SECTION 7:
Sleep-Wake Disturbances
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.

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

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

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.
More than 50% of patients report sleep disturbances following mTBI, specifically insomnia, hypersomnia, obstructive sleep apnea, poor sleep maintenance, poor sleep efficiency, early awakening, delayed sleep onset, or alterations in circadian cycle. (see Appendix 7.1).1-5 In the immediate acute stage of mTBI, there may be an increased need for sleep6 however this decreases over time and insomnia is the most common form of sleep disturbance reported in the subacute and chronic stages of mTBI. Insomnia is characterized by problems with sleep initiation and/or sleep maintenance that can lead to increases in daytime sleepiness and fatigue.3,4 Although some research has shown a discrepancy between subjective sleep complaints and objective evidence of sleep disturbance (e.g., obtained via polysomnography), recent data has provided evidence of objectively measured alterations in sleep both in the acute stage and chronic stages of injury.5,7 Sleep disturbance itself has been shown to be a prognostic factor for functional and social outcomes up to one year post-injury.6 Patients may experience circadian rhythm sleep disorders, specifically delayed sleep phase syndrome and irregular sleep-wake patterns. Patients experiencing sleep disturbances after mTBI commonly find these symptoms to interfere with mood, mental capacities, communication, social or leisure activities, or their principal occupation.9,10 It has also been suggested that sleep disturbance among this population may be associated with impairments on neuropsychological and cognitive-communication tests.10,11 As is the case with many persistent symptoms following mTBI, sleep disturbances can be secondary to other conditions such as depression, anxiety, PTSD or pain. Recent studies by Suzuki et al 2017 12 and Lavigne et al 2015,13 found that patients experiencing pain in the acute phase of mTBI may require more sleep than those without pain.12 Management strategies should take this potential interaction of symptoms into account as it may exacerbate poor attention, memory, language processing and learning capabilities.9,14-18

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

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

See Algorithm 7.1, which outlines the key steps for assessment and management of persistent sleep-wake disturbances following mTBI.
Table 7.1 Important Components to Include in the Sleep-Wake Disturbance Screen

<table>
<thead>
<tr>
<th>Medical Conditions</th>
<th>e.g., endocrine dysfunction, metabolic, pain-provoking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Medication Use</td>
<td>e.g., verify if used prescribed or non-prescribed medications impact on sleep because of inadequate type, dosage or timing of administration. See Appendix F for useful references regarding specific classes of medications and their impact on sleep.</td>
</tr>
<tr>
<td>Comorbid Psychopathology</td>
<td>e.g., mood or anxiety disorder</td>
</tr>
<tr>
<td>Unhealthy Habits</td>
<td>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</td>
</tr>
<tr>
<td>Physical</td>
<td>e.g., alterations in menstrual cycle, comorbid physical and pain</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RECOMMENDATIONS FOR ASSESSMENT OF SLEEP-WAKE DISTURBANCES</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1 Patients should be educated and reassured about the fact that sleep alterations are very common in the acute stages of concussion/mTBI.</td>
<td><strong>B</strong></td>
</tr>
<tr>
<td>7.2 Patients who have identified sleep alterations should be monitored for sleep/wake disturbances. Patients who have persisting sleep disturbances should be monitored for sleep-wake disorders (e.g., insomnia, excessive daytime sleepiness). (see Appendices 7.2 and 7.3).</td>
<td><strong>C</strong></td>
</tr>
<tr>
<td>7.3 Screen for pre-existing sleep disturbances/ disorders, medical conditions, current medication use, comorbid psychopathology and risk factors for sleep disturbances, which may influence the sleep/wake cycle (see Table 7.1).</td>
<td><strong>C</strong></td>
</tr>
<tr>
<td>7.4 Referral for a sleep specialist consultation and polysomnography (e.g., sleep study, Multiple Sleep Latency Test, Maintenance of Wakefulness Test) should be considered if sleep disturbances persist or if there is suspicion of sleep-related breathing disorders, nocturnal seizures, periodic limb movements, or narcolepsy.</td>
<td><strong>C</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RECOMMENDATIONS FOR NON-PHARMACOLOGIC TREATMENT OF SLEEP-WAKE DISTURBANCES</th>
<th>GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5 It is recommended to treat sleep-wake disturbances in patients with concussion/mTBI. Treatment of sleep disorders may help with:</td>
<td><strong>B</strong></td>
</tr>
<tr>
<td>• Mood</td>
<td></td>
</tr>
<tr>
<td>• Anxiety</td>
<td></td>
</tr>
<tr>
<td>• Pain</td>
<td></td>
</tr>
<tr>
<td>• Fatigue</td>
<td></td>
</tr>
<tr>
<td>• Cognitive Problems</td>
<td></td>
</tr>
<tr>
<td>7.6 All patients with persistent sleep-wake complaints should be placed on a program of sleep hygiene. Behavioural interventions for sleep (e.g., cognitive-behavioral therapy techniques, mindfulness-based therapies) should also be considered. See Appendix 7.4 for a sleep hygiene program and Appendix 7.5 for behavioral recommendations for optimal sleep.</td>
<td><strong>C</strong></td>
</tr>
<tr>
<td>7.7 Cognitive behavioural therapy (CBT) for insomnia is established as the treatment of choice for either primary insomnia or insomnia comorbid to a medical or psychiatric condition.</td>
<td><strong>B</strong></td>
</tr>
<tr>
<td>7.8 Other non-pharmacologic treatment options that have been found to be useful in the treatment of insomnia include:</td>
<td><strong>C</strong></td>
</tr>
<tr>
<td>• Melatonin (taken 2 hours before bedtime in conjunction with reduced evening light exposure and light therapy in the morning)</td>
<td></td>
</tr>
<tr>
<td>• Magnesium and zinc supplementation</td>
<td></td>
</tr>
<tr>
<td>• Acupuncture and mindfulness-based stress reduction therapy</td>
<td></td>
</tr>
</tbody>
</table>
### RECOMMENDATIONS FOR PHARMACOLOGIC TREATMENT OF SLEEP-WAKE DISTURBANCES

