

PedsConcussion

— LIVING GUIDELINE FOR —
PEDIATRIC CONCUSSION CARE



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DISCLAIMER:

The recommendations and resources found within the Living Guideline for Diagnosing and Managing Pediatric Concussion are intended to inform and instruct care providers and other stakeholders who deliver services to children and youth who have sustained or are suspected of having sustained a concussion. This guideline is not intended for use with patients or clients over the age of 18 years. It is not for self-diagnosis or treatment. Patient, parents, and/or caregivers may wish to bring their healthcare and other providers' attention to this guideline.

The best available evidence has informed the recommendations in this document, and relevant evidence published after this guideline could influence the recommendations made within. Healthcare professionals should also consider their own judgment, the preferences of their patients, and factors such as the availability of resources in their decisions.

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GUIDELINE OVERVIEW

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LIST OF RECOMMENDATIONS

Domain 1. <u>Concussion Recognition and Directing to Care</u>	
1.1a	<u>School boards, sports organizations, and community centres should provide pre-season concussion education and conduct a review of all concussion policies in effect within the school or sport setting.</u>
1.1b	<u>School boards, sports organizations, and community centres should ensure updated policies are in place to recognize and accommodate a child/adolescent who has sustained a concussion.</u>
1.2	<u>Remove the child/adolescent from the activity immediately if a concussion is suspected for immediate assessment and to avoid another injury.</u>
1.3	<u>Recommend an emergency medical assessment for a child/adolescent with any of the “red flag” symptoms.</u>
1.4	<u>Concussion should be suspected and diagnosed as soon as possible to maintain health and improve outcomes. Concussion can be suspected in the community by healthcare professionals, parents, teachers, coaches, and peers. Those with a suspected concussion should be referred to a physician or nurse practitioner to perform a comprehensive medical assessment to exclude more severe injuries, consider a full differential diagnosis, and confirm the diagnosis of concussion.</u>
Domain 2. <u>Initial Medical Assessment and Management</u>	
2.1	<u>Physicians or nurse practitioners should perform a comprehensive medical assessment on all children/adolescents with a suspected concussion or with acute head or spine trauma.</u>
2.1a	<u>Take a comprehensive clinical history.</u>
2.1b	<u>Note common modifiers that may delay recovery and use a clinical risk score to predict risk of prolonged symptoms.</u>
2.1c	<u>Perform a comprehensive physical examination.</u>
2.1d	<u>Consider CT of the brain or cervical spine only in patients with acute head trauma in whom, after a medical assessment, a structural intracranial or cervical spine injury is suspected; do not conduct routine neuroimaging for the purpose of diagnosing concussion.</u>

2.2	<u>Provide verbal information and written (electronic) handouts regarding the course of recovery and when the child/adolescent can return-to-school/activity/sport/work.</u>
2.3	<u>Recommend graduated return to cognitive and physical activity to promote recovery.</u>
2.3a	<u>Recommend an initial 24-48 hour period of rest with limited physical and cognitive activity.</u>
2.3b	<u>Recommend that low to moderate level physical and cognitive activity be gradually started 24-48 hours after a concussion at a level that does not result in recurrence or exacerbation of symptoms. Activities that pose no/low risk of sustaining a concussion should be resumed even if mild residual symptoms are present or whenever acute symptoms improve sufficiently to permit activity.</u>
2.3c	<u>Recommend that patients avoid activities associated with a risk of contact, fall, or collisions such as high speed and/or contact activities and full-contact sport that may increase the risk of sustaining another concussion during the recovery period.</u>
2.3d	<u>Consider referring select patients (e.g., competitive athletes, those who are not tolerating a graduated return to physical activity, or those who are slow to recover) to a medically supervised interdisciplinary team with the ability to individually assess sub-symptom threshold aerobic exercise tolerance and to prescribe aerobic exercise treatment.</u>
2.4	<u>Provide education and guidance regarding strategies to promote recovery.</u>
2.4a	<u>Advise on the importance of sleep and discuss sleep hygiene.</u>
2.4b	<u>Advise on maintaining social networks and interactions as tolerated beyond a brief initial period of cognitive and physical rest (24-48 hours after injury).</u>
2.4c	<u>Advise on the use of computers, phones, and other devices with screens. Beyond an initial period of cognitive and physical rest (24-48 hours after injury), use of devices with screens may be gradually resumed at a level that does not result in recurrence or exacerbation of symptoms.</u>
2.4d	<u>Advise on avoiding alcohol and other recreational drugs after a concussion.</u>
2.4e	<u>Advise to avoid driving during the first 24-48 hours after a concussion. Advise patients to begin driving when they are feeling improved, can concentrate sufficiently to feel safe behind the wheel, and when the act of driving does not provoke significant concussion symptoms.</u>
2.5	<u>Over-the-counter medications such as acetaminophen and ibuprofen may be recommended to treat acute headache. Advise on limiting the use of these medications to less than 15 days a month and avoiding “around-the-clock” dosing to prevent overuse or rebound headaches (i.e., advise that children/adolescents avoid using over the counter medications at regular scheduled times throughout the day).</u>
2.6	<u>At present, there is limited evidence to support the administration of intravenous medication to treat acute headaches in pediatric concussion patients in the Emergency Department setting.</u>

2.7	<u>After assessment, nearly all children/adolescents with concussion may be safely discharged from clinics and Emergency Departments for observation at home.</u>
2.8	<u>Recommend a medical follow-up in 1-2 weeks to re-assess and monitor clinical status. Recommend an immediate medical follow-up in the presence of any deterioration.</u>
2.9	<u>Consider referral to an interdisciplinary concussion team in the presence of modifiers that may delay recovery.</u>
2.10	<u>Provide post-concussion information and a written medical assessment to the child/adolescent and the parent/caregiver prior to sending the child/adolescent home.</u>
Domain 3. <u>Medical Follow-up and Management of Prolonged Symptoms</u>	
3.1	<u>Perform a repeat medical assessment on all patients presenting with post-concussion symptoms 1-2 weeks following acute injury.</u>
3.1a	<u>Take a focused clinical history based on symptoms described.</u>
3.1b	<u>Examine the child/adolescent and perform a focused physical examination.</u>
3.1c	Recommendation 2.1d: <u>Consider diagnostic brain or cervical spine MRI imaging for those with focal or worrisome symptoms.</u>
3.2	<u>Provide patients with general education and guidance that outlines mental health considerations, non-pharmacological strategies to minimize symptoms including sleep hygiene, activity modifications, limiting triggers, information on screen time, the importance of social interaction, and how to work with the school team to facilitate school success.</u>
3.3	<u>Encourage patients with post-concussion symptoms to engage in cognitive activity and low-risk physical activity as soon as tolerated while staying below their symptom-exacerbation thresholds. Activities that pose no/low risk of sustaining a concussion (no risk of contact, collision, or falling) should be resumed even if mild residual symptoms are present or whenever acute symptoms improve sufficiently to permit activity.</u> <u>Recommendation 2.3d: Consider referring select patients (e.g., competitive athletes, those who are not tolerating a graduated return to physical activity, or those who are slow to recover) to a medically supervised interdisciplinary team with the ability to individually assess sub-symptom threshold aerobic exercise tolerance and to prescribe aerobic exercise treatment.</u>
3.4	<u>Refer to specialized care with an interdisciplinary concussion team if post-concussion symptoms do not gradually resolve by 4 weeks.</u>
3.5	<u>Consider early referral (prior to 4-week post-injury) to an interdisciplinary concussion team in the presence of modifiers that may delay recovery.</u>
3.6	<u>Consider initiating treatment for specific symptoms or concerns while waiting for a referral to an interdisciplinary concussion team or sub-specialist.</u>

3.7	Recommend regular medical follow-up if a child/adolescent is still experiencing post-concussion symptoms or has not completed the return-to-school or return-to-sport/activity stages. Recommend an immediate medical follow-up in the presence of any deterioration.
Domain 4. Medical Clearance for Full-Contact Sport or High-Risk Activity	
4.1	Consider patients for medical clearance to return to full-contact activities and sport/game play if clinical criteria have been met.
4.2	Provide patients with a letter indicating medical clearance to return to all activities when medically cleared.
4.3	Advise medically cleared patients to seek immediate medical attention if he or she develops new concussion-like symptoms or sustains a new suspected concussion.
Domain 5. Sport Concussion Considerations	
5.1	Refer a child/adolescent with multiple concussions or baseline conditions associated with concussion-like symptoms to an interdisciplinary concussion team to help with return to full-contact sports or high-risk activities, or retirement decisions from full-contact sports, or high-risk activities.
5.2	Baseline testing on children/adolescents using concussion assessment tools or tests (or any combination of tests/tools) is not recommended or required for concussion diagnosis or management following an injury.
5.3	Special considerations regarding baseline testing.
5.4	Recommendation 2.3d: Consider referring select patients (e.g., competitive athletes, those who are not tolerating a graduated return to physical activity, or those who are slow to recover) to a medically supervised interdisciplinary team with the ability to individually assess sub-symptom threshold aerobic exercise tolerance and to prescribe aerobic exercise treatment.
Domain 6. Headache	
6.1	Perform a repeat medical assessment on all patients presenting with post-concussion headaches 1-2 weeks following acute injury.
6.1a	Take a focused clinical history.
6.1b	Perform a focused physical examination.
6.1c	Consider diagnostic brain or cervical spine MRI imaging for those with focal or worrisome symptoms.
6.1d	Classify and characterize the headache subtype based on the clinical history and physical examination findings.

6.2	<u>Provide general post-concussion education and guidance on headache management.</u>
6.2a	<u>Advise on non-pharmacological strategies to minimize headaches including sleep hygiene, activity modifications, limiting triggers, and information on screen time.</u>
6.2b	<u>Encourage patients with headaches to engage in cognitive activity and low-risk physical activity as soon as tolerated while staying below their symptom-exacerbation thresholds. Activities that pose no/low risk of sustaining a concussion (no risk of contact, collision, or falling) should be resumed even if mild residual symptoms are present or whenever acute symptoms improve sufficiently to permit activity.</u>
6.2c	<u>Consider suggesting the use of a headache and medication diary in order to monitor symptoms and medications taken. Use clinical judgment and an individualized approach on use or duration of this strategy.</u>
6.2d	<u>Over-the-counter medications such as acetaminophen and ibuprofen may be recommended to treat acute headache. Advise on limiting the use of these medications to less than 15 days a month and avoiding “around-the-clock” dosing to prevent overuse or rebound headaches. I.e., advise that children/adolescents avoid using over the counter medications at regular scheduled times throughout the day.</u>
6.3	<u>Refer patients who have prolonged post-concussion headaches for more than 4 weeks to an interdisciplinary concussion team or to a sub-specialist for further evaluation and management.</u>
6.4	<u>Consider initiating pharmacological therapy to treat and manage prolonged headaches while waiting for the interdisciplinary concussion team or sub-specialist referral.</u>
6.5	<u>Recommend a medical follow-up to reassess clinical status if headaches persist. Recommend an immediate medical follow-up in the presence of any deterioration. Consider early referral (prior to 4-weeks after the acute injury) to an interdisciplinary concussion team in the presence of modifiers that may delay recovery.</u>
Domain 7. <u>Sleep</u>	
7.1	<u>Perform a repeat medical assessment on all patients presenting with post-concussion sleep disturbances 1-2 weeks following acute injury.</u>
7.2	<u>Provide general education and guidance on sleep hygiene that outlines non-pharmacological strategies to improve sleep.</u>
7.2a	<u>Continue to encourage patients with sleep disturbances to engage in sub-symptom threshold cognitive activities and physical activities that pose no/low risk of sustaining a concussion (no risk of contact, collision, or falling) as soon as tolerated.</u>
7.3	<u>Consider managing patients who experience sleep-wake disturbances for more than 4 weeks with cognitive behavioural therapy, treat with daily supplements, and/or refer to an interdisciplinary concussion team.</u>

7.4	Refer patients with prolonged post-concussion sleep disturbances (more than 6 weeks) to a sleep specialist or an interdisciplinary concussion team if the interventions introduced at 4 weeks have been unsuccessful and sleep issues persist.
7.5	Consider prescribing medication on a short-term basis if sleep has not improved after 6 weeks following the acute injury.
7.6	Recommend a medical follow-up to reassess clinical status if sleep disturbances persist. Recommend an immediate medical follow-up in the presence of any deterioration. Consider early referral (before 4 weeks) to an interdisciplinary concussion team in the presence of modifiers that may delay recovery.
Domain 8. Mental Health	
8.1	Assess existing and new mental health symptoms and disorders.
8.2	Assess the child/adolescent’s broader environment, including family and caregiver function, mental health, and social connections.
8.3	Treat mental health symptoms or refer to a specialist in pediatric mental health.
Domain 9. Cognition	
9.1	Evaluate a child/adolescent for cognitive symptoms that interfere with daily functioning following the acute injury.
9.2	Manage cognitive symptoms that interfere with daily functioning for more than 4 weeks following acute injury.
Domain 10. Vision, Vestibular, and Oculomotor Function	
10.1	Perform a repeat medical assessment on all patients presenting with dizziness, blurred or double vision, vertigo, difficulty reading, postural imbalance, or headaches elicited by prolonged visual or vestibular stimulation 1-2 weeks following acute injury.
10.2	Screen for oculomotor or vision deficits.
10.3	Screen for benign paroxysmal positional vertigo (BPPV) if the patient reports vertigo or dizziness that occurs for seconds following position changes and consider targeted particle re-positioning manoeuvres.
10.4	Screen for vestibulo-ocular deficits.
10.5	Screen for balance deficits.
10.6	Screen for and consider underlying psychosocial contributors of vestibular, vision, and oculomotor dysfunction.

