

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

## Second Edition

For adults (18+ years of age)



### Module 7: Persistent Sleep / Wake Disturbances



Ontario Neurotrauma Foundation  
Fondation ontarienne de neurotraumatologie

# MODULE 7: PERSISTENT SLEEP/WAKE DISTURBANCES



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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# Table of Contents

## GUIDELINE RECOMMENDATIONS

|   |   |
|---|---|
| 7. Persistent Sleep/Wake Disturbances ..... | 1 |
|---|---|

## ALGORITHM

|   |   |
|---|---|
| 7.1: Assessment and Management of Persistent Sleep/Wake Disturbances following mTBI ..... | 4 |
|---|---|

## APPENDICES

|   |    |
|---|----|
| 7.1: Brief Definitions of Sleep Disorders Most Frequently Reported following TBI..... | 5  |
| 7.2: Short Clinical Interview for Sleep after Head Injury .....                       | 6  |
| 7.3: Sleep and Concussion Questionnaire .....   | 7  |
| 7.4: Sleep Hygiene Program .....  | 9  |
| 7.5: Behavioural Recommendations for Optimal Sleep.....                               | 10 |
| 7.6: Sleep Diary .....  | 11 |
| A: Project Members .....  | 12 |
| B: Other Useful Links/References for Resources to Consider .....                      | 14 |

## TABLE

|   |   |
|---|---|
| 7.1: Important Components to Include in the Sleep/Wake Disturbances Screen..... | 1 |
|---|---|

## 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).

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](#)).<sup>1,4</sup> 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.<sup>3,4</sup> 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.<sup>2</sup> 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.<sup>5</sup> It has also been suggested that sleep disturbance among this population may be associated with impairment on neuropsychological testing.<sup>6,7</sup> 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.<sup>5,8-10</sup> 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.<sup>11,12</sup> 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](#)).<sup>2,13,14</sup> 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.<sup>2,10,14</sup> However, there is limited data about the effect of sleep medications on patients with neurological impairment, and more controlled trials are needed.<sup>2,15</sup> 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.<sup>16</sup>

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**

|                                  |  |
|----------------------------------|--|
| <b>Medical Conditions</b>        | e.g., endocrine dysfunction, metabolic, pain-provoking   |
| <b>Current Medication Use</b>    | e.g., verify if used prescribed or non-prescribed medications impact on sleep because of inadequate type, dosage or timing of administration<br><b>See <a href="#">Appendix B</a> for useful references regarding specific classes of medications and their impact on sleep.</b> |
| <b>Co-morbid Psychopathology</b> | e.g., mood or anxiety disorder   |
| <b>Unhealthy Habits</b>          | 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; <a href="#">Appendix 7.2</a> and <a href="#">7.3</a> ).   | <b>C</b> |
| 7.2  | Screen for medical conditions, current medication use, comorbid psychopathology, and risk factors for sleep disturbances, which may influence the sleep/wake cycle ( <a href="#">Table 7.1</a> ).   | <b>C</b> |
| 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.  | <b>C</b> |
| 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.  | <b>C</b> |
| 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 <a href="#">Appendix 7.4</a> for a sleep hygiene program and <a href="#">Appendix 7.5</a> for behavioural recommendations for optimal sleep.   | <b>C</b> |
| 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>B</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.<br><br>Medications that can be used include trazodone, mirtazapine, and tricyclic antidepressants (e.g., amitriptyline).<br><br>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. | <b>C</b> |
| 7.8  | Other non-pharmacologic treatment options that have been found to be useful in the treatment of insomnia include: <ul style="list-style-type: none"> <li>Daily supplements of magnesium, melatonin, and zinc.</li> <li>Consider other interventions such as acupuncture, exercise, and mindfulness-based stress reduction.</li> </ul>   | <b>C</b> |