<table>
<thead>
<tr>
<th>Section</th>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.9</td>
<td>C</td>
<td>When pharmacologic interventions are used, the aim is to establish a more routine sleep-wake pattern using agents with minimal risk of dependency and adverse effects in patients with concussion/mTBI. Medications to be considered include low-dose trazodone and tricyclic antidepressants (e.g., Amitryptyline, Doxepine), as well as mirtazapine. Prazosin may be considered in patients with nightmares and PTSD. Benzodiazepines should generally be avoided; however, non-benzodiazepine medications (e.g., Zopiclone, Exzopiclone) may have fewer adverse effects and may be considered for short-term use.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section</th>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.10</td>
<td>A</td>
<td>The use of Modafinil and Armodafinil can be considered in patients with excessive daytime sleepiness.</td>
</tr>
</tbody>
</table>

### RESOURCES

#### APPENDICES

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

#### TABLES

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

#### ALGORITHMS

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

### References

Algorithm 7.1

Assessment and Management of Sleep-Wake Disturbances Following mTBI

**Assessment**
Every person with mTBI who has identified sleep problems should be screened for sleep-wake disturbances (see Appendix 7.2 and 7.3), such as insomnia or excessive daytime sleepiness.

Screen for medical conditions, current medication use, comorbid psychopathology, and risk factors for sleep disturbances (see Table).

All patients with persistent sleep-wake complaints should be placed on a sleep hygiene program (see Appendix 7.4) in addition to other interventions.

**Pharmacological Treatment**
If medications are to be used, ensure they do not produce dependency and that they have minimal adverse effects for mTBI patients. The aim is to establish a more routine sleep pattern (Sidebar 1).

**Do sleep disturbances persist?**

**Yes**

Is there a suspicion of sleep-related breathing disorders, nocturnal seizures, periodic limb movements, or narcolepsy?

**Yes**

Refer for sleep specialist consultation (ideally one with experience with mTBI and polysomnography).

**No**

Consider Daily Supplements
magnesium, zinc, melatonin

**Non-Pharmacological Treatment**

**Cognitive Behaviour Therapy (CBT)**
The treatment of choice for either primary insomnia or insomnia comorbid to a medical or psychiatric condition.

Is CBT unavailable to the patient or is the patient waiting for CBT treatment?

**Yes**

Behavioural recommendations of sleep restrictions and stimulus control can be implemented with weekly monitoring of the patient for the first few weeks (Appendix 7.5).

**No**

Was CBT successful?

**Yes**

Other Treatment Options
Acupuncture, exercise, mindfulness-based stress reduction, magnesium and zinc supplementation

**No**

Continue to treat and monitor sleep-wake disturbances. Refer for sleep specialist consultation (ideally one with experience with mTBI and polysomnography) if unable to manage sleep disturbances.