10.7	<u>Provide general post-concussion education that outlines symptoms of concussion, provides suggestions regarding activity modification and includes academic accommodations to manage visual, vestibular and oculomotor symptoms.</u>
10.8	<u>Encourage patients with post-concussion vestibular, vision, or oculomotor symptoms to engage in cognitive activity and low-risk physical activity as soon as tolerated while staying below their symptom-exacerbation thresholds. Activities that pose no/low risk of sustaining a concussion (no risk of contact, collision, or falling) should be resumed even if mild residual symptoms are present or whenever acute symptoms improve sufficiently to permit activity.</u>
10.9	<u>Refer patients with prolonged post-concussion vestibular functioning, balance or visual dysfunction (more than 4 weeks following the acute injury) to an interdisciplinary concussion team with appropriate experience. Consider early referral (before 4 weeks) to an interdisciplinary concussion team in the presence of modifiers that may delay recovery.</u>
10.10	<u>Recommend a medical follow-up to reassess clinical status if vestibular functioning, balance or visual dysfunction symptoms persist. Recommend an immediate medical follow-up in the presence of any deterioration.</u>
Domain 11. <u>Fatigue</u>	
11.1	<u>Perform a repeat medical assessment on all patients presenting with post-concussion fatigue 1-2 weeks following acute injury.</u>
11.2	<u>Provide patients with post-concussion fatigue with general education and guidance that outlines non-pharmacological strategies to help cope with fatigue symptoms and set expectations.</u>
11.3	<u>Encourage patients with post-concussion fatigue to engage in cognitive activity and low-risk physical activity as soon as tolerated while staying below their symptom-exacerbation thresholds. Activities that pose no/low risk of sustaining a concussion (no risk of contact, collision, or falling) should be resumed even if mild residual symptoms are present or whenever acute symptoms improve sufficiently to permit activity.</u>
11.4	<u>Consider referral to an interdisciplinary concussion team for patients with prolonged post-concussion fatigue (more than 4 weeks following the acute injury) to learn pacing techniques.</u>
11.5	<u>Recommend a medical follow-up to reassess clinical status if fatigue symptoms persist. Recommend an immediate medical follow-up in the presence of any deterioration. Consider early referral (before 4 weeks) to an interdisciplinary concussion team in the presence of modifiers that may delay recovery.</u>
Domain 12. <u>Return-to-School and Work</u>	
12.1	<u>Recommend a stepwise return-to-school plan and monitor once the student is ready to start a graduated return-to-school. Include temporary accommodations based on symptoms and recommendations from the healthcare professional. Modify the return-to-school plan based on ongoing assessment of symptoms.</u>

12.2	Assess for school difficulties using clinical judgment.
12.3	Manage school difficulties.
12.4	Encourage patients with school difficulties to engage in cognitive activity and low-risk physical activity as soon as tolerated while staying below their symptom-exacerbation thresholds. Activities that pose no/low risk of sustaining a concussion (no risk of contact, collision, or falling) should be resumed even if mild residual symptoms are present or whenever acute symptoms improve sufficiently to permit activity.
12.5	Return-to-school and return-to-sport strategies can be performed simultaneously. Recommend that the child/adolescent returns to school full-time at a full academic load, including writing exams without accommodations, before returning to full-contact sport or high-risk activities.
12.6	Prioritize return-to-school before return-to-work.
Domain 13. Biomarkers- Neuroimaging	
13.1	At this stage, advanced neuroimaging biomarkers are not yet ready for clinical implementation/management.
13.2	When conventional MRI is performed in the clinical management of concussion patients, the inclusion of susceptibility-weighted images (SWI) sequences could be considered as it may be useful for detecting small hemorrhages. The clinical significance of small hemorrhages on SWI is not clear at present.
Domain 14. Biomarkers- Serologic	
14.1	The use of serologic biomarkers is not clinically indicated. Presently there is no validated “concussion blood test” that can be used to accurately detect concussion in children/adolescents.
Domain 15. Considerations for Telemedicine and Virtual Concussion Care	
15.1	Virtual medical assessment
15.1a	Obtain informed consent from the patient and/or their parent/caregiver to conduct a remote medical assessment via telemedicine.
15.1b	Take a comprehensive virtual clinical history.
15.1c	See Recommendation 2.b “Note common modifiers that may delay recovery and use a clinical risk score to predict risk of prolonged symptoms.”
15.1d	Considerations for a virtual physical assessment
15.1e	Recommendation 2.1d: “Consider CT of the brain or cervical spine only in patients whom, after a medical assessment, a structural intracranial or cervical spine injury is suspected; do not

	<u>conduct routine neuroimaging for the purpose of diagnosing concussion.</u>
15.2	<u>Provide verbal information and written (electronic) handouts regarding the course of recovery and when the child/adolescent can return to school/activity/sport/driving/work and strategies to promote recovery.</u>
15.3	<u>Provide a written (electronic) medical assessment or clearance letter to the child/adolescent and the parent/caregiver.</u>
15.4	<p><u>Provide a medical follow-up assessment on children/adolescents with concussion in 1-2 weeks to re-assess and monitor clinical status. A regular medical follow-up is also recommended if a child/adolescent is still experiencing post-concussion symptoms or has not completed the return-to-school or return-to-sport/activity stages. Recommend immediate in-person medical attention in the presence of any deterioration.</u></p> <p>Please refer to Domain 3: Medical follow-up and Management of Prolonged Symptoms for a full list of clinical guideline recommendations to consider when performing a medical follow-up assessment and managing prolonged concussion symptoms.</p>
15.5	<u>Please refer to Domain 4: Medical Clearance for full-contact sports and high-risk activities for a full list of clinical recommendations to consider when determining if a child/adolescent is ready to return to full-contact sports or high-risk activities. Medical clearance is not required to return to school.</u>
15.6	<u>Recommendations for inter-disciplinary healthcare professionals involved in the care of concussion patients.</u>

RECOMMENDATIONS

Section A: Concussion

Recognition, Initial Medical Assessment, and Management

Introduction:

Concussion is a condition that exists along a clinical-pathological spectrum of traumatic brain injury (TBI) and can result in non-specific physical, cognitive, sleep, and emotional symptoms. To provide a comprehensive medical assessment in a patient with acute head and neck trauma, a more severe form of TBI, cervical spine injury, medical conditions, mental health conditions, and neurological conditions that can present with non-specific neurological symptoms including red flags must be ruled out. This requires a comprehensive clinical history, a comprehensive physical examination, ordering and interpreting necessary diagnostic tests, and initiating referrals to medical specialists and healthcare professionals as needed. Patients diagnosed with a concussion must be provided with education and guidance on how to manage their symptoms and how to make a safe and graduate return-to-school/activity/sport and work.

The majority of children and adolescents with an acute concussion will experience symptom resolution and a return to daily activities within 1-4 weeks'. Those with prolonged symptoms (symptoms that last more than 4 weeks following the acute injury) can benefit from a referral to interdisciplinary teams and experienced healthcare professionals who are optimally trained to evaluate and treat the heterogeneous causes of these symptoms. When providing medical clearance to return to activities with a risk of future concussion, patients should be managed on an individualized basis. Interdisciplinary concussion teams may be recommended to manage recovery in situations in which patients have prolonged symptoms, complex medical histories, repeated concussions, or pre-injury conditions or diagnoses.

Medical and healthcare professionals should work together with patients, their families, and those involved in their lives (teachers, coaches, employers, friends, etc.) using a team and family-centred approach to best manage the needs of the patient after a concussion and promote positive health outcomes. Proper concussion recognition in children and adolescents requires all involved in a child/adolescent's life to be educated on the signs and symptoms of this condition and to collaborate to ensure that youth with suspected concussion are immediately removed from play or activity and directed to the most appropriate care. The following sections provide recommendations specific to concussion recognition, initial medical assessment, and management.



Domain 1: Concussion Recognition and Directing to Care

Introduction:

All school and sport stakeholders including students, athletes, parents, teachers, coaches, officials, and healthcare professionals play an important role in recognizing suspected concussions and supporting the child when returning to school, sport, work, and other activities.

Tool 1.1: [Pediatric Concussion: The Role of School Boards, Community Sports Organizations, and Centres](#)

Tool 1.2: [Concussion Recognition Tool 5](#)

Tool 1.3: [Manage Acute and Prolonged Symptoms Algorithm](#)

Recommendations:

1.1a School boards, sports organizations, and community centres should provide pre-season concussion education and conduct a review of all concussion policies in effect within the school or sport setting.

Level of Evidence: C

1.1b School boards, sports organizations, and community centres should ensure updated policies are in place to recognize and accommodate a child/adolescent who has sustained a concussion.

Tool 1.1: [Pediatric Concussion: The Role of School Boards, Community Sports Organizations, and Centres](#)

Level of Evidence: C

1.2 Remove the child/adolescent from the activity immediately if a concussion is suspected for immediate assessment and to avoid another injury.

Do not leave the child alone and contact the parent/caregiver immediately. Do not let the child/adolescent return-to-sport (practice or game play) or other activities that day. “If in doubt, sit them out.”

A concussion should be suspected:

- In any child/adolescent who sustains a significant impact to the head, face, neck, or body and demonstrates/exhibits *any* of the visual signs of a suspected concussion or reports *any* symptoms of a suspected concussion as detailed in the [Concussion Recognition Tool 5 \(Tool 1.2\)](#).

Premature return to activities and sport can lead to another injury. Another blow to the head may complicate the injury further and have a longer recovery time due to the higher risk of prolonged symptoms. Severe brain swelling or cerebral edema after a concussion is very rare but potentially fatal.

Suggested concussion tools to share with teachers, coaches, parents, peers, and others

- Link: [Parachute Return to School Strategy](#) (handout) (Parachute)
- Link: [Concussion Ed – Parachute Concussion Education](#) (app from Parachute)
- Link: [PAR Concussion Recognition & Response: Concussion symptom recognition tool for coaches and parents](#) (app)
- Link: [CATT: Concussion Resources for School Professionals](#) (handout)

Level of Evidence: B

1.3 Recommend an emergency medical assessment for a child/adolescent with any of the “red flag” symptoms.

If a child/adolescent demonstrates any of the ‘Red Flags’ indicated by the [Concussion Recognition Tool 5](#) (Tool 1.2), a more severe head or spine injury should be suspected and an emergency medical assessment is required. Consider arranging an ambulance service as necessary to facilitate urgent medical assessment at the nearest hospital and execution of the Emergency Action Plan for your organization. When calling an ambulance, describe the specific red flags symptoms over the phone.

Red flag symptoms include:

- Severe or increasing headache
- Neck pain or tenderness
- Double vision
- Weakness or numbness in arms/legs
- Seizure or convulsions
- Loss of consciousness
- Deteriorating conscious state
- Repeated vomiting
- Increasingly restless, agitated or combative state
- Slurred speech

Suggested tools to help identify “Red Flag” symptoms

- Tool 1.2: [Concussion Recognition Tool 5: To help identify concussion in children, adolescents and adults](#) (handout)
- Link: [Concussion Ed – Parachute Concussion Education](#) (app- Parachute)
- Link : [PAR Concussion Recognition & Response](#) (app)

Level of Evidence: B

1.4 Concussion should be suspected and diagnosed as soon as possible to maintain health and improve outcomes. Concussion can be suspected in the community by healthcare professionals, parents, teachers, coaches, and peers. Those with a suspected concussion should be referred to a physician or nurse practitioner to perform a thorough medical assessment to exclude more severe injuries, consider a full differential diagnosis, and confirm the diagnosis of concussion.

Tool 1.3: [Manage Acute and Prolonged Symptoms Algorithm](#)

Symptoms may appear immediately or within several hours after injury

- A concussion is an evolving injury; symptoms may change over time
- See Recommendation 1.3: [Recommend emergency assessment for a child/adolescent with any of the “red flag” symptoms](#)

Suggested tools for the general community to suspect a concussion

- [Concussion Recognition Tool 5: To help identify concussion in children, adolescents and adults](#)

Suggested tools for experienced healthcare professionals to suspect a concussion:

- Link: Sport Concussion Recognition Tool 5 (SCAT5) for Children aged 5-12
[English](#) / [French](#)
- Link: SCAT5 for Athletes aged 13+ [English](#) / [French](#)

Level of Evidence: B



Domain 2: Initial Medical Assessment and Management

Introduction:

A thorough medical assessment by a physician or nurse practitioner should be performed on all children and adolescents with a suspected concussion. This assessment includes a full differential diagnosis (ruling out: a more severe TBI, cervical spine injury, medical conditions, mental health conditions, and neurological conditions that can present with non-specific neurological symptoms including red flags) and a confirmation of the diagnosis of concussion. If a more severe injury or other conditions identified at initial assessment are suspected, emergent referrals should be made to appropriate healthcare professionals. Acute signs and symptoms should be considered in context with the child/adolescent's normal pre-injury performance, especially for those with learning and communication deficits, ADHD, and/or physical disabilities. At the initial assessment, verbal and written information should be shared regarding the course of recovery and about when the child/adolescent can return-to-school/activity/sport and work. Patients and their parents and/or caregivers need to know that most patients recover fully from concussion even though the recovery rate is variable and unpredictable. Providing information reduces anxiety, helps set realistic expectations, promotes recovery, and prevents re-injury.

Some children/adolescents will continue to have symptoms at one month and beyond. In these situations, the healthcare professional should refer the patient to an interdisciplinary concussion team for individualized care that targets specific prolonged symptoms. Findings from the patient's clinical history and initial assessment can identify patients who may have an elevated risk of experiencing prolonged symptoms following concussion. Identifying patients at risk for delayed recovery in the acute stage allows for early supportive care, close monitoring for prolonged symptoms, and an opportunity to consider early referral (before 4-weeks post-acute injury) to an interdisciplinary concussion team. Prolonged rest beyond the first 24-48 hours after a concussion is not recommended and may cause more harm than good. Return to physical and cognitive activity should be gradual and individualized based on activity tolerance and symptom presentation (e.g., the patient is able to engage in an activity without worsening of post-concussion symptoms). Full-contact sport or high-risk activities where there is a risk for repeat concussion should be avoided until 1) post-concussion symptoms have subsided, 2) the child/adolescent has returned to full school activities without accommodations related to post-concussion symptoms, and 3) child/adolescent has medical clearance to return to full-contact sport and high-risk activities following the completion of a return-to-sport protocol. Upon discharge from initial assessment from the Emergency Department or Primary Care Provider (physician or nurse practitioner), families should be provided with written instructions which include red flags to return for urgent re-assessment. Families should be informed that most patients recover fully from concussion even though the recovery rate is variable; this will help set realistic expectations, promote recovery and prevent re-injury.

Tool 1.3: [Manage Acute and Prolonged Symptoms Algorithm](#)

Recommendations:

2.1 Physicians or nurse practitioners should perform a comprehensive medical assessment on all children/adolescents with a suspected concussion or with acute head or spine trauma.

Tool 1.3: [Manage Acute and Prolonged Symptoms Algorithm](#)

Include a clinical history, physical examination, and the evidence-based use of diagnostic tests or imaging as needed.

2.1a Take a comprehensive clinical history.

Details that should be collected in the clinical history include:

- Patient demographics (e.g., age, sex, gender)
- Assess injury mechanism and symptoms at the time of injury
- Assess symptom burden at the time of initial presentation
 - Number of symptoms
 - Severity of symptoms
 - Type of symptoms
- Presence of loss of consciousness, post-traumatic amnesia, and red flags (seizures, neck pain, focal neurological deficits)
- Current post-concussion symptoms (using age-appropriate standardized symptom inventory)
- Review mental health (Domain 8: [Mental Health](#))
- Past medical history (e.g., previous concussions, migraine or non-specific headaches, mental health disorders, coagulopathy). Note the duration until recovery from previous concussions (i.e., within 7-10 days or prolonged).
- Allergies/immunizations
- Ask whether the child/adolescent is taking any substances or medications: Prescribed or over-the-counter medications or supplements, alcohol, or recreational drugs including cannabis. These substances may mask or modify concussion symptoms.
- Ask about school, activities, work, and sports participation

Level of Evidence: B

2.1b Note common modifiers that may delay recovery and use a clinical risk score to predict risk of prolonged symptoms.

Link: [Predicting Persistent Post-Concussive Problems in Pediatrics \(5P\): Score Calculator](#)

Modifiers that may delay recovery:

- Age (increased risk with increased age).
- Sex (female).
- Duration of recovery from a previous concussion.
- High pre-injury symptom burden.
- High symptom burden at initial presentation.
- Clinical evidence of vestibular or oculomotor dysfunction.
- Personal and family history of migraines.
- History of learning or behavioural difficulties.

- Personal and family history of mental health.
- Family socioeconomic status/education.

Level of Evidence: A

2.1c Perform a comprehensive physical examination.