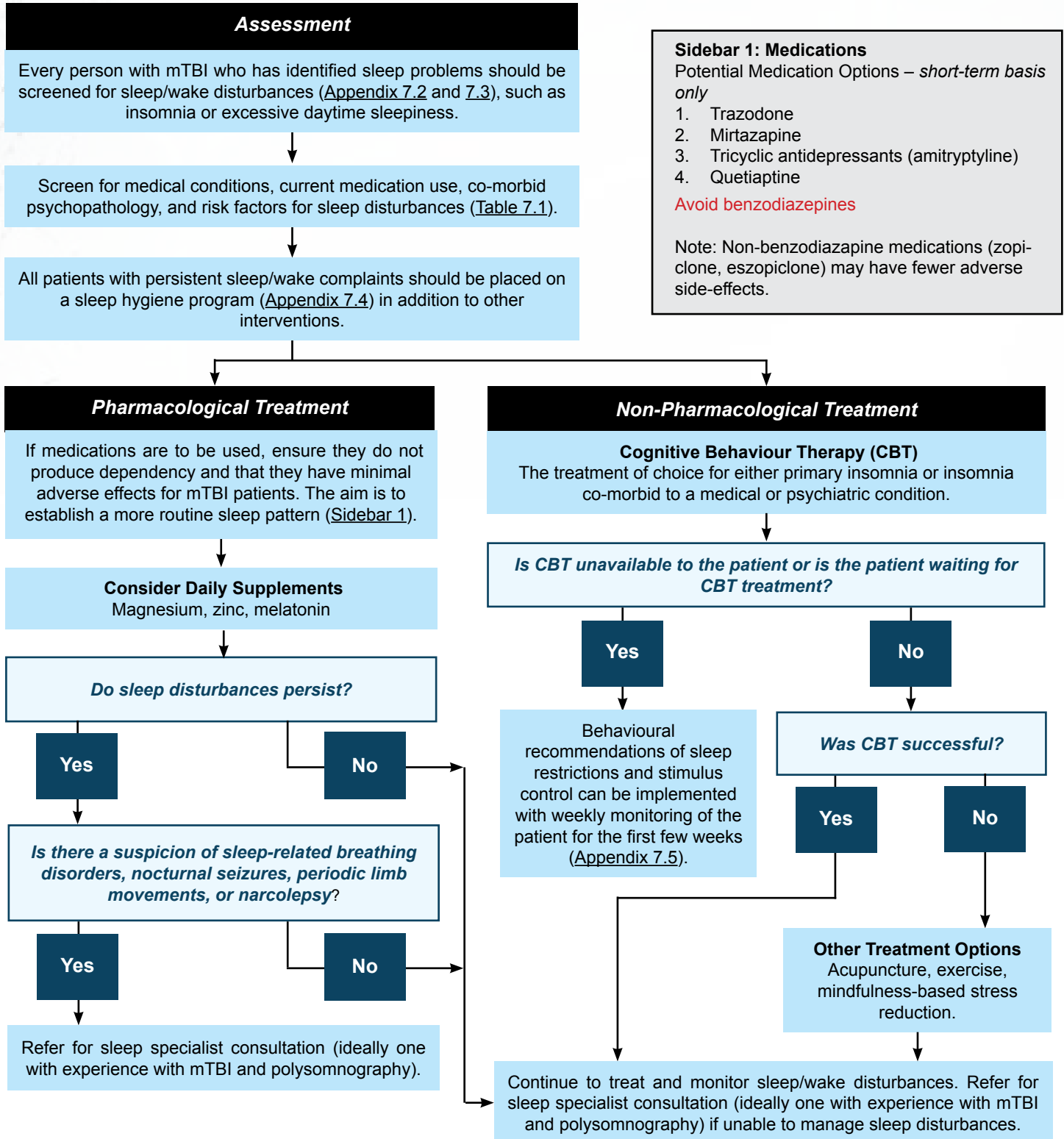
| RESOURCES         |  |               |
|-------------------|--|---------------|
| <b>APPENDICES</b> |  |               |
| 1                 | Brief Definitions of Sleep Disorders Most Frequently Reported Following TBI    | Appendix 7.1  |
| 2                 | Short Clinical Interview for Sleep after 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 B    |
| <b>TABLES</b>     |  |               |
| 1                 | Important Components to Include in the Sleep/Wake Disturbances Screen          | Table 7.1     |
| <b>ALGORITHMS</b> |  |               |
| 1                 | Assessment and Management of Persistent Sleep/Wake Disturbances Following mTBI | Algorithm 7.1 |

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# 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**.



# Appendix 7.1

## Brief Definitions of Sleep Disorders Most Frequency Reported following mTBI\*

### Insomnia

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

### Sleep-related breathing disorders

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

### Narcolepsy

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

### Post-traumatic hypersomnia

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

### Circadian rhythm sleep disorders

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

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

# Appendix 7.2

## Short Clinical Interview for Sleep after Head Injury\*

### Short Clinical Interview for Sleep after Head Injury

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

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

**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 or ventilatory effort. *Symptoms:* Daytime sleepiness, frequent awakenings to restart breathing, restless and non-restorative sleep, snoring. To confirm, refer for polysomnography and verify if there is presence of at least 5 documented apneas or hypopneas per hour of sleep.

**Narcolepsy.** Rare disorder characterized by recurrent daytime napping or sleep episodes. *Symptoms:* Tetrad of classic symptoms (that are not always all present): daytime sleepiness, cataplexy (i.e., episodic loss of muscle function), hypnagogic hallucinations (i.e. dreamlike experiences while falling asleep, dozing or awakening), and sleep paralysis (i.e., transitory inability to talk or move upon awakening).

**Post-traumatic hypersomnia.** Hypersomnia due to medical condition (TBI) when other primary sleep disorders have been ruled out. *Symptoms:* Excessive daytime sleepiness, increased sleep duration.

**Circadian rhythm sleep disorders.** Delayed sleep phase disorder: prolonged delay in the sleep-wake episodes relative to conventional times. *Symptoms:* Irregular sleep-wake rhythm: high day-to-day variability in sleep onset and offset. Sleep disturbances when trying to conform with conventional times (inability to fall asleep or remain asleep).

A more comprehensive clinical interview canvas is available in: N. Zaslter, D. Katz, & R. Zafonte, *Brain Injury Medicine: Principles and Practice* (Second edition). Boston. Brain Injury Medicine., Chapter 43, pp. 707-725.

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

# Appendix 7.3

## Sleep and Concussion Questionnaire\*

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).

The Sleep and Concussion Questionnaire© was developed in 2012 by Catherine Wiseman-Hakes Ph.D. and Marie-Christine Ouellet Ph.D., with support from Simon Beaulieu-Bonneau Ph.D. All Rights Reserved. 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.

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

## Other Links/References for Resources to Consider

### 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.