

# Guidelines for Concussion / Mild Traumatic Brain Injury & Persistent Symptoms

## Second Edition

For adults (18+ years of age)



### Module 4: General Recommendations Regarding Diagnosis / Assessment of Persistent Symptoms



Ontario Neurotrauma Foundation  
Fondation ontarienne de neurotraumatologie

# MODULE 4: GENERAL RECOMMENDATIONS REGARDING DIAGNOSIS/ ASSESSMENT OF PERSISTENT SYMPTOMS



Ontario Neurotrauma Foundation  
Fondation ontarienne de neurotraumatologie

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

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The recommendations and resources found within the *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.

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## 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 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 in the Complete Version). 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 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).

# 4

## General Recommendations Regarding Diagnosis/Assessment of Persistent Symptoms

While full recovery is expected within 3 months after concussion/mTBI,<sup>1,2</sup> not all patients experience such rapid recovery, with up to 15% experiencing ongoing symptoms.<sup>3,4</sup> 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.<sup>5-7</sup> 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	<i>Clinicians should assess, monitor, and document persisting somatic, cognitive, and emotional/behavioural symptoms following concussion/mTBI using a standardized assessment scale (Appendix 1.5).*</i>	<b>C</b>
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. <sup>a</sup>	<b>C</b>
4.3	The assessment should include a review of currently prescribed medications, over-the-counter medications/supplements, and substance use, including alcohol.	<b>C</b>
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).	<b>C</b>

\* THIS RECOMMENDATION IS DUPLICATED FROM SECTION/MODULE 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	
<b>APPENDICES</b>	
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
<b>TABLES</b>	
1 Differential Diagnoses Related to mTBI	Table 4.1
2 Risk Factors Influencing Recovery Post mTBI	Table 1.1

## References

- King N. Mild head injury: Neuropathology, sequelae, measurement and recovery. *British Journal of Clinical Psychology*. 1997;36:161-184.
- 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.
- 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.
- Ruff RM, Weyer Jamora C. Myths and mild traumatic brain injury. *Psychological Injury and Law* 2005;2:34-42.
- 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.
- 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.
- 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.

**Table 1.1. Risk Factors Influencing Recovery Post mTBI**

<b>Medical Factors (red flags):</b> <b>Pre-existing medical conditions or post-injury symptoms that are associated with poor outcomes post mTBI</b>	<ul style="list-style-type: none"> <li>• Post-traumatic amnesia (PTA)</li> <li>• History of previous traumatic brain injury</li> <li>• History of previous physical limitations</li> <li>• History of previous neurological or psychiatric problems</li> <li>• High number of symptoms reported early after injury</li> <li>• Skull fracture</li> <li>• Early onset of pain and in particular headache within 24 hours after injury</li> <li>• Reduced balance or dizziness during acute stage</li> <li>• Confounding effects of other health-related issues, e.g., pain medications, disabling effects of associated injuries, emotional distress</li> <li>• Presence of nausea after injury</li> <li>• Presence of memory problems after injury</li> </ul>
<b>Contextual Factors (yellow flags):</b> <b>Personal, psychosocial, or environmental factors that may negatively influence recovery post mTBI</b>	<ul style="list-style-type: none"> <li>• Injury sustained in a motor vehicle accident</li> <li>• Potential influence of secondary gain issues related to litigation and compensation</li> <li>• Not returning to work or significant delays in returning to work following the injury</li> <li>• Being a student</li> <li>• Presence of life stressors at the time of the injury</li> <li>• Higher levels of symptom reporting is associated with mood symptoms and heightened self-awareness of deficits</li> <li>• Older age</li> <li>• Lack of social supports</li> <li>• Less education/lower social economic status</li> </ul>

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

# Appendix 1.5

## The Rivermead Post Concussion Symptoms Questionnaire\*

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

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

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

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

Are you experiencing any other difficulties?

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

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

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# Appendix 4.1

## ICD-10 Definitions for Differential Diagnoses Related to mTBI

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

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

# Appendix A

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\* The recommendations in this document are those of the Ontario Neurotrauma Foundation, identified by the guideline development team and expert consensus group members, and do not necessarily represent agreement of or endorsement by the Centers for Disease Control and Prevention.

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