Vital signs (resting heart rate and blood pressure)

- Level of consciousness (GCS)
- Mental status
- A complete neurological examination (cranial nerve, motor, sensory, reflex, cerebellar, gait and balance testing) (Tool 2.1: [Physical Examination](#))
- A cervical spine examination (palpation, range of motion, provocative cervical spine tests) (Tool 2.1: [Physical Examination](#))
- An examination of the visual and vestibular systems

Tools to consider:

- Link: SCAT5 for Children aged 5-12 [English](#) / [French](#)
- Link: SCAT5 for Athletes aged 13+ [English](#) / [French](#)
- Link: [Post-Concussion Symptom Inventory \(PCSI\) Self Assessment](#) (age 5-7, 8-12, age 13-18)
- Link: [CDC Pediatric mTBI Guideline Checklist](#)
- Link: [Heads Up to Health Care Professionals \(CDC\)](#)
- Link: [Acute Concussion Evaluation \(ACE\)](#).

Level of Evidence: B

2.1d Consider CT of the brain or cervical spine only in patients whom, after a medical assessment, a structural intracranial or cervical spine injury is suspected; do not conduct routine neuroimaging for the purpose of diagnosing concussion.

Most children/adolescents who sustain an acute head injury or suspected concussion do not need diagnostic imaging.

Use the following tools, as appropriate, to determine the need for CT imaging in patients with acute head trauma:

- Tool 2.2: [PECARN Management Algorithm for Children after Head Trauma](#)
- Tool 2.3: [CATCH 2 Rule for children after head trauma](#)
- Tool 2.4: [Algorithm for the Management of the Pediatric Patient \$\geq\$ 2 Years With Minor Head Trauma](#)

Although validated clinical decision-making rules are highly sensitive, these tools are meant to assist but not replace clinical judgment. CT scans should be used judiciously as the exposure of children/adolescents to the effects of ionizing radiation carries a small increased lifetime risk of cancer. If a structural brain injury is suspected in a patient with acute head trauma undergoing initial medical assessment in the office setting, urgent referral to an Emergency Department should be

arranged.

Diagnostic imaging of the spine should be considered when symptoms are suggestive of structural cervical spine injury. Imaging should be considered in patients with severe neck pain, tenderness or clinical evidence of radiculopathy or myelopathy. The choice of imaging modality (plain radiographs, CT or MRI of the cervical spine) should be guided by the suspected pathology.

Patients with positive traumatic findings observed on diagnostic imaging of the brain or spine should be urgently referred to a neurosurgeon for consultation.

Level of Evidence: A- CT. B- MRI

2.2 Provide verbal information and written (electronic) handouts regarding the course of recovery and when the child/adolescent can return to school/activity/sport/work.

Consider the following anticipatory guidance (verbal reassurance) in order to reduce anxiety, set realistic expectations, promote recovery, and prevent re-injury:

- Most patients recover fully from concussion even though the recovery rate is variable and unpredictable.
- Current symptoms are expected and common.
- The burden and distress parents/caregivers of children/adolescents who have sustained a concussion may experience is common.
- Children typically recover in 1-4 weeks but some children/adolescents will have symptoms at one month and beyond and need to be monitored/seek additional care. Females aged 13-18 years have an increased risk of prolonged recovery.
- Recommendation 2.3 [Recommend graduated return to physical and cognitive activity](#)
- Domain 12: [Return-to-School and Work](#)

Summary of online tools to consider related to lifestyle strategies and expectations:

- Link: [Return to Activity Strategy](#) (CATT)
- Link: [Return to Sport Strategy](#) (CATT)
- Link: [After a Concussion: Return to Sport Strategy](#) (Parachute)
- Link: [Return-to-School Strategy](#) (CATT)
- Link: [HEADS UP Resources for Returning to School](#) (CDC)
- Link: [Return to School Strategy](#) (Parachute)
- Link: Advice for gradually resuming intellectual, physical and sports activities [English/ French](#) (INESSS)

Level of Evidence: B

2.3 Recommend graduated return to cognitive and physical activity to promote recovery.

While most children/adolescents fully recover, the recovery rate can be variable. Return to physical and cognitive activity should be individualized based on activity tolerance and symptom presentation.

2.3a Recommend an initial 24-48 hour period of rest with limited physical and cognitive activity.

Level of Evidence: B- Gradual return to physical activity. C- Gradual return to cognitive activity.

2.3b Recommend that low to moderate level physical and cognitive activity be gradually started 24-48 hours after a concussion at a level that does not result in recurrence or exacerbation of symptoms. Activities that pose no/low risk of sustaining a concussion should be resumed even if mild residual symptoms are present or whenever acute symptoms improve sufficiently to permit activity.

Low to moderate level physical and cognitive activity:

- Avoid activities associated with a risk of contact, fall, or collisions ([Recommendation 2.3c](#)).
- Symptoms should be monitored carefully and activities that make symptoms worse should be avoided
- Child/adolescent should gradually increase exercise/activity that matches an improvement in symptoms
- Emphasize that spreading activities throughout the day helps patients achieve more and that they should avoid doing too much at once. Tool 2.5: [“Four P’s” – Prioritize, Plan, Pace, and Position](#)
- Domain 12: [Return-to-School and Work](#)
- Tool 2.6: [Post-Concussion Information Sheet](#) (includes a list of examples of low-risk activities)
- Link: [CATT Return to Sport Strategy](#) (CATT online; includes examples of low risk activities)

Level of Evidence: B- Gradual return to physical activity. C- Gradual return to cognitive activity.

2.3c Recommend that patients avoid activities associated with a risk of contact, fall, or collisions such as high speed and/or contact activities and full-contact sport that may increase the risk of sustaining another concussion during the recovery period.

Advise/emphasize that returning to full-contact sport or high-risk activities before the child/adolescent has recovered increases the risk of delayed recovery and for sustaining another more severe concussion or more serious injury.

Level of Evidence: B

2.3d Consider referring select patients (e.g., competitive athletes, those who are not tolerating a graduated return to physical activity, or those who are slow to recover) to a medically supervised interdisciplinary team with the ability to individually assess sub-symptom threshold aerobic exercise tolerance and to prescribe aerobic exercise treatment.

Level of Evidence: B

2.4 Provide education and guidance regarding strategies to promote recovery.

2.4a Advise on the importance of sleep and discuss sleep hygiene.

Advise that consistent sleep schedules and duration of sleep may contribute to general recovery from a concussion and alleviate symptoms such as mood, anxiety, pain, fatigue, and cognitive difficulties if these are present.

Summary of tools to consider:

- Tool 2.7: [Strategies to Promote Good Sleep and Alertness](#)
- Link: [Sleep for Youth. CHEO Sleep Hygiene handout](#)
- Link: [Concussion Handbook](#) (Holland Bloorview Kids Rehabilitation Hospital)

Level of Evidence: C

2.4b Advise on maintaining social networks and interactions as tolerated beyond a brief initial period of cognitive and physical rest (24-48 hours after injury).

Beyond a brief initial period of cognitive and physical rest, 24-48 hours after injury, children/adolescents should participate in rewarding social activities, modified as needed, while staying below their symptom-exacerbation thresholds and avoiding risk for re-injury. There is evidence that reducing the risk of social isolation and mental health issues may promote recovery.

- Identify these activities and suggest modifications as appropriate.
- Educate on the principle that participation in rewarding social activities in the presence of residual or prolonged symptoms may have to be limited so that they do not result in a recurrence or exacerbation of symptoms.

Level of Evidence: B

2.4c Advise on the use of computers, phones, and other devices with screens. Beyond an initial period of cognitive and physical rest (24-48 hours after injury), use of devices with screens may be gradually resumed at a level that does not result in recurrence or exacerbation of symptoms.

Advise that computers, phone, and other devices with screens may exacerbate symptoms, especially in the first days after injury. The use of these devices can be increased according to symptom tolerance as the child/adolescent recovers. For sleep hygiene purposes, these devices should not be used in the hour prior to bedtime.

Level of Evidence: C

2.4d Advise on avoiding alcohol and other recreational drugs after a concussion.

Alcohol and recreational drugs may have a negative effect on concussion recovery. Avoiding alcohol or drugs prevents a child/adolescent from self-medicating and resorting to drugs to relieve symptoms. Impaired judgment after a concussion could lead to risky behaviour that causes further harm or may delay the identification of complications.

Level of Evidence: C

2.4e Advise to avoid driving during the first 24-48 hours after a concussion. Advise patients to begin driving when they are feeling improved, can concentrate sufficiently to feel safe behind the wheel, and when the act of driving does not provoke significant concussion symptoms.

Provide verbal information related to when an adolescent should return to driving during recovery from a concussion. Driving is a complex coordinated process that requires vision, balance, reaction time, judgment, cognition, and attention. Concussion may have affected some or all of these skills. Driving impairments have been shown to exist even in asymptomatic patients 48 hours after a concussion. Avoiding driving for at least 24-48 hours after a concussion may potentially prevent motor vehicle accidents and, therefore, injury to the adolescent or to others.

Level of Evidence: C

2.5 Over-the-counter medications such as acetaminophen and ibuprofen may be recommended to treat acute headache. Advise on limiting their use to less than 15 days a month and avoiding “around-the-clock” dosing to prevent overuse or rebound headaches (i.e., advise that children/adolescents avoid using over the counter medications at regular scheduled times throughout the day).

Level of Evidence: B

2.6 At present, there is limited evidence to support the administration of intravenous medication to treat acute headaches in pediatric concussion patients in the Emergency Department setting.

Level of Evidence: B

2.7 After assessment, nearly all children/adolescents with concussion may be safely discharged from clinics and Emergency Departments for observation at home.

The decision to observe in the hospital will depend on clinical judgment. Indicators for longer in-hospital observation (or to return to emergency for re-assessment) may include:

- Worsening symptoms (headache, confusion, irritability)
- Decreased level of consciousness
- Prolonged clinical symptoms (persistent/prolonged vomiting, severe headache, etc.)
- Bleeding disorders
- Multi-system injuries
- Co-morbid symptoms

Other discharge considerations:

- Observe the child/adolescent for a period of time to verify that they do not develop “red flag” symptoms prior to discharge. Use clinical judgment.
- Verify that the child/adolescent has a normal mental status (alertness/behaviour/cognition) and their symptoms are improving prior to discharge.
- Verify that an assessment of clinical risk factors indicating the need for a CT scan was performed or a normal result was obtained if a CT scan was performed prior to discharge. See

[Recommendation 2.1d](#) for more information on when to consider diagnostic brain or cervical spine imaging.

Level of Evidence: B

2.8 Recommend a medical follow-up visit in 1-2 weeks to re-assess and monitor clinical status. Recommend an immediate medical follow-up in the presence of any deterioration.

Those with a confirmed diagnosis of concussion may be managed by a healthcare professional who within their formally designated scope of practice has the capacity to manage ongoing concussion-related symptoms.

Level of Evidence: C

2.9 Consider referral to an interdisciplinary concussion team in the presence of modifiers that may delay recovery.

See Recommendation 2.1b: [Note any modifiers that may delay recovery and use a clinical risk score to predict risk of prolonged symptoms.](#)

Level of Evidence: A

2.10 Provide post-concussion information and a written medical assessment to the child/adolescent and the parent/caregiver prior to sending the child/adolescent home.

Write the discharge note/written medical assessment with the following information:

- The outcome of the initial medical assessment.
- Indicate to the child/adolescent and their parents, teachers, and coaches if they have been medically cleared to participate in full-contact sports or high-risk activities.
- Link: [Canadian Guideline on Concussion in Sport Medical Assessment Letter](#) (Parachute Canada)
- Link: [Montreal Children's Hospital Discharge Instructions](#)

Verbal and written (or electronic) guidance should include:

- Tool 2.6: [Post-Concussion Information Sheet](#)
- An overview of common concussion symptoms.
- Warning signs that should prompt emergency medical assessment.
- Suggestions regarding activity modifications and non-pharmacological strategies to manage symptoms.
- Information on how and when to make a gradual return-to-school and low-risk physical activities. (Domain 12: [Return-to-School and Work](#))
- Recommendation 2.3: [Recommend a graduated return to physical and cognitive activity](#)).
- Information on when a medical follow-up appointment is needed ([Recommendation 2.7](#)).

Examples of patient information handouts to consider:

- Link : Institut national d'excellence en sante et en services sociaux (INESSS- Québec). Advice for gradually resuming intellectual, physical and sports activities. [English](#) / [French](#)
- Link: [CDC: Heads UP Discharge Instructions](#)
- Link: [Concussion & You Handbook: Holland Bloorview Kids Rehabilitation Hospital](#)
- Link: [Understanding and Managing Concussion in Youth: 3rd Edition Concussion Kit: Montreal Children's Hospital](#)

Level of Evidence: B



Domain 3: Medical Follow-up and Management of Prolonged Symptoms

Introduction:

A medical follow-up is recommended if a child/adolescent is experiencing post-concussion symptoms, has not completed the return-to-school or return-to-activity/sport stages, or experiences any deterioration. Post-concussion symptoms and return-to-school/ activity/sport/work status should be reassessed. A medical assessment including clinical history, comprehensive physical examination, and consideration for diagnostic tests or imaging should be considered in patients with red flag symptoms or worrisome clinical findings. Those with a confirmed diagnosis of concussion may be managed by a healthcare professional that, within their formally designated scope of practice, has the capacity to manage ongoing concussion-related symptoms.

Patients who are experiencing clinical improvement in their post-concussion symptoms should continue to be provided with education, reassurance, and guidance on advancing through their return-to-school/activity/sport strategies. At follow-up visits, patients should be provided with an updated medical clearance letter indicating if they are medically cleared to participate in full-contact sport or high-risk activities.

If post-concussion symptoms have not resolved by one-month, or if the child/adolescent's condition/symptoms worsen, consider referral to specialized care with an interdisciplinary concussion team and ensure that the child/adolescent is well supported at school and at home. Additionally, early identification of patients with modifiers that may delay recovery allows for early targeted supportive care, close monitoring for prolonged symptoms, and consideration for early referral (before 4-weeks following acute injury) to an interdisciplinary concussion team.

[Tool 1.3: Manage Acute and Prolonged Symptoms Algorithm](#)

Recommendations:

3.1 Perform a repeat medical assessment on all patients presenting with post-concussion symptoms 1-2 weeks following acute injury.

Include a focused clinical history, focused physical examination, and consideration for the need for diagnostic tests including imaging. See [Tool 1.3: Manage Acute and Prolonged Symptoms Algorithm](#).

3.1a Take a focused clinical history based on symptoms described.

- Domain 6: [Headache](#)
- Domain 7: [Sleep](#)
- Domain 8: [Mental Health](#)
- Domain 9: [Cognition](#)
- Domain 10: [Vision, Vestibular, and Oculomotor Function](#)

- Domain 11: [Fatigue](#)
- Domain 12: [Return-to-School and Work](#)

Consider signs and symptoms in context with the child/adolescent’s normal performance, especially for those with pre-existing conditions (e.g., learning and communication deficits, ADHD, and/or physical disabilities) to identify the underlying causes of the prolonged symptoms or concerns and develop a management strategy.

Level of Evidence: B

3.1b Examine the child/adolescent and perform a focused physical examination.

