 of the items were not applicable.

Outcome (Results, Discussion, Conclusion)
RESULTS & DISCUSSION: Evidence demonstrates that Attention Process Training (APT), in isolation or combined with other rehabilitative approaches, is effective in short-term, whereas further studies are warranted to verify its specificity and stability of improvements. Results show a positive effect of procedures, such as visuo-spatial orientation trainings, prism adaptation, optokinetic stimulation, etc. for the task in which feedback is actually provided, but no data show generalization to untrained visuo-spatial abilities, or to the patient's functional outcome. Although treatment effectively reduced dysexecutive disorders in all studies, very few verified the stability of the improvements obtained by follow-up testing. The literature on neuro psychological rehabilitation in patients with mTBI is scanty. It also demonstrated the scarce attention given to methodological aspects such as randomization of study design, the need for a follow-up, etc. CONCLUSION: The selected papers reported positive outcome, particularly when rehabilitative trainings are tailored on patients' neuropsychological profile and when treatments are based on strategic approaches rather than on repeated execution of specific tasks.

Appendix H

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 health care 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.
http://www.impacttest.com/products/?The-ImPACT-Test-2

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.

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)

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

Mini Mental State Examination (MMSE)
A brief screening tool to provide a quantitative assessment of cognitive impairment and to record cognitive changes over time. It includes tests of orientation, attention, memory, language and visual-spatial skills.

Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*.1975 Nov;12(3):189-198.

Section 10: Persistent Vision & 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. C*linical Journal of Sports Medicine*. 2001;11:182–189.

Links for Dix-Hallpike & 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

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.