**Sidebar 1: Medications**
Potential Medication Options – short-term basis only
1. Trazodone
2. Mirtazapine
3. Tricyclic antidepressants (amitriptyline)
4. Prazosin (for PTSD + nightmares)
Avoid benzodiazepines

Note: Non-benzodiazepine medications (zopiclone, eszopiclone) may have fewer adverse side-effects.
### Appendix 7.1

**Brief Definitions of Sleep Disorders Most Frequently Reported Following mTBI***

#### Insomnia

<table>
<thead>
<tr>
<th><strong>Main feature</strong></th>
<th>Dissatisfaction with the quality or quantity of sleep.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Common symptoms</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Additional criteria</strong></td>
<td>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.</td>
</tr>
</tbody>
</table>

#### Sleep-related breathing disorders

<table>
<thead>
<tr>
<th><strong>Main feature</strong></th>
<th>Altered respiration during sleep.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main subtypes</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Common symptoms</strong></td>
<td>Daytime sleepiness, frequent awakenings to restart breathing, restless and nonrestorative sleep, snoring.</td>
</tr>
<tr>
<td><strong>Additional criteria</strong></td>
<td>Presence of at least 5 polysomnography-documented apneas or hypopneas per hour of sleep.</td>
</tr>
</tbody>
</table>

#### Narcolepsy

<table>
<thead>
<tr>
<th><strong>Main feature</strong></th>
<th>Rare disorder characterized by recurrent unplanned daytime napping or sleep episodes.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Common symptoms</strong></td>
<td>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).</td>
</tr>
</tbody>
</table>

#### Post-traumatic hypersomnia

<table>
<thead>
<tr>
<th><strong>Main feature</strong></th>
<th>Hypersomnia because of medical condition (TBI) when other primary sleep disorders have been ruled out.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Common symptoms</strong></td>
<td>Excessive daytime sleepiness, increased sleep duration.</td>
</tr>
</tbody>
</table>

#### Circadian rhythm sleep disorders

<table>
<thead>
<tr>
<th><strong>Main feature</strong></th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Common symptoms</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Additional criteria</strong></td>
<td>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.</td>
</tr>
</tbody>
</table>

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## 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*

### 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., temporary 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 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).

Appendix 7.3

Sleep and Concussion Questionnaire

Sleep and Concussion Questionnaire

Name / ID#: __________________________ Age: ______ Date of Visit: __D / M / Y__

Date of Injury: __D / M / Y__ Completed by: ☐ Self  ☐ Parent/Other: _______________________

Have you had more than one brain injury/concussion?
☐ Yes  ☐ No  If yes, how many?______________________________________________________________

Have you completed this questionnaire at our clinic before?
☐ Yes—Begin at Section 2 (see page 2)  ☐ No—Begin at Section 1

Section 1: Initial Assessment

1. a) In the last 6 months before your injury(s), did you consider yourself to be a good sleeper?
☐ Most of the time  ☐ Some of the time  ☐ Rarely  ☐ Never

b) Have you ever sought medical attention for your sleep problems?
☐ Yes  ☐ No

c) Have you ever used any sleep interventions?
☐ Yes  ☐ No

d) If yes, please specify the sleep interventions being used:
☐ Medication  ☐ Non-medicinal supplements
☐ Behavioural techniques  ☐ Other: __________________________________________________________

2. a) Since your injury(s), has your sleep changed?
☐ No (0)  ☐ Yes, Mild Change (1)  ☐ Yes, Moderate Change (2)  ☐ Yes, Significant Change (3)

b) If yes, please indicate the type of change:
☐ Sleep more (1)  ☐ Sleep less (1)  ☐ Sleep the same amount but is less restful (1)

c) If you have had more than one injury, when did you first experience changes in sleep?
☐ After first injury  ☐ After subsequent injury - If so, please describe:

__________________________________________________________________________________________

__________________________________________________________________________________________

* Taken with permission from the authors.
Section 2: Follow-Up

3. a) Since the last time you completed this questionnaire, which sentence best describes your sleep?
   - My sleep is now the same as before my injury(s) (0)
   - My sleep is returning to the same as before my injury(s) (1)
   - My sleep is the same as last time and is still different from before my injury(2)
   - My sleep has gotten worse (3)

   b) If sleep has gotten worse, please describe the change:
   - I sleep more (1)
   - I sleep less (2)
   - I sleep the same amount but it is less restful (3)

Section 3: Changes in Sleep

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

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) I fall asleep earlier than usual.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>c) I have difficulty staying asleep.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>e) I wake up too early &amp; can’t fall back asleep.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

4. My sleep is affected by: (check all that apply)
   - Nothing, my sleep is unaffected (0)
   - Pain (1)
   - Feeling Restless (1)
   - Breathing Problems/Snoring (1)
   - Mood (1)
   - Unsure (0)
   - Bad Dreams/Nightmares (1)
   - Worrying (1)
   - Other: (1)