- Tool 2.1: [Physical Examination](#)
- Vital signs (Resting heart rate and blood pressure).
- A complete neurological examination (cranial nerve, motor, sensory, reflex, cerebellar, gait, balance testing) (Tool 2.1: [Physical Examination](#)).
- A cervical spine examination (palpation, range of motion, provocative cervical spine tests) (Tool 2.1: [Physical Examination](#)).
- Review mental health. Perform a post-concussive assessment and a cognitive screen, reassessing for existing and new mental health symptoms such as anxiety and mood.
- Screen the child/adolescent for medication/substances that may mask or modify the symptoms.
- Consider a broad differential diagnosis for children/adolescents with prolonged symptoms.
- Monitor the return-to-activity/sport and return-to-school status.
- Further examination of the child/adolescent should be based on symptoms:
 - Link: [Post-Concussion Symptom Inventory \(PCSI\) Self-Assessment](#) (age 5-7, 8-12, age 13-18)
 - Domain 6: [Headache](#)
 - Domain 7: [Sleep](#)
 - Domain 8: [Mental Health](#)
 - Domain 9: [Cognition](#)
 - Domain 10: [Vision, Vestibular, and Oculomotor Function](#)
 - Domain 11: [Fatigue](#)
 - Domain 12: [Return-to-School and Work](#)

Level of Evidence: B

3.1c Consider diagnostic brain or cervical spine MRI imaging for those with focal or worrisome symptoms.

See [Recommendation 2.1d](#): When to consider diagnostic brain or cervical spine imaging.

Urgent conventional MRI should be considered in concussion patients who present with focal or worrisome symptoms (e.g., deteriorating vision, focal weakness or numbness, altered awareness, prominent behavioural changes, or worsening headaches that are not responding to treatment) and in whom a structural brain injury or abnormality is suspected.

Level of Evidence: B-MRI

3.2 Provide patients with general education and guidance that outlines mental health considerations, non-pharmacological strategies to minimize symptoms including sleep hygiene, activity modifications, limiting triggers, information on screen time, the importance of social interaction, and how to work with the school team to facilitate school success.

- Tool 2.6: [Post-Concussion Information Sheet](#)
- Tool 2.7: [Strategies to Promote Good Sleep and Alertness](#)
- Link: [Sleep for Youth. CHEO Sleep Hygiene handout](#)
- Recommendation 2.3 [Recommend graduated return to cognitive and physical activity](#)
- Domain 12: [Return-to-School and Work](#)
- Recommendation 2.4c: [Advise on the use of computers, phones, and other screen devices](#)

Level of Evidence: C

3.3 Encourage patients with post-concussion symptoms to engage in cognitive activity and low-risk physical activity as soon as tolerated while staying below their symptom-exacerbation thresholds. Activities that pose no/low risk of sustaining a concussion (no risk of contact, collision, or falling) should be resumed even if mild residual symptoms are present or whenever acute symptoms improve sufficiently to permit activity.

Consider referring select patients (e.g., competitive athletes, those who are not tolerating a graduated return to physical activity, or those who are slow to recover) to a medically supervised interdisciplinary team with the ability to individually assess sub-symptom threshold aerobic exercise tolerance and to prescribe aerobic exercise treatment.

See [Recommendation 2.3](#).

See Tool 2.6: [Post-Concussion Information Sheet](#) for examples of low-risk activities.

Level of Evidence: B- Gradual return to physical activity. C- Gradual return to cognitive activity.

3.4 Refer to specialized care with an interdisciplinary concussion team if post-concussion symptoms do not gradually resolve by 4 weeks.

See Tool 1.3: [Manage Acute and Prolonged Symptoms Algorithm](#).

Assessment by an interdisciplinary concussion team can assist in identifying the type of management that is required, along with the medical and health professions on the interdisciplinary concussion team or external to this team who can provide the required management. Not all children/adolescents will require care from all members of the interdisciplinary concussion team and care should be targeted based on identified symptoms and patient needs.

Level of Evidence: B

3.5 Consider early referral (prior to 4-week post-injury) to an interdisciplinary concussion team in the presence of modifiers that may delay recovery.

See Recommendation 2.1b: [Note any modifiers that may delay recovery and use a clinical risk score to predict risk of prolonged symptoms.](#)

Level of Evidence: A

3.6 Consider initiating treatment for specific symptoms or concerns while waiting for a referral to an interdisciplinary concussion team or sub-specialist.

- Domain 6: [Headache](#)
- Domain 7: [Sleep](#)
- Domain 8: [Mental Health](#)
- Domain 9: [Cognition](#)
- Domain 10: [Vision, Vestibular, and Oculomotor Function](#)
- Domain 11: [Fatigue](#)
- Domain 12: [Return-to-School and Work](#)

Level of Evidence: B

3.7 Recommend regular medical follow-up if a child/adolescent is still experiencing post-concussion symptoms or has not completed the return-to-school or return-to-sport/activity stages. Recommend an immediate medical follow-up in the presence of any deterioration.

Level of Evidence: C



Domain 4: Medical Clearance for Full-Contact Sports or High-Risk Activity

Introduction:

Medical clearance to return to full-contact sports or high-risk activities should be made on an individual basis using clinical judgment based on the findings of the medical follow-up. Presently there is no objective test to confirm physiological recovery following concussion. The child/adolescent should have returned to all school activities, including writing exams without accommodations related to their concussion/post-concussion symptoms, before medical clearance is given for returning to full-contact sports or high-risk activities.

Recommendations:

4.1 Consider patients for medical clearance to return to full-contact activities and sport/game play if clinical criteria have been met.

The following clinical criteria should be considered or met before recommending that a child/adolescent returns to full-contact activities and sport/game play:

- Child/adolescent has successfully returned to all school activities including writing exams without symptoms above their previous pre-injury level or requiring accommodations related to their concussion/post-concussion symptoms, (e.g., child/adolescent may have pre-existing accommodations or new accommodations related to something other than their concussion).
- Normal neurological and cervical spine examination.
- Asymptomatic at rest (or back to the pre-injury state in patients with pre-existing conditions such as baseline headaches or mental health conditions).
- Tolerating physical activities and non-contact activities without any symptoms.
- No longer taking any drugs or substances atypical to their pre-injury functioning that could mask symptom presentation.

For children/adolescents with complex medical histories (e.g., repeated concussion, baseline concussion-like symptoms), see [Recommendation 5.1](#) for information regarding returning to full-contact sports or high-risk activities, or retirement from full-contact sports or high-risk activities.

Level of Evidence: B

4.2 Provide patients with a letter indicating medical clearance to return to all activities when medically cleared.

Link: [Canadian Guideline on Concussion in Sport Medical Assessment Letter](#)

Link: Quebec Association of Sport and Exercise Medicine physicians: Medical clearance letter. [English/](#)
[French](#)

Level of Evidence: C

4.3 Advise medically cleared patients to seek immediate medical attention if he or she develops new concussion-like symptoms or sustains a new suspected concussion.

Tool 1.2: [Concussion Recognition Tool 5: To help identify concussion in children, adolescents, and adults](#)

Level of Evidence: B



Domain 5: Sport Concussion Considerations

Introduction:

Return to full-contact sport or high-risk activity decisions may be complicated for children/adolescents who have experienced multiple concussions or who have baseline conditions that are associated with concussion-like symptoms. Numerous factors including concussion history, co-morbidities, contraindications, symptom presentation, injury threshold, and sequelae should be considered when making return to sport decisions for children/adolescents who have complex medical histories. The current evidence does not support an added benefit of baseline testing. Mandatory pre-season baseline testing is not recommended.

Link: [Parachute Statement on Baseline Testing](#) (Parachute Canada)

Recommendations:

5.1 Refer a child/adolescent with multiple concussions or baseline conditions associated with concussion-like symptoms to an interdisciplinary concussion team to help with return to full-contact sports, or high-risk activities or retirement decisions from full-contact sports, or high-risk activities.

Return to full-contact sport or high-risk activity decisions can be complicated for children/adolescents with more complex medical histories. The following factors should be taken into consideration in the discussion and decisions made about return-to-sport or retirement:

- Concussion history
- Co-morbidities (e.g., learning and communication deficits, ADHD, physical disabilities, psychiatric disorders)
- Absolute contraindications for return-to-sport and high-risk activities
- Early recurrence or greater frequency of symptoms
- Lower injury threshold
- Increasing recovery time
- Potential short- and long-term sequelae

Some patients may benefit from neuropsychological assessment to determine resolution of cognitive problems. If a post-injury cognitive or neuropsychological assessment is deemed clinically necessary, it is recommended that this assessment be interpreted by a pediatric neuropsychologist.

Level of Evidence: C

5.2 Baseline testing on children/adolescents using concussion assessment tools or tests (or any combination of tests/tools) is not recommended or required for concussion diagnosis or management following an injury.

See the [Parachute Statement on Baseline Testing](#) for more information (Parachute Canada).

“Baseline testing refers to the practice of having an athlete complete certain concussion assessment tools/tests prior to sports participation to provide baseline measurements that can be compared to post-injury values in the event of a suspected concussion. Current evidence does not support a significant added benefit of baseline testing athletes. This includes the Child SCAT5 and the SCAT5 tools, as well as neuropsychological and neurocognitive tests, both computerized or not.” ([Parachute Statement on Baseline Testing](#))

See [Recommendation 5.3](#): Special considerations regarding baseline testing.

Level of Evidence: B

5.3 Special considerations regarding baseline testing.

Please consult the [Parachute Statement on Baseline Testing](#) for more information (Parachute Canada).

“There may be unique athlete populations and sports environments where baseline testing may be considered. These situations should be considered the exception and not the rule.”

- “Clinical neuropsychologists may consider baseline cognitive or neuropsychological testing in select youth athletes (greater than 12 years old) who have pre-existing conditions, such as a history of previous concussion, ADHD, or learning disorders, that may impact the interpretation of post-injury test results.”
- “Certain teams and sporting federations have well-established physician-supervised concussion protocols with dedicated experienced healthcare professionals working directly and continuously with youth athletes (i.e., that are present at training and competition events). In these sport environments, baseline testing may be considered as an optional assessment within the comprehensive concussion protocol as long as the medical teams caring for these athletes include experienced healthcare professionals who have competency-based training and clinical experience to allow them to administer and interpret these tests.”

(Reproduced with permission from Parachute Canada: [Parachute Statement on Baseline Testing](#))

Level of Evidence: B

5.4 [Recommendation 2.3d](#): Consider referring select patients (e.g., competitive athletes, those who are not tolerating a graduated *return* to physical activity, or those who are slow to recover) to a medically supervised interdisciplinary team with the ability to individually assess sub-symptom threshold aerobic exercise tolerance and to prescribe aerobic exercise treatment.

Level of Evidence: B



Domain 15: Telemedicine and Virtual Concussion Care

Introduction:

Preliminary research has demonstrated that telemedicine can be used to provide timely access to safe and cost-effective medical care of carefully selected concussion patients living in underserved regions. Research from the teleneurology, telepsychiatry and teleneuropsychology literature suggests that patients with prolonged concussion symptoms including those with headaches, mental health disorders, and cognitive impairment may also benefit from accessing care via telemedicine. While the COVID-19 pandemic has propelled greater use of virtual care, healthcare professionals using virtual platforms to deliver concussion care should be aware of the limitations of these approaches in order to ensure they are practicing in accordance with regional guidelines and policies outlined by their respective professional regulatory bodies. The future use of telemedicine and virtual care to assist in delivering primary and interdisciplinary concussion care will continue to be refined by future research and experience.

Definitions:

Telemedicine: Telemedicine has been defined as “the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment, and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities.” (WHO, 2010). Telemedicine can be delivered synchronously (e.g., in-person videoconferencing) or asynchronously (e.g., store and forward or EConsultation).

Virtual care: Virtual care has been defined as “any interaction between patients and/or members of their circle of care, occurring remotely, using any forms of communication or information technologies, with the aim of facilitating or maximizing the quality and effectiveness of patient care” (Shaw et al, 2018).

The following clinical recommendations and preliminary algorithm have been developed to share evidence and expert opinion on how to guide the medical and interdisciplinary care of pediatric concussion patients using telemedicine and includes suggestions to optimize a virtual medical assessment.

- Tool 15.1: [Considerations for Telemedicine and Virtual Care Algorithm](#)
- Tool 15.2 [Considerations for a virtual physical examination for medical assessment and follow-up of concussion patients](#)

Clinical Recommendations:

Recommendation 15.1 **Virtual medical assessment:**

See [Recommendation 2.1](#) *“Physicians or nurse practitioners should perform a comprehensive medical assessment on all children/adolescents with a suspected concussion or with acute head or spine trauma.*

- *Include a clinical history, physical examination, and the evidence-based use of diagnostic tests or imaging as needed.”*

In-person medical assessments are ideal for all children/adolescents with suspected or diagnosed concussion, however, telemedicine may be considered to assist in the medical assessment for patients who meet the following criteria:

- A previous medical assessment by a physician or nurse practitioner has been performed.
- Access or travel for an in-person medical assessment is limited or difficult
- There is no history of abnormal diagnostic imaging (e.g., intracranial hemorrhage, spine or facial fracture)

Note: All providers should be aware of current public health recommendations when providing care to their patients.

Tool 15.1: [Considerations for Telemedicine and Virtual Care Algorithm](#)

Level of Evidence: C

15.1a Obtain informed consent from the patient and/or their parent/caregiver to conduct a remote medical assessment via telemedicine.

This process should outline the benefits and limitations of performing clinical care via telemedicine as well as taking measures to ensure privacy and confidentiality. Discuss the important limitation of not being able to perform some aspects of the physical examination virtually (e.g., testing of motor or sensory functioning, fundoscopy, etc.) and outline what arrangements will be made to facilitate an urgent in-person assessment as needed to optimize clinical care.

Level of Evidence: C

For other general considerations on how clinicians and patients can be prepared for a virtual visit see the following links:

- Canadian Medical Association. Scaling up virtual care in Canada: CMA a key player in new national task force. February 2020. <https://www.cma.ca/scaling-virtual-care-canada-cma-key-player-new-national-task-force>
- American Medical Association. [TeleHealth Quick Guide](#) September 2020.
- Canadian Medical Association. [Virtual Care Guide for Patients](#). June 2020.

15.1b Take a comprehensive virtual clinical history.

Complete a comprehensive virtual clinical history that addresses the same key components of an in-person medical assessment including patient demographics, injury mechanism, symptoms at the time of injury, symptom burden at the time of presentation, loss of consciousness, post-traumatic amnesia, self-reported red flags, mental health, past medical history, assessment of concussion modifiers, current medications and allergies, school, work, and sports participation.

- See [Recommendation 2.1a](#) for details that should be collected in the clinical history. This recommendation includes a validated age-appropriate symptom inventory that can be considered as a tool to assess current symptoms and severity.

Level of Evidence: C

15.1c See [Recommendation 2.b](#) “Note common modifiers that may delay recovery and use a clinical risk score to predict risk of prolonged symptoms.”

15.1d Considerations for a virtual physical assessment

A virtual physical examination should aim to assess similar aspects of neurological functioning evaluated during an in-person medical assessment with modifications based on the presence of a remote telepresenter or examiner.

- The unassisted virtual physical examination should include assessment of mental status, speech, cranial nerves, coordination, balance, gait, cognitive functioning, oculomotor functioning, and the cervical spine.
- Certain aspects of the physical examination including assessment of motor, sensory and vestibular functioning; palpation and provocative testing of the cervical spine; testing of visual acuity and deep tendon reflexes; as well as fundoscopic and otoscopic examinations cannot be performed virtually.

Tool 15.2: [Considerations for a virtual physical examination for medical assessment and follow-up of concussion patients](#)

Link: [Recommendation 2.1c](#) -recommendations on an in-person medical assessment.

Level of Evidence: C

15.1e [Recommendation 2.1d](#): “Consider CT of the brain or cervical spine only in patients whom, after a medical assessment, a structural intracranial or cervical spine injury is suspected; do not conduct routine neuroimaging for the purpose of diagnosing concussion.”

15.2 Provide verbal information and written (electronic) handouts regarding the course of recovery and when the child/adolescent can return to school/activity/sport/driving/work and strategies to promote recovery.

This should include the following:

[Guideline for Diagnosing and Managing Pediatric Concussion – Recommendations / Tools](#)

- Guidance on the appropriate use of rest and guidance on making a gradual return to symptom-limiting cognitive, school, social, and low-risk physical activities.
 - Recommendation 2.3 Recommend graduated return to cognitive and physical activity to promote recovery.
 - Domain 12: Return to school
- Guidance on sleep (Recommendation 2.4 a)
- Recommendation on social networks and interactions (Recommendation 2.4b)
- Recommendation on driving (Recommendation 2.4e)
- Guidance on the appropriate use of over-the-counter medications for symptom management (Recommendation 2.5)
- Recommendation on screen time and electronic device use (Recommendation 2.4c)
- Recommendation to avoid alcohol and recreational drugs (Recommendation 2.4d)

Where available, provide post-injury education that is appropriate for the patient’s culture and/or preferred language.

Summary of online tools to consider related to lifestyle strategies and expectations:

- Link: [Advice for gradually resuming intellectual, physical and sports activities English/ French \(INESSS\)](#)
- Link: [After a Concussion: Return to Sport Strategy](#) (Parachute Canada)
- Link: [HEADS UP Resources for Returning to School](#) (CDC)
- Link: [Return to Activity Strategy](#) (CATT)
- Link: [Return-to-School Strategy](#) (CATT)
- Link: [Return to Sport Strategy](#) (CATT)
- Link: [Return to School Strategy](#) (Parachute)
- Link: [Post Concussion Information Sheet](#) (Parachute)
- Link: [Post Concussion Information Sheet for First Nations Youth](#) (Parachute)
- Link: [Post Concussion Information Sheet for Nunavut Youth – French](#) (Parachute)
- Link: [Post Concussion Information Sheet for Nunavut Youth – English](#) (Parachute)
- Link: [Post Concussion Information Sheet for Nunavut Youth – Inuktitut](#) (Parachute)
- Link: [Post Concussion Information Sheet for Nunavut Youth – Inuinnaqtun](#) (Parachute)

Level of Evidence: C

15.3 Provide a written (electronic) medical assessment or clearance letter to the child/adolescent and the parent/caregiver.

Link: [Canadian Guideline on Concussion in Sport Medical Assessment Letter](#)

Link: [Canadian Guideline on Concussion in Sport Medical Clearance Letter](#)

Level of Evidence: C

15.4 Provide a medical follow-up assessment on children/adolescents with concussion in 1-2 weeks to re-assess and monitor clinical status. A regular medical follow-up is also recommended if a child/adolescent is still experiencing post-concussion symptoms or has not completed the return-to-

school or return-to-sport/activity stages. Recommend immediate in-person medical attention in the presence of any deterioration.

While in-person medical follow-up is ideal, telemedicine (e.g., real-time in-person videoconferencing) may be considered for follow-up appointments for the following patients with concussion:

- a) Those for whom access or travel for follow-up is limited or unavailable such as those who live in rural and remote communities.
- b) Those who have undergone a previous in-person medical assessment by the treating physician or nurse practitioner
- c) Those whose symptoms are stable, improving, or resolved
- d) Those who do not report any subjective red flags (e.g., blurred or double vision, weakness or numbness, vertigo) and who have a satisfactory virtual physical examination with no objective red flags (e.g., diplopia on extraocular movement testing, positive pronator drift, pain on testing of cervical spine range of motion)
- e) Those who do not require supplemental testing (diagnostic imaging, neuropsychological testing, graded aerobic exercise testing), and/or inter-disciplinary referrals to optimize patient care

Tool 15.1: [Considerations for Telemedicine and Virtual Care Algorithm](#)

Level of Evidence: C

Please refer to [Domain 3: Medical follow-up and Management of Prolonged Symptoms](#) for a full list of clinical guideline recommendations to consider when performing a medical follow-up assessment and managing prolonged concussion symptoms.

15.5 Please refer to [Domain 4: Medical Clearance for full-contact sports and high-risk activities](#) for a full list of clinical recommendations to consider when determining if a child/adolescent is ready to return to full-contact sports or high-risk activities. Medical clearance is not required to return to school.

15.6 Recommendations for inter-disciplinary healthcare professionals involved in the care of concussion patients:

a. Neuropsychologists

Virtual care may be considered to assist in the assessment and longitudinal care of concussion patients who develop persistent cognitive and mood-related symptoms or who are having persistent problems in school. Neuropsychologists should be aware of the limitations of performing certain neuropsychological tests via in-person videoconferencing. Specific symptom assessments can be administered virtually or completed before the virtual appointment and sent to the neuropsychologist ahead of time.

Level of Evidence: B

b. Physiotherapists

Virtual care may be considered by physiotherapists to advance vestibular, cervical spine and medically supervised individually tailored sub-symptom threshold aerobic exercise treatment plans in patients who have undergone previous in-person assessment by the treating physiotherapist. Physiotherapists

should recognize that a comprehensive assessment of the cervical spine and vestibular system as well as graded aerobic exercise testing, which are required to provide initial recommendations regarding targeted rehabilitation, cannot be performed virtually. If a physiotherapist is providing virtual care, they must be able to arrange an urgent in-person assessment as needed.

Level of Evidence: C

- See link for general information on telerehabilitation: TR-Telerehab Toolkit: <https://kite-uhn.com/tools/tr-telerehab-toolkit>
- Alberta Physiotherapy: Telerehabilitation Resource Guide https://www.physiotherapyalberta.ca/files/guide_telerehabilitation.pdf

c. Psychiatrists

Telemedicine may be considered to assist in the assessment and longitudinal care of concussion patients who develop persistent psychiatric and sleep-related symptoms and disorders.

Level of Evidence: B

d. Headache neurologists

Telemedicine may be considered to assist in the assessment and longitudinal care of concussion patients who develop persistent headaches.

Level of Evidence: B

e. Occupational therapists

Virtual care may be considered to assist in the assessment and longitudinal care of concussion patients who develop prolonged cognitive and mood-related symptoms and to assist with a successful return to school and other activities of daily living.

Level of Evidence: C

Section B: Managing Concussion Symptoms 1-4 Weeks Following Acute Injury



Domain 6: Headache

Introduction:

Headache is one of the most common symptoms reported by children/adolescents who sustain a concussion. In most cases, headache associated with an acute concussion will resolve spontaneously within 1-4 weeks of injury along with other concussion symptoms. In some cases, headaches can persist beyond this timeframe.

For patients with post-concussion headaches 1-2 weeks following acute injury, a repeat medical assessment must be conducted including a clinical history, physical examination, and the evidence-informed use of diagnostic imaging. The assessment should also include proper classification or characterization of the patient's headache. This assessment will help identify co-morbid medical disorders (e.g., a history of migraine or non-specific headaches or psychiatric disorders) and other factors (e.g., overuse of analgesics) that can contribute to prolonged headaches. Some prolonged post-concussion headaches can be classified according to the [International Classification of Headache Disorders \(ICHD-III\)](#), while others cannot. Proper characterization of prolonged post-concussion headaches can help provide information to execute appropriate interdisciplinary referrals and guide evidence-based management.

Tool 6.1: [Post-Concussion Headache Algorithm](#).

Recommendations:

6.1 Perform a repeat medical assessment on all patients presenting with post-concussion headaches 1-2 weeks following acute injury.

Include a focused history, physical examination, and consideration of diagnostic brain or cervical spine MRI imaging for those with focal or worrisome symptoms.

Tool 6.1: [Post-Concussion Headache Algorithm](#).

Level of Evidence: B

6.1a Take a focused clinical history.

Collect details that help to classify or characterize the headache subtype(s) that are present.

- Headache onset, location, quality or character, severity, and frequency.
- Factors that elicit or worsen headaches (e.g., bright lights, reading, exercise, foods, etc.).
- Factors that alleviate headaches.
- Associated symptoms (e.g., aura, photosensitivity, dizziness, eye strain, neck pain).
- The presence of red flags which may indicate a more severe brain injury or other intracranial pathology (e.g., worsening headaches, repeated vomiting, weakness or numbness of the extremities, visual changes).
- The level of disability associated with the headache (e.g., missed days from school).
- Use of medications or other substances.
- Psychological or social factors or conditions that can be associated with stress and headaches (e.g., mood or anxiety disorders) (Domain 8: [Mental Health](#)).
- Assess how much headaches affect day-to-day activities Link: [pedMIDAS Headache Severity Tool for Children aged 4-18](#).
- Disturbed sleep.
- Personal and family history of headaches and headache disorders (e.g., migraine).
- Future participation in full-contact sport or high-risk activities.

Level of Evidence: B

6.1b Perform a focused physical examination.

- Vital signs (resting heart rate and blood pressure).
- A complete neurological examination (cranial nerve, motor, sensory, reflex, cerebellar, gait and balance testing) Tool 2.1: [Physical Examination](#).
- A cervical spine examination (palpation, range of motion, provocative cervical spine tests) Tool 2.1: [Physical Examination](#).
- With appropriate experience, consider performing an examination of vision, oculomotor and vestibular functioning (Domain 10: [Vision, Vestibular, and Oculomotor Function](#)).

Level of Evidence: B

6.1c Consider diagnostic brain or cervical spine MRI imaging for those with focal or worrisome symptoms.

See [Recommendation 2.1d](#) for more information on when to consider diagnostic brain or cervical spine imaging.

Level of Evidence: A (CT), B (MRI)

6.1d Classify and characterize the headache subtype based on the clinical history and physical examination findings.

Consult the [International Classification of Headache Disorders \(ICHD-III\)*](#) and Tool 6.1: [Post-Concussion Headache Algorithm](#) for more information.

Common prolonged post-concussion headache subtypes include:

- Migraine, tension, or cluster headaches
- Cervicogenic headaches
- Physiological or exercise-induced headaches
- Headaches associated with prolonged visual stimulation
- Occipital neuralgia

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Level of Evidence: B

6.2 Provide general post-concussion education and guidance on headache management.

6.2a Advise on non-pharmacological strategies to minimize headaches including sleep hygiene, activity modifications, limiting triggers, and information on screen time.

Tool 2.7: [Strategies to Promote Good Sleep and Alertness.](#)

Link: [Sleep for Youth. CHEO Sleep Hygiene handout](#)

Recommendation 2.4c: [Advise on the use of computers, phones, and other screen devices.](#)

Level of Evidence: C

6.2b Encourage patients with headaches to engage in cognitive activity and low-risk physical activity as soon as tolerated while staying below their symptom-exacerbation threshold. Activities that pose no/low risk of sustaining a concussion (no risk of contact, collision, or falling) should be resumed even if mild residual symptoms are present or whenever acute symptoms improve sufficiently to permit activity.

See [Recommendation 2.3](#)

See Tool 2.6: [Post-Concussion Information Sheet](#) for examples of low-risk activities.

Level of Evidence: B- Gradual return to physical activity. C- Gradual return to cognitive activity.

6.2c Consider suggesting the use of a headache and medication diary in order to monitor symptoms and medications taken. Use clinical judgment and an individualized approach on use or duration of this strategy.

Link: [Headache and Medication Diary \(Boston Children's Hospital\)](#)

Level of Evidence: C

6.2d Over-the-counter medications such as acetaminophen and ibuprofen may be recommended to treat acute headache. Advise on limiting the use of these medications to less than 15 days a month and avoiding “around-the-clock” dosing to prevent overuse or rebound headaches. I.e., advise that children/adolescents avoid using over the counter medications at regular scheduled times throughout the day.

Level of Evidence: C

6.3 Refer patients who have prolonged post-concussion headaches for more than 4 weeks to an interdisciplinary concussion team or to a sub-specialist for further evaluation and management.

Prolonged headaches in pediatric concussion patients can be difficult to classify and manage and can co-occur with other prolonged post-concussion symptoms (dizziness, neck pain, sleep disturbance, cognitive or mood challenges).

If an interdisciplinary concussion team member is not available:

- Consider appropriate referral to interdisciplinary professionals who have competency-based training and clinical experience to independently manage the identified headaches and headache disorders.

If a child/adolescent with prolonged post-concussion headache has not had a recent vision assessment, refer to an optometrist for an assessment.

Level of Evidence: C

6.4 Consider initiating pharmacological therapy to treat and manage prolonged headaches while waiting for the interdisciplinary concussion team or sub-specialist referral.

For patients with post-traumatic headaches that are migrainous in nature, the use of migraine-specific abortants such as triptan class medications may be used if effective. Due to the risk of developing medication-induced headaches, limit use of abortants to fewer than 6-10 days per month.

Tool 6.2: [General Considerations Regarding Pharmacotherapy](#)

Tool 6.3: [Approved Medications for Pediatric Indications](#)

Prophylactic therapy should be considered:

- If headaches are occurring frequently
- If headaches are disabling
- If acute headache medications are contraindicated, poorly tolerated, or are being used too frequently.

Level of Evidence: B

6.5 Recommend a medical follow-up to reassess clinical status if headaches persist. Recommend an immediate medical follow-up in the presence of any deterioration. Consider early referral (prior to 4-

weeks after the acute injury) to an interdisciplinary concussion team in the presence of modifiers that may delay recovery.

See Recommendation 2.1b: [Note any modifiers that may delay recovery and use a clinical risk score to predict risk of prolonged symptoms.](#)

Level of Evidence: C- Medical follow-up. A- Early referral in the presence of modifiers that may delay recovery



Domain 7: Sleep

Introduction:

Sleep disturbances may occur following a concussion. Symptoms vary between different children/adolescents and within an individual child/adolescent. Examples include having difficulties falling asleep/staying asleep or excessive daytime sleeping. Medication use, headaches and mental health conditions (e.g. anxiety, depression) may also affect sleep. Poor sleep may be related to cognitive complaints and worse post-concussion symptoms. A repeat medical exam to rule out a more severe injury is required for children/adolescents who are experiencing sleep disturbances that last more than 1-2 weeks following a concussion. The presence of sleep disturbances following concussion is a risk factor for a prolonged recovery from concussion. Early identification allows for early targeted supportive care, close monitoring for prolonged symptoms, and consideration for early referral.

Information related to sleep hygiene and non-pharmacological strategies to improve sleep should be shared with families. Children/adolescents with prolonged sleep disturbances should be encouraged to engage in low-risk physical activity and resume sub-symptom cognitive activities. Children/adolescents who are experiencing sleep disturbances more than 4 weeks following a concussion should be referred to a cognitive behavioural therapist or an interdisciplinary concussion team. If sleep disturbances are present for more than 6 weeks following a concussion the child/adolescent may require more specialized care from a sleep specialist.

Tool 7.1: [Managing Post-Concussion Sleep Disturbances Algorithm.](#)

Tool 7.2: [Factors That May Influence the Child/Adolescent's Sleep/Wake Cycle.](#)

Recommendations:

7.1 Perform a repeat medical assessment on all patients presenting with post-concussion sleep disturbances 1-2 weeks following acute injury.

Include a focused history, physical examination, and consider diagnostic brain or cervical spine MRI imaging for those with focal or worrisome symptoms.

- Tool 7.1: [Managing post-concussion sleep disturbances algorithm.](#)

Screen for factors that may influence the child/adolescent's sleep/wake cycle and for sleep-wake disturbances such as insomnia or excessive daytime sleepiness.

- [Tool 7.2: Factors that may influence the child/adolescent's sleep/wake cycle.](#)

Level of Evidence: C

7.2 Provide general education and guidance on sleep hygiene that outlines non-pharmacological strategies to improve sleep.

- Tool 2.7: [Strategies to Promote Good Sleep and Alertness](#)
- Link: [Sleep for Youth. CHEO Sleep Hygiene handout](#)
- Link: [Holland Bloorview Kids Rehabilitation Hospital: Concussion Handbook](#)

Level of Evidence: C

7.2a Continue to encourage patients with sleep disturbances to engage in sub-symptom threshold cognitive activities and physical activities that pose no/low risk of sustaining a concussion (no risk of contact, collision, or falling) as soon as tolerated.

See [Recommendation 2.3](#).

See Tool 2.6: [Post-Concussion Information Sheet](#) for examples of low-risk activities.

Level of Evidence: B- Gradual return to physical activity. C- Gradual return to cognitive activity.

7.3 Consider managing patients who experience sleep-wake disturbances for more than 4 weeks with cognitive behavioural therapy, treat with daily supplements, and/or refer to an interdisciplinary concussion team.

Refer the child/adolescent to a cognitive behavioural specialist.

- The treatment of choice for primary insomnia and insomnia co-morbid to a medical or psychiatric condition is cognitive behavioural therapy (CBT).

Consider suggesting non-pharmacological supplements such as magnesium, melatonin, and zinc to improve sleep and recovery without the use of medication that may have side effects.

- Tool 6.3: [Approved Medications for Pediatric Indications](#)

If CBT is unavailable to the patient or the patient is waiting for CBT treatment:

- Optimize and implement sleep hygiene (Tool 2.7 [Strategies to Promote Good Sleep and Alertness](#))
- Monitor the patient weekly for the first few weeks:
- Re-emphasize that patients with sleep disturbances should continue to engage in sub-symptom threshold cognitive and physical activities that pose no/low risk of sustaining a concussion (no risk of contact, collision, or falling) as tolerated ([Recommendation 2.3](#)).
- Consider referring to an interdisciplinary concussion team

Level of Evidence: C

7.4 Refer patients with prolonged post-concussion sleep disturbances (more than 6 weeks) to a sleep specialist or an interdisciplinary concussion team if the interventions introduced at 4 weeks have been unsuccessful and sleep issues persist.

If sleep issues persist for more than 6 weeks post-acute injury, sleep hygiene can't be optimized, and if poor sleep quality is impacting the ability to return-to-school or ability to recondition:

- Refer to a sleep specialist who has experience with concussion and polysomnography or to an interdisciplinary concussion team that has the expertise to understand sleep disturbances in the context of concussion-related symptoms.

Consider ordering sleep tests to rule out possible sleep-related breathing disorders, nocturnal seizures, periodic limb movements, or narcolepsy.

- Examples of sleep tests include Sleep Study, Multiple Sleep Latency Test, and the Maintenance of Wakefulness Test.

Level of Evidence: C

7.5 Consider prescribing medication on a short-term basis if sleep has not improved after 6 weeks following the acute injury.

Ensure that medications do not result in dependency and that the patient has minimal adverse effects. The aim is to establish a more routine sleep pattern.

- Potential medication options include trazodone 12.5 mg or amitriptyline 5.0 – 10.0 mg
- Tool 6.2: [General Considerations Regarding Pharmacotherapy](#)
- Tool 6.3: [Approved Medications for Pediatric Indications](#)

If sleep disturbances persist after pharmacological treatment refer to a pediatric sleep specialist ideally with experience with concussion and polysomnography.

Level of Evidence: C

7.6 Recommend a medical follow-up to reassess clinical status if sleep disturbances persist. Recommend an immediate medical follow-up in the presence of any deterioration. Consider early referral (before 4 weeks) to an interdisciplinary concussion team in the presence of modifiers that may delay recovery.

See Recommendation 2.1b: [Note any modifiers that may delay recovery and use a clinical risk score to predict risk of prolonged symptoms.](#)

Level of Evidence: C- Medical follow-up. A- Early referral in the presence of modifiers that may delay recovery.



Domain 8: Mental Health

Introduction:

There is evidence that early identification of common mental health disorders and risk factors for mental health disorders may prevent/mitigate additional problems such as learning and behavior problems, school avoidance and exacerbation of pre-existing problems. Having a mental health disorder prior to concussion is a critical risk factor for a post-concussion mental health disorder.

Early identification of family problems or parental mental health disorders permits healthcare professionals to watch for environmental factors that are known to influence recovery from a concussion and identify any associated negative outcomes.

It is important to:

- Assess if there is an association between concussion symptoms and restrictions to activity based on the child/adolescent's mental health.
- Treat and manage the mental health disorder itself and prevent it from becoming a long-term problem.
- Encourage the child/adolescent to remain connected and engage with their peers, friends, and teammates.

Tool 8.1: [Post-Concussion Mental Health Considerations Algorithm](#)

Tool 8.2: [Management of Prolonged Mental Health Disorders Algorithm](#)

Recommendations:

8.1 Assess existing and new mental health symptoms and disorders.

Experienced and trained healthcare professionals should use appropriate screening tools to assess the child/adolescent. These assessments should be considered for children/adolescents with a history of mental health problems or with prolonged post-concussive symptoms.

Use Tool 8.1: [Post-Concussion Mental Health Considerations Algorithm](#) and refer to a mental health specialist using clinical judgment.

Assessment screening tools to consider (direct website links):

- Link: [PHQ-SADS \(somatic\)](#)
- Link: [Severity Measure for Depression- Child Age 11–17 \(adapted from PHQ-9 modified for Adolescents \[PHQ-A\]\)](#)
- Link: [Severity Measure for Generalized Anxiety Disorder-Child Age 11–17 \(adapted from GAD-7\)](#)
- Link: [HEADS-ED Tool](#)—Screening for Pediatric Mental Health (online interactive tool)
- PROMIS Anxiety (pediatric and parent versions are available via [HealthMeasures.net](#))
- PROMIS Depression (pediatric and parent versions are available via [HealthMeasures.net](#))

- PROMIS Profile (25 questions, 37 questions, 49 questions versions are available via [HealthMeasures.net](https://www.healthmeasures.net))
- Link: [Children’s Somatization Inventory \(CSI\)](#)

Level of Evidence: A

8.2 Assess the child/adolescent’s broader environment, including family and caregiver function, mental health, and social connections.

- Ask about socioeconomic status (caregiver education, family income, occupation)
- Ask about social impacts and life stressors (school setting, friends, teammates)
- Ask the child/adolescent and parents and/or caregivers to complete the following, as appropriate:
 - Link: PROMIS Family Function
 - Link: [Patient Health Questionnaire \(PHQ-9\)](#) (self-administered screen for depression in adults)
 - Link: [Generalized Anxiety Disorder scale \(GAD-7\)](#)

Level of Evidence: B

8.3 Treat mental health symptoms or refer to a specialist in pediatric mental health.

Base the mental health treatment on individual factors, patient preferences, the severity of symptoms, and co-morbidities.

Tools to assist healthcare professionals to make treatment decisions:

- Tool 8.1: [Post-Concussion Mental Health Considerations Algorithm](#)
- Tool 8.2: [Management of Prolonged Mental Health Disorders Algorithm](#)
- Tool 6.2: [General Considerations Regarding Pharmacotherapy](#)
- Tool 6.3: [Approved Medications for Pediatric Indications](#)

Consider referring to a local healthcare professional, specialized pediatric concussion program or to a specialist with experience in pediatric mental health if child/adolescent has prolonged or urgent mental health symptoms. Provide the name of a specialist with experience in pediatric mental health.

For deciding when to refer a child/adolescent to a specialist, use Tool 8.1: [Post-Concussion Mental Health Considerations Algorithm](#).

Level of Evidence: B



Domain 9: Cognition

Introduction:

Prolonged cognitive problems post-concussion that are affecting a child/adolescent's daily functioning (e.g., problems with speech, learning, attention, memory, information processing, etc.) need to be identified and managed appropriately. Identifying the nature and interaction between pre-existing and concussion-related cognitive problems will help to clarify the most appropriate supports based on the child/adolescent's characteristics, including return-to-school and return-to-activity/sport. Experienced school-based educational professionals, where available, can support the healthcare professionals in this area. Examples of school-based educational professionals vary and may include: vice-principals, learning support teachers (LST), guidance counsellors, student success teachers, and school board services such as psychology, social work, speech language pathology (SLP), etc.

Recommendations:

9.1 Evaluate a child/adolescent for cognitive symptoms that interfere with daily functioning following the acute injury.

For symptoms that interfere with daily functioning for more than 4 weeks following acute injury, further evaluation by experienced professionals to assess cognitive problems may be required.

Depending on the nature of the cognitive symptoms, examples of professionals may include:

- Experienced educational professionals.
- Pediatric neuropsychologists.
- Occupational therapists.
- Speech language pathologists.

Other assessments may be required to determine the underlying cause(s) and any pre-existing contributing factors that can be managed:

- Use a risk score to assess any modifiers that may delay recovery ([Recommendation 2.1b](#)).
- Mental health assessment and a closer look at the family (Domain 8: [Mental Health](#)).
- Vision, vestibular, and hearing assessments (Domain 10: [Vision, Vestibular, and Oculomotor Function](#)).
- Physical examination (Tool 2.1: [Physical Examination](#)).
- As per usual pediatric clinical practice, broad clinical history taking is recommended to understand the youth's developmental, medical, social, academic, and family histories. Particular consideration should be given to the interplay between these pre-existing factors and current cognitive profile/presentation/symptoms.

Level of Evidence: B

9.2 Manage cognitive symptoms that interfere with daily functioning for more than 4 weeks following acute injury.

See [Domain 3: Medical Follow-up and Management of Prolonged Symptoms](#)

See Domain 12: [Return-to-School and Work](#) for suggestions to guide an initial discussion about the best pathways for the student in school, employment, sports, social, and home environments. Tools and tests should be used in conjunction with an examination of previous school records such as marks and teacher observations.

Level of Evidence: B



Domain 10: Vision, Vestibular, and Oculomotor Function

Introduction:

Patients with acute head and neck trauma can present with symptoms such as dizziness, blurred or double vision, vertigo, postural imbalance, difficulty focusing, motion sensitivity, and/or headaches during reading. These symptoms may be suggestive of dysfunction within the neurological systems responsible for visual, vestibular, and oculomotor functioning, including balance, and gait. Identification of these deficits can aid in the provision of academic and activity-related accommodations during the acute stage after injury. Most acute concussion patients with these clinical features will experience symptom resolution and return to daily activities within 4 weeks following the acute injury and these patients will only need supportive care and anticipatory guidance. By conducting early screening for impairments in visual, vestibular, and oculomotor functioning as well as balance and gait, appropriate referrals to an interdisciplinary concussion team and sub-specialists can be initiated to provide evidence-based targeted interventions.

A repeat medical assessment on concussion patients with prolonged dizziness, blurred or double vision, vertigo, difficulty reading, postural imbalance, or headaches elicited by prolonged visual or vestibular stimulation is required 1-2 weeks following the acute injury. Although the cause of these prolonged symptoms can be multi-factorial, the assessment often reveals impairments in vestibular functioning, balance, or vision. The repeat medical assessment should include a focused clinical history, focused physical examination, and a consideration for the use of additional diagnostic tests as indicated (i.e., screening vestibular oculomotor assessment, visual field testing, and neuroimaging). The medical assessment must consider conditions such as intraparenchymal hemorrhage, stroke, traumatic cranial neuropathy, or temporal bone fractures.

Tool 10.1: [Post-concussion Vision, Vestibular, and Oculomotor Disturbances Algorithm.](#)

Oculomotor or Vision Deficits:

Visual and oculomotor deficits can be due to cranial neuropathies, structural brain injuries, or functional impairments in convergence, accommodation, smooth pursuits, saccades, and vestibulo-ocular reflex functioning. Visual deficits are common symptoms following a concussion. In some patients, these deficits will spontaneously recover and will only need monitoring, supportive care, and anticipatory guidance. However, there is evidence that these deficits may also be associated with increased risk for prolonged symptoms. Identifying these deficits early will allow for early targeted supportive care, management, close monitoring for prolonged, and early referral for further treatment.

Benign Paroxysmal Positional Vertigo:

Benign paroxysmal positional vertigo (BPPV) can be caused by the traumatic displacement of the crystals (otoconia) of the inner ear into one of the semi-circular canals. This displacement results in intermittent brief episodes of vertigo and a characteristic pattern of nystagmus (involuntary eye movement) with head movements that stimulate fluid flow in the affected canal (e.g., laying down, sitting up, rolling in bed, looking up, bending over, rapid horizontal head movements). If the patient reports vertigo or dizziness that occurs for seconds following position changes, a screen for BPPV and consideration for targeted particle re-positioning manoeuvres should be conducted. In patients who continue to experience prolonged vertigo or dizziness after completing 3 particle repositioning manoeuvres,

consideration should be given to a referral to an interdisciplinary concussion team or sub-specialist (i.e., otolaryngology) for further assessment and management.

Vestibulo-ocular Deficits:

The vestibulo-ocular reflex (VOR) enables clear vision with head motion. In many cases, difficulties with clear vision during head motion are reported following a concussion and there is emerging evidence that alterations in VOR function may predict a longer recovery following concussion. Dizziness and/or blurred vision with head motion may be reported and should be further investigated by a healthcare professional with experience in this area. Vestibular rehabilitation has been reported to facilitate recovery when a child/adolescent is experiencing altered gain of the VOR.

Recommendations:

10.1 Perform a repeat medical assessment on all patients presenting with dizziness, blurred or double vision, vertigo, difficulty reading, postural imbalance, or headaches elicited by prolonged visual or vestibular stimulation 1-2 weeks following acute injury.

Depending on the nature of the symptoms, the medical assessment should include a focused history, focused physical examination, and consideration for the need for diagnostic brain or cervical spine MRI imaging for those with focal or worrisome symptoms.

Tool 10.1: [Post-concussion Vision, Vestibular, and Oculomotor Disturbances Algorithm](#)

Tool 2.1: [Physical Examination](#)

[Recommendation 2.1d](#): When to consider diagnostic brain or cervical spine imaging.