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

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) I feel more tired during the day.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>b) I need to nap more often during the day.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
# Guidelines for Administration

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

## Guidelines for Scoring/Interpretation and Suggested Action

*Note: This is a preliminary scoring guide that is currently being validated. The scoring guide was inspired by Dr. Charles Morin ISI 1993.*

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

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-7</td>
<td>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.</td>
</tr>
<tr>
<td>8-15</td>
<td>Subclinical change: Requires monitoring. Reassure individual that complete resolution anticipated with resolution of concussion symptoms.</td>
</tr>
<tr>
<td>16-22</td>
<td>Clinical changes of moderate severity: Further assessment of precipitating factors recommended and possible intervention required.</td>
</tr>
<tr>
<td>23-36</td>
<td>Clinically severe changes in sleep or wakefulness: Further assessment of precipitating factors, referral to specialist may be indicated and intervention may be indicated.</td>
</tr>
</tbody>
</table>
Appendix 7.4

Sleep Hygiene Program*

Healthy Habits to Promote Good Sleep

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

Nutrition, Exercise and Lifestyle

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

Sleeping Environment

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

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

* Taken with permission from the authors: C. Wiseman-Hakes (U of Toronto, Canada), M-C. Ouellet (U Laval) & S. Beaulieu-Bonneau (U Laval).
Appendix 7.5

Behavioural Recommendations for Optimal Sleep*

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

1- Monitor your sleep with a sleep diary (Appendix 7.6) for 1 or 2 weeks. Calculate the time spent actually sleeping (Time spent in bed minus time to fall asleep and awakenings).

2- Under the supervision of your health-care provider, set up a sleep window with a duration corresponding to the actual sleep time of the past 1-2 weeks, and with fixed bedtime and rising time. The sleep window should not be of less than 5.5 hours.

3- Maintain the sleep window for at least one week.

4- Set a consistent wake time (even on weekends), and regardless of amount of sleep obtained.

5- On a weekly basis, gradually adjust the sleep window based on your sleep quantity and quality:
   - If you sleep more than 85% of time you spend in bed and/or you constantly feel sleepy during the day, increase the sleep window by 15-20 minutes.
   - If you sleep less than 85% of the time you spend in bed, decrease the sleep window by 15-20 minutes.
   - Continue this procedure until you achieve an acceptable sleep quality and duration AND you do not feel sleepy during the day.

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

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

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

1- **Get up at the same time every morning, regardless of the amount of sleep you obtained.** Maintaining fixed bedtime and rising time helps regulating the biological and maximizing sleep drive at the optimal time.

2- **Allow at least 1 hour before bedtime to unwind.** This is intended to facilitate the transition from wakefulness to sleepiness, and to sleep onset. In this time, you should plan quiet, relaxing, and pleasant activities.

3- **Go to bed only when sleepy.** Going to bed when feeling wide awake only leads to prolonged wakefulness and further associates the bed and bedroom with insomnia rather than sleep. Wait until you feel the signs of sleepiness (yawning, eyelids drooping) before trying to sleep.

4- **If you are unable to fall asleep or fall back to sleep within 15-20 min, get out of bed and find something else to do in another room.** Again, the rationale is to strengthen the association between your bed and bedroom, and sleep. When applying this strategy, it is important to choose a quiet and relaxing activity, avoid stimulating ones (e.g., computer or TV), and avoid bright light. Go back to bed only when you feel sleepy again. Repeat this procedure as often as necessary.

5- **Reserve your bed and bedroom for sleep only.** The bedroom environment should be associated with sleep only, sexual activities being the only exception. All other activities, such as reading, worrying about your personal or health problems, or watching TV, should be done elsewhere.

6- **Limit daytime napping.** Beyond the first few days post-injury, it is best to avoid daytime napping. Naps can affect the quantity and quality of sleep the following night. Naps longer than 30 min can be followed by an unpleasant period of sleepiness and difficulty concentrating than can last up to 1 hour upon awakening. If daytime sleepiness is too overwhelming, take a short nap (not exceeding 1 hour and taken before 3:00 PM).