Level of Evidence: B

10.2 Screen for oculomotor or vision deficits

Perform an assessment of visual acuity, pupillary function, visual fields, funduscopy, and extra-ocular movements.

- With appropriate experience, consider an objective assessment of convergence, accommodation, saccades and smooth pursuits.
- Consider additional tests such as automated visual field testing, formal vestibular testing or diagnostic imaging.

Assessment video to consider:

Link: [Visio-vestibular examination](#) (The Children's Hospital of Philadelphia).

Consider referral to an interdisciplinary concussion team or neuro-ophthalmologist, neuro-optometrist, developmental optometrist, occupational therapist, or physiotherapist with competency-based training in vestibular rehabilitation to assess for impairments in convergence, accommodation, saccades and other visual oculomotor disorders.

Level of Evidence: C

10.3 Screen for benign paroxysmal positional vertigo (BPPV) if the patient reports vertigo or dizziness that occurs for seconds following position changes and consider targeted particle re-positioning manoeuvres.

After completing a neurological screen and clearing the cervical spine to move into the test position, perform the Dix-Hallpike Test. If positive for BPPV (i.e., reproduction of vertigo, typically for seconds, in addition to a characteristic pattern of nystagmus for the canal that is being assessed), a Particle Repositioning Manoeuvre may be appropriate.

Consider the Epley Manoeuvre which can be used to treat the anterior and posterior canals in the case of a canalithiasis. There are many subtypes of BPPV that may require further assessment or alternate canalith repositioning manoeuvres and referral to a healthcare professional (often a physiotherapist with competency-based training in vestibular rehabilitation) for treatment. If symptoms are provoked by pressure (i.e., val salva) or accompanied by a change in hearing, referral to an otolaryngologist or neuro-otologist is warranted.

In patients who continue to experience prolonged vertigo or dizziness despite 3 particle repositioning manoeuvres, consider referral to an interdisciplinary concussion team or neuro-otologist or physiotherapist with competency-based training in vestibular rehabilitation. These experienced healthcare professionals should rule out alternative peripheral and central vestibular disorders (e.g., superior semi-circular canal dehiscence (SSCD), vestibular hypofunction) and initiate active management with rehabilitation or referral as appropriate.

Online videos to consider:

- Link: [Dix-Hallpike Test](#) (University of Calgary)
- Link: [Epley Manoeuvre](#) (University of Calgary)

Level of Evidence: C

10.4 Screen for vestibulo-ocular deficits.

With appropriate experience, perform an assessment of the vestibulo-ocular reflex (VOR) such as the head thrust test and dynamic visual acuity.

Consider referral to a physiotherapist with competency-based training in vestibular rehabilitation.

Online videos to consider:

- Link: [Head Thrust Test and Dynamic Visual Acuity \(University of Calgary\)](#)
- Link: [Visio-Vestibular Examination \(The Children's Hospital of Philadelphia\)](#)
- Link: [Dynamic Visual Acuity \(University of Calgary\)](#)

Level of Evidence: B

10.5 Screen for balance deficits.

Assess for prolonged balance deficits and determine which systems (visual reflexes, inner ear, musculoskeletal, nervous system or brain) might be contributing to dizziness, headaches, and balance

problems. Vestibular rehabilitation may improve balance and dizziness. If prolonged impairment is identified, refer to a specialist immediately.

Perform assessment of postural stability and balance.

- Standing balance test (eyes open/closed, tandem stance, single leg stance), Balance Error Scoring System.
- Dynamic balance: Consider the Functional Gait Assessment, BOT.

Consider referral to an interdisciplinary concussion team or physiotherapist with competency-based training in vestibular rehabilitation.

Online videos to consider:

- Link: [Visio-Vestibular Examination](#) (The Children's Hospital of Philadelphia)
- Link: [Balance Error Scoring System](#)
- Link: [Functional Gait Assessment](#) (University of Calgary)

Level of Evidence: C

10.6 Screen for and consider underlying psychosocial contributors of visual, vestibular, and oculomotor dysfunction.

See Domain 8: [Mental Health](#).

Level of Evidence: C

10.7 Provide general post-concussion education that outlines symptoms of concussion, provides suggestions regarding activity modification and includes academic accommodations to manage visual, vestibular and oculomotor symptoms.

Guidance about how to make a gradual return-to-school, cognitive activities, and physical activities:

- Recommendation 2.3: [Recommend graduated return to cognitive and physical activity](#)
- Recommendation 2.4c: [Advise on the use of computers, phones, and other screen devices](#)
- Domain 12: [Return-to-School and Work](#)

Level of Evidence: C

10.8 Encourage patients with post-concussion vestibular, vision or oculomotor symptoms to engage in cognitive activity and low-risk physical activity as soon as tolerated while staying below their symptom-exacerbation thresholds. Activities that pose no/low risk of sustaining a concussion (no risk of contact, collision, or falling) should be resumed even if mild residual symptoms are present or whenever acute symptoms improve sufficiently to permit activity.

See [Recommendation 2.3](#).

See Tool 2.6: [Post-Concussion Information Sheet](#) for examples of low-risk activities.

Level of Evidence: B- Gradual return to physical activity. C- Gradual return to cognitive activity.

10.9 Refer patients with prolonged post-concussion vestibular functioning, balance or visual dysfunction (more than 4 weeks following the acute injury) to an interdisciplinary concussion team with appropriate experience. Consider early referral (before 4 weeks) to an interdisciplinary concussion team in the presence of modifiers that may delay recovery.

Tool 10.1: [Post-Concussion Vision, Vestibular, and Oculomotor Disturbances Algorithm](#).

Assessment by an interdisciplinary concussion team can assist in identifying the type of management that is required, along with the medical and health professions on the interdisciplinary concussion team or external to this team who can provide the required management. Not all children/adolescents will require care from all members of the interdisciplinary concussion team and care should be targeted based on identified symptoms and patient needs.

See Recommendation 2.1b: [Note any modifiers that may delay recovery and use a clinical risk score to predict risk of prolonged symptoms](#).

Level of Evidence: C- Medical follow-up. A- Early referral in the presence of modifiers that may delay recovery

10.10 Recommend a medical follow-up to reassess clinical status if vestibular functioning, balance or visual dysfunction symptoms persist. Recommend an immediate medical follow-up in the presence of any deterioration.

Level of Evidence: C



Domain 11: Fatigue

Introduction:

Physical, mental, or cognitive fatigue is common following a concussion. Fatigue can be defined as weariness or tiredness following physical and/or cognitive/mental exertion. A repeat medical exam is necessary for children/adolescents experiencing fatigue 1-2 weeks following a concussion to rule out a serious medical condition or injury. Children/adolescents experiencing prolonged post-concussion fatigue should be encouraged to participate in low-risk physical and cognitive activities below their symptom exacerbation threshold (at a level that does not bring on symptoms or make symptoms worse). Pacing and energy management techniques should be shared with the child/adolescent (Tool 2.5 [“Four P’s” – Prioritize, Plan, Pace and Position](#)). If a child/adolescent experiences fatigue for more than 4 weeks following the acute injury consider referring to an interdisciplinary concussion team.

Recommendations:

11.1 Perform a repeat medical assessment on all patients presenting with post-concussion fatigue 1-2 weeks following acute injury.

The medical assessment should include a clinical history of symptoms, physical examination, and screen for other causes of fatigue (e.g., mononucleosis, anemia, thyroid dysfunction, mood disorders, pregnancy, etc.).

Level of Evidence: C

11.2 Provide patients with post-concussion fatigue with general education and guidance that outlines non-pharmacological strategies to help cope with fatigue symptoms and set expectations.

Strategies and post-concussion education guidance related to fatigue:

- Emphasize that spreading activities throughout the day helps patients achieve more and that they should avoid doing too much at once. Tool 2.5 [“Four P’s” – Prioritize, Plan, Pace and Position](#)
- Encourage good diet and hydration
- Encourage good sleep hygiene. Tool 2.7: [Strategies to Promote Good Sleep and Alertness](#)
- Link: [Sleep for Youth. CHEO Sleep Hygiene handout](#)
- Avoid daytime napping
- Identify the triggers of fatigue
- Encourage the child/adolescent to plan meaningful goals, record activity achievement, and identify patterns of fatigue by using a notebook or diary.
- Inform that fatigue can be worsened by low mood or stress.
- Inform that deconditioning can compound fatigue.
- Encourage a gradual return-to-school with accommodation (Domain 12: [Return-to-School and Work](#))

Level of Evidence: C

11.3 Encourage patients with post-concussion fatigue to engage in cognitive activity and low-risk physical activity as soon as tolerated while staying below their symptom-exacerbation thresholds. Activities that pose no/low risk of sustaining a concussion (no risk of contact, collision, or falling) should be resumed even if mild residual symptoms are present or whenever acute symptoms improve sufficiently to permit activity.

See [Recommendation 2.3](#).

See Tool 2.6: [Post-Concussion Information Sheet](#) for examples of low-risk activities.

Level of Evidence: B- Gradual return to physical activity. C- Gradual return to cognitive activity.

11.4 Consider referral to an interdisciplinary concussion team for patients with prolonged post-concussion fatigue (more than 4 weeks following the acute injury) to learn pacing techniques.

Level of Evidence: C

11.5 Recommend a medical follow-up to re-assess clinical status if fatigue symptoms persist. Recommend an immediate medical follow-up in the presence of any deterioration. Consider early referral (before 4 weeks) to an interdisciplinary concussion team in the presence of modifiers that may delay recovery.

See Recommendation 2.1b: [Note any modifiers that may delay recovery and use a clinical risk score to predict risk of prolonged symptoms](#).

Level of Evidence: C- Medical follow-up. A- Early referral in the presence of modifiers that may delay recovery



Domain 12: Return-to-School and Work

Introduction:

Parents and/or caregivers need to be made aware that most youth will experience symptom resolution and full return to daily activities following a concussion; however this is highly variable and individual. It is reasonable for a child/adolescent to miss some school after a concussion, regardless of symptoms. However, it is also important not to allow or encourage the child/adolescent to "settle into the habit" of missing school. The school setting provides beneficial contact with peers and social support. A gradual return-to-school and activity is the best way to make sure that the child/adolescent remains symptom-free when he or she fully engages in school and related activities.

Overview:

- The return-to-school process should be coordinated by the school's concussion management team and/or a point person in the school (e.g., guidance counsellor, principal/vice principal, teacher, etc.).
- A key to the initial management of concussion is a gradual return-to-school and activities as symptoms are improving.
- Manage the gradual return to school/activity/sport on a case-by-case basis.
- Making short-term changes to a student's school workload and schedule can help the child/adolescent get back to their regular school routine. Accommodations can be modified as symptoms resolve.
- Recommend an additional assessment or referral to an interdisciplinary concussion team if symptoms worsen or fail to improve 2-4 weeks following the acute injury.

Identifying and managing new or pre-existing school difficulties will:

- Clarify the most appropriate treatment and management options and accommodations based on the child/adolescent's characteristics
- Promotes cognitive recovery and successful reintegration at school or work
- Support/assist return-to-school, engagement in daily activities, return to social engagement, management and treatment of symptoms

Recommendations:

12.1 Recommend a stepwise return-to-school plan and monitor once the student is ready to start a graduated return-to-school. Include temporary accommodations based on symptoms and recommendations from the healthcare professional. Modify the return-to-school plan based on ongoing assessment of symptoms.

This involves collaboration and communication among healthcare professionals, school-based professionals, the child/adolescent, and parents/caregivers.

Summary of tools to consider: These tools are suggestions for initiating a discussion to determine the best pathways for the student in learning environments.

- Tool 12.1: [Concussion Implications and Interventions for the Classroom](#)
- Tool 12.2: [Template: Letter of Accommodation from the Concussion Care Team to the School](#)
- Tool 12.3: [Template Letter of Accommodation from Physician to School](#)
- Tool 12.4: [Sample Letter/Email from School to Parents](#)
- Link: [CATT Student Return to School Strategy](#)
- Link: [CATT Return to School Strategy](#)
- Link: [Heads Up Schools: Helping Students Recover from a Concussion: Classroom Tips for Teachers](#)
- Link: [SCHOOLFirst: Enabling successful return to school for Canadian youth following a concussion](#) (Holland Bloorview Kids Rehabilitation Hospital)
- Link: [Parachute’s Protocol for Return to Learn After a Concussion](#) (Parachute Canada)
- Link: [Post-Concussion Academic Accommodation Protocol](#) (University of Oregon)

Level of Evidence: B

12.2 Assess for school difficulties using clinical judgment.

Determine how much school the child/adolescent has missed post-concussion and how much missed workload the child/adolescent is expected to catch up on from missed school days.

Obtain school records to determine what issues may have been present prior to the concussion

School or cognitive difficulties may overlap with vision, vestibular, hearing, mental health, and social/family issues. Please assess.

- Domain 8: [Mental Health](#)
- Domain 9: [Cognition](#)
- Domain 10: [Vision, Vestibular, and Oculomotor Function](#)

Level of Evidence: B

12.3 Manage school difficulties.

On re-evaluation, experienced health professionals (and school-based educational professionals where available) should manage school cognitive difficulties, provide accommodations, and reduce stressors. This should be done in collaboration with the child/adolescent, parents/caregivers, schools and/or employers to support success in the home, school, and community.

Refer to an interdisciplinary concussion team and/or a school-based educational professional (if available) if symptoms interfere with daily functioning more than 4 weeks following a concussion (Domain 9: [Cognition](#)). Refer for a formal evaluation if school difficulties may have been pre-existing.

Use tools to encourage reintegration within the school, employment, sports, social, and home environments. Summary of tools to consider:

- Link: [SCHOOLFirst: Enabling successful return to school for Canadian youth following a concussion](#) page 6 (Holland Bloorview Kids Rehabilitation Hospital)
- Tool 12.1: [Concussion Implications and Interventions for the Classroom](#)

- Tool 12.2: [Template: Letter of Accommodation from the Concussion Care Team to the School](#)
- Tool 12.3: [Template Letter of Accommodation from Physician to School](#)
- Tool 12.4: [Sample Letter/Email from School to Parents](#)

Level of Evidence: C

12.4 Encourage patients with school difficulties to engage in cognitive activity and low-risk physical activity as soon as tolerated while staying below their symptom-exacerbation thresholds. Activities that pose no/low risk of sustaining a concussion (no risk of contact, collision, or falling) should be resumed even if mild residual symptoms are present or whenever acute symptoms improve sufficiently to permit activity.

See [Recommendation 2.3.](#)

Level of Evidence: B- Gradual return to physical activity. C- Gradual return to cognitive activity.

12.5 Return-to-school and return-to-sport strategies can be performed simultaneously. Recommend that the child/adolescent return-to-school full-time at a full academic load, including writing exams without accommodations related to their concussion/post-concussion symptoms, before returning to full-contact sport or high-risk activities.

See Domain 4: [Medical clearance for full-contact sport or high-risk activity.](#)

Level of Evidence: B

12.6 Prioritize return-to-school before return to work.

For teens who work, please consult the “[Guidelines for Concussion/ Mild Traumatic Brain Injury and Persistent Symptoms 3rd Edition For Adults \(18+ years of age\)](#)” for recommendations on how to work with the adolescent’s employer regarding non-academic accommodations so that the adolescent can gradually return-to-work while promoting recovery.

Level of Evidence: B- Need for rest. C- Ideal duration of rest. B- Starting return to activity earlier.

Section C: Additional Information



Domain 13: Biomarkers – Neuroimaging

Recommendations:

13.1 At this stage, advanced neuroimaging biomarkers are not yet ready for clinical implementation/management.

Biomarkers such as functional MRI (fMRI), diffusion tensor imaging (DTI), magnetic resonance spectroscopy (MRS), arterial spin labeling (ASL), cerebrovascular-reactivity mapping (CVR), quantitative susceptibility based susceptibility weighted imaging (qSWI), electroencephalography/event-related potential (EEG/ERP), transcranial magnetic stimulation (TMS), while potentially useful as research tools, are not ready for clinical implementation.

Level of Evidence: C

13.2 When conventional MRI is performed in the clinical management of concussion patients, the inclusion of susceptibility-weighted images (SWI) sequences could be considered as it may be useful for detecting small hemorrhages. The clinical significance of small hemorrhages on SWI is not clear at present.

See [Recommendation 2.1d](#) for more information on when to consider diagnostic brain or cervical spine imaging.

Level of Evidence: C



Domain 14: Biomarkers – Serologic

Recommendations:

14.1 The use of serologic biomarkers is not clinically indicated. Presently there is no validated “concussion blood test” that can be used to accurately detect concussion in children/adolescents.

At this stage, newer serologic and other clinical biomarkers, while potentially useful as research tools, are not ready for clinical implementation/management.

Level of Evidence: C

TOOLS

Tool 1.1: [Pediatric Concussion: The role of school boards, community sports organizations, and centres](#)

Tool 1.2: [Concussion Recognition Tool 5. To help identify concussion in children, adolescents, and adults](#)

Tool 1.3: [Manage Acute and Prolonged Symptoms Algorithm](#)

Tool 2.1: [Physical Examination](#)

Tool 2.2: [PECARN Management Algorithm for Children after Head Trauma](#)

Tool 2.3: [CATCH2 Rule](#)

Tool 2.4: [Algorithm for the Management of the Pediatric Patient \$\geq\$ 2 years with Minor Head Trauma](#)

Tool 2.5: [“Four P’s” – Prioritize, Plan, Pace, and Position](#)

Tool 2.6: [Post-Concussion Information Sheet](#)

Tool 2.7: [Strategies to Promote Good Sleep and Alertness](#)

Tool 6.1: [Post-Concussion Headache Algorithm](#)

Tool 6.2: [General Considerations Regarding Pharmacotherapy](#)

Tool 6.3: [Approved Medications for Pediatric Indications](#)

Tool 7.1: [Managing Post-Concussion Sleep Disturbances Algorithm](#)

Tool 7.2: [Factors That May Influence the Child/Adolescent’s Sleep/Wake Cycle](#)

Tool 8.1: [Post-Concussion Mental Health Considerations Algorithm](#)

Tool 8.2: [Management of Prolonged Mental Health Disorders Algorithm](#)

Tool 10.1: [Post-Concussion Vestibular \(balance/dizziness\) and Vision Disturbances Algorithm](#)

Tool 12.1: [Concussion Implications and Interventions for the Classroom](#)

Tool 12.2: [Template: Letter of Accommodation from the Concussion Care Team to the School](#)

Tool 12.3: [Template Letter of Accommodation from Physician to School](#)

Tool 12.4: [Sample Letter/Email from School to Parents](#)

Tool 15.1: [Considerations for Telemedicine and Virtual Care Algorithm](#)

Tool 15.2 [Considerations for a virtual physical examination for medical assessment and follow-up of concussion patients](#)

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TOOL 1.1: Pediatric Concussion: The Role of School Boards, Community Sports Organizations, and Centres

School boards, community sports organizations, and centres must ensure updated policies are in place to recognize and accommodate a child/adolescent who has sustained a concussion.

- Publicize these policies widely among schools, staff, and sports organizations.
- Schools and their staff should be ready to promote the child/adolescent's safe and effective return-to-school.
- Immediate removal from play/activity is the first step in mitigating prolonged recovery.
- Allow the child/adolescent:
 - Enough time away from school and sport to begin cognitive recovery
 - Accommodations to support cognitive deficits such as additional time for homework and/or exams during recovery

Links to toolkits that are useful for developing school board concussion policies:

- [Ontario Ministry of Education School Board Policies for Concussion](#)
- [SCHOOLFirst Handbook: Enabling successful return to school for Canadian youth following a concussion \(Holland Bloorview Kids Rehabilitation Hospital\)](#)
- [Pan-Canadian School Concussion Protocol Template](#): Concussion Protocol Harmonization Project

Links to tools that are useful for informing school policies:

- [An Educator's Guide to Concussions in the Classroom, 2nd Edition](#): Nationwide Children's Hospital, Columbus, OH.
- [Concussion Awareness Training Tool: CATT Online](#)
- [SCHOOLFirst Handbook: Enabling successful return to school for Canadian youth following a concussion \(Holland Bloorview Kids Rehabilitation Hospital\)](#)
- [Parachute Concussion Series: Concussion Guide for Teachers](#)
- Advice for gradually resuming activities after a concussion: Institut national d'excellence en sante et en services sociaux (INESSS – Québec)
[English handout](#) / [French handout](#)
- [Canadian Guideline on Concussion in Sport Medical Assessment Letter](#)

Link to toolkits that are useful for developing sports organization policies:

- [A roadmap for implementing concussion management policies and protocols in sport \(Canadian Academy of Sport and Exercise Medicine\)](#)
- Advice for gradually resuming activities after a concussion: Institut national d'excellence en sante et en services sociaux (INESSS – Québec)
[English handout](#) / [French handout](#)
- [Parachute: Canadian Guideline for Concussion in Sport](#)

Links to tools that are useful for informing a policy for sports organizations:

- [Parachute Concussion Series – After a Concussion: Return-to-Sport strategy](#)
- [2016 Berlin Consensus in Sport Group Statement](#)
- [HEADS UP Concussion and Helmet Safety App \(Centers for Disease Control and Prevention\)](#)
- [Concussion Ed – Parachute Concussion Education](#)
- Advice for gradually resuming activities after a concussion: Institut national d'excellence en sante et en services sociaux (INESSS – Québec)
[English handout](#) / [French handout](#)
- [Canadian Guideline on Concussion in Sport Pre-Season Education Sheet \(Parachute\)](#)
- [Concussion recognition tool 5: To help identify concussion in children, adolescents and adults](#)
- [Canadian Guideline on Concussion in Sport Medical Assessment Letter](#)



TOOL 1.2: Concussion Recognition Tool 5

CONCUSSION RECOGNITION TOOL 5[©]

To help identify concussion in children, adolescents and adults



FIFA[®]

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RECOGNISE & REMOVE

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

STEP 1: RED FLAGS – CALL AN AMBULANCE

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

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

Remember:

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

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

STEP 2: OBSERVABLE SIGNS

Visual clues that suggest possible concussion include:

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

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STEP 3: SYMPTOMS

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

STEP 4: MEMORY ASSESSMENT

(IN ATHLETES OLDER THAN 12 YEARS)

Failure to answer any of these questions (modified appropriately for each sport) correctly may suggest a concussion:

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

Athletes with suspected concussion should:

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

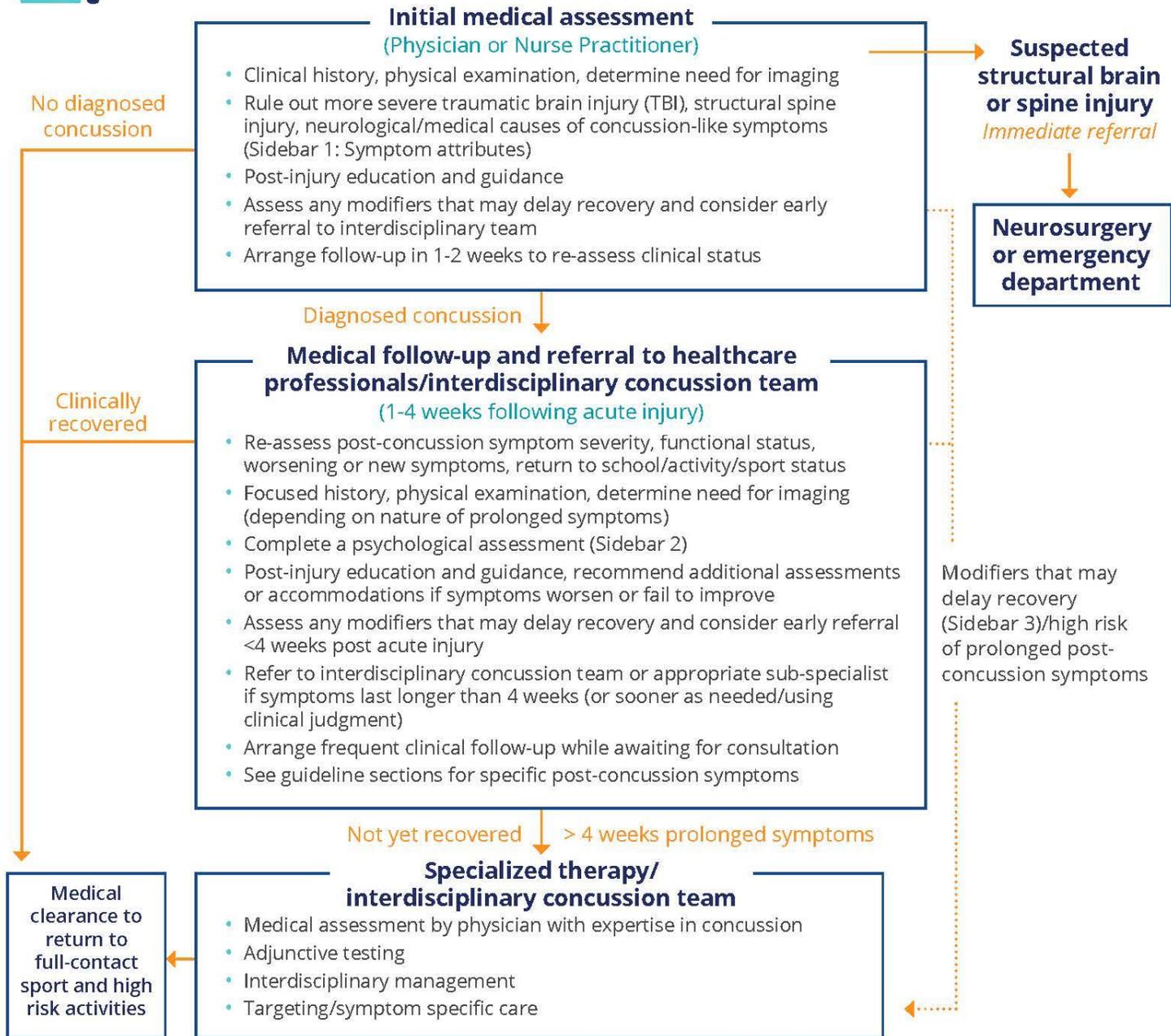
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ANY ATHLETE WITH A SUSPECTED CONCUSSION SHOULD BE IMMEDIATELY REMOVED FROM PRACTICE OR PLAY AND SHOULD NOT RETURN TO ACTIVITY UNTIL ASSESSED MEDICALLY, EVEN IF THE SYMPTOMS RESOLVE

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TOOL 1.3: Manage Acute and Prolonged Concussion Symptoms Algorithm



Links to Recommendations:

- 1: Recognition and Directing to Care
- 2: Initial Medical Assessment and Management
- 3: Medical Follow-up
- 4: Medical Clearance: Full-contact sport or high-risk activity
- 5: Sport Concussion Considerations
- 6: Headache
- 7: Sleep
- 8: Mental Health
- 9: Cognition
- 10: Vision/vestibular/oculomotor
- 11: Fatigue
- 12: Return-to-School and Work

SIDEBAR 1

> Symptom Attributes

- Duration, onset, triggers, location
- Intensity and impact
- Perception of symptoms
- Impact on functioning
- Previous episodes
- Previous treatment and response

SIDEBAR 2

> Psychosocial Evaluation

- Support system
- Mental health history
- Comorbid conditions (chronic pain, mood/stress/personality disorder)
- Substance use disorder
- Absence from school or academic difficulties

SIDEBAR 3:

Modifiers That May Delay Recovery:

- Age (increases with age)
- Sex (female)
- Personal and family history of migraines
- History of learning or behavioural difficulties
- Personal and family history of mental health
- Family socioeconomic status/education
- High pre-injury symptom presentation

Adapted with permission from the [Ontario Neurotrauma Foundation Standards for Post-Concussion Care - Post Concussion Care Pathway](#)



TOOL 2.1: Physical Examination

All patients presenting with a suspected acute concussion in the emergency department or office setting should undergo a complete physical examination that includes a neurological examination and cervical spine examination, as well as examination for any other traumatic injury. Depending on the patient's presenting or prolonged symptoms, supplementary physical examination tests can be considered. This also depends on the healthcare professional's experience in performing and interpreting these objective tests.

Core physical examination: neurological and cervical spine examination

Neurological examination

- Glasgow Coma Scale (GCS) scoring
- Vital signs (resting heart rate, blood pressure)
- Screen for signs of orbital trauma or calvarial or basilar skull fracture signs (raccoon eyes, battle sign, hemotympanum)
- Screening for other trauma
- Cranial nerve examination (fundoscopy, pupillary function, visual acuity, visual fields, extra-ocular movements, facial sensation and motor function, hearing, palate symmetry, trapezius strength, tongue movements)
- Pronator drift, motor function, and tone/bulk
- Sensory function
- Reflexes
- Cerebellar testing (finger-to-nose, rapid alternating movements)
- Balance (tandem stance, one leg stance, Romberg)
- Gait (tandem gait)
- Cognitive screen (concentration, immediate, and delayed recall components of the SCAT5 and Child SCAT5 can be considered)

Cervical spine examination

- Palpation of cervical spine and posterior and anterior paraspinal musculature (tenderness or reactive muscle guarding)
- Range of motion

Supplemental tests

Healthcare professional experience and comfort with these tests may vary. If a child/adolescent develops prolonged post-concussion symptoms, consider referring to an interdisciplinary concussion team.

For patients with prolonged dizziness, vertigo, postural imbalance or motion sensitivity

- Dix-Hallpike test (to assess for benign paroxysmal positional vertigo)
- Head thrust test (to assess vestibulo-ocular reflex)
- Balance Error Scoring System (for balance)

For patients with prolonged blurred vision, difficulty focusing, headaches with visual stimulation, and motion sensitivity

- Cover/Uncover test
- Convergence
- Accommodation
- Horizontal and vertical saccades
- Smooth pursuits
- Head thrust testing

The healthcare professional should also note if performing these tests significantly recreates or exacerbates the patient's symptoms.

For patients with jaw/temporo-mandibular joint pain or discomfort

- Inspection of jaw alignment and occlusion
- Observation of active movements
- Palpation of the jaw and the temporo-mandibular joints
- Otoscopic examination



TOOL 2.2: PECARN Management Algorithm for Children after Head Trauma