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

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

How to Use the National Sleep Foundation Sleep Diary

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

Visit sleepfoundation.org for more sleep tips.
Sleep Diary: Morning

Complete in Morning

Start date: __/__/__

Day of week:

<table>
<thead>
<tr>
<th>Day</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
<th>Day 6</th>
<th>Day 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>I went to bed last night at:</td>
<td>PM/AM</td>
<td>PM/AM</td>
<td>PM/AM</td>
<td>PM/AM</td>
<td>PM/AM</td>
<td>PM/AM</td>
<td>PM/AM</td>
</tr>
<tr>
<td>I got out of bed this morning at:</td>
<td>AM/PM</td>
<td>AM/PM</td>
<td>AM/PM</td>
<td>AM/PM</td>
<td>AM/PM</td>
<td>AM/PM</td>
<td>AM/PM</td>
</tr>
</tbody>
</table>

Last night I fell asleep:
- Easily
- After some time
- With difficulty

I woke up during the night:
- # of times
- # of minutes

Last night I slept a total of:
- Hours

My sleep was disturbed by:
- List mental or physical factors including noise, lights, pets, allergies, temperature, discomfort, stress, etc.

When I woke up for the day, I felt:
- Refreshed
- Somewhat refreshed
- Fatigued

Notes:
- Record any other factors that may affect your sleep (i.e. hours of work shift, or monthly cycle for women).

Sleep Diary: End of Day

Complete at the End of Day

Day of week:

<table>
<thead>
<tr>
<th>Day</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
<th>Day 6</th>
<th>Day 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>I consumed caffeinated drinks in the:</td>
<td>Morning, Afternoon, Evening, (NA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I exercised at least 20 minutes in the:</td>
<td>Morning, Afternoon, Evening, (NA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Medications I took today:

Took a nap? (circle one)
- Yes
- No

If Yes, for how long?

During the day, how likely was I to doze off while performing daily activities:
- No chance
- Slight chance
- Moderate chance
- High chance

Throughout the day, my mood was...
- Very pleasant
- Pleasant
- Unpleasant
- Very unpleasant

Approximately 2-3 hours before going to bed, I consumed:
- Alcohol
- A heavy meal
- Caffeine
- Not applicable

In the hour before going to sleep, my bedtime routine included:
- List activities including reading a book, using electronics, taking a bath, doing relaxation exercises, etc.
One of the strategies most commonly used to try to eliminate insomnia is to spend more time in bed, by going to bed earlier, getting up later, or taking naps. These practices can be beneficial in the short term. However, they can be detrimental in the long term: spending too much time awake in bed tends to fragment sleep and perpetuate insomnia. Indeed, while they are in bed yet not sleeping, many people start worrying or using that time to problem-solve. The solution is to limit the time spent in bed to actual sleeping time.

→ This strategy is very effective for decreasing sleep fragmentation and increasing sleep quality;

→ The initial effect is to produce a mild state of sleep deprivation, which makes it easier to fall asleep and improves the continuity of sleep through the night;

→ In the beginning, the goal is to improve sleep quality and efficiency, but not necessarily to increase sleep duration, which can be achieved subsequently.

### How to apply this strategy?

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

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

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

Limiting the time spent in bed to actual sleep time

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

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

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

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

**For example:**

<table>
<thead>
<tr>
<th>DAYS</th>
<th>MONDAY</th>
<th>TUESDAY</th>
<th>WEDNESDAY</th>
<th>THURSDAY</th>
<th>FRIDAY</th>
<th>SATURDAY</th>
<th>SUNDAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOURS OF SLEEP</td>
<td>7:00</td>
<td>6:00</td>
<td>5:30</td>
<td>6:00</td>
<td>6:15</td>
<td>5:45</td>
<td>5:30</td>
</tr>
</tbody>
</table>

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

The first sleep window will be of six hours.

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

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

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

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

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

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

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

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

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

<table>
<thead>
<tr>
<th>SLEEP EFFICIENCY = Total sleep time (in minutes)</th>
<th>Time spent in bed at night (in minutes)</th>
</tr>
</thead>
</table>

If your sleep efficiency is **above 85%**

**OR**

if you are very sleepy during the day (much sleepier than before you began this strategy).

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

If your sleep efficiency is **below 80%**

**AND**

you are not too sleepy during the day.

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

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

**Maintain the same sleep window** for another week.

What to expect?

→ The side effect of this strategy of restricting time spent in bed is that you will feel more sleepy during the day. This is normal and temporary. After one or two weeks, you will realize that, in spite of spending less time in bed, you are functioning just as well during the day. Exercise caution if you need to drive or use hazardous machinery.

→ Continue to adjust your sleep window each week until you achieve a satisfactory duration of sleep combined with good sleep efficiency (more than 85%). You may need to apply this strategy for several weeks (6 to 10) before achieving this result.

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

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

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

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

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

Re-creating a time and place for sleep

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

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

2. Go to bed only when you feel sleepy.

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

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

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

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

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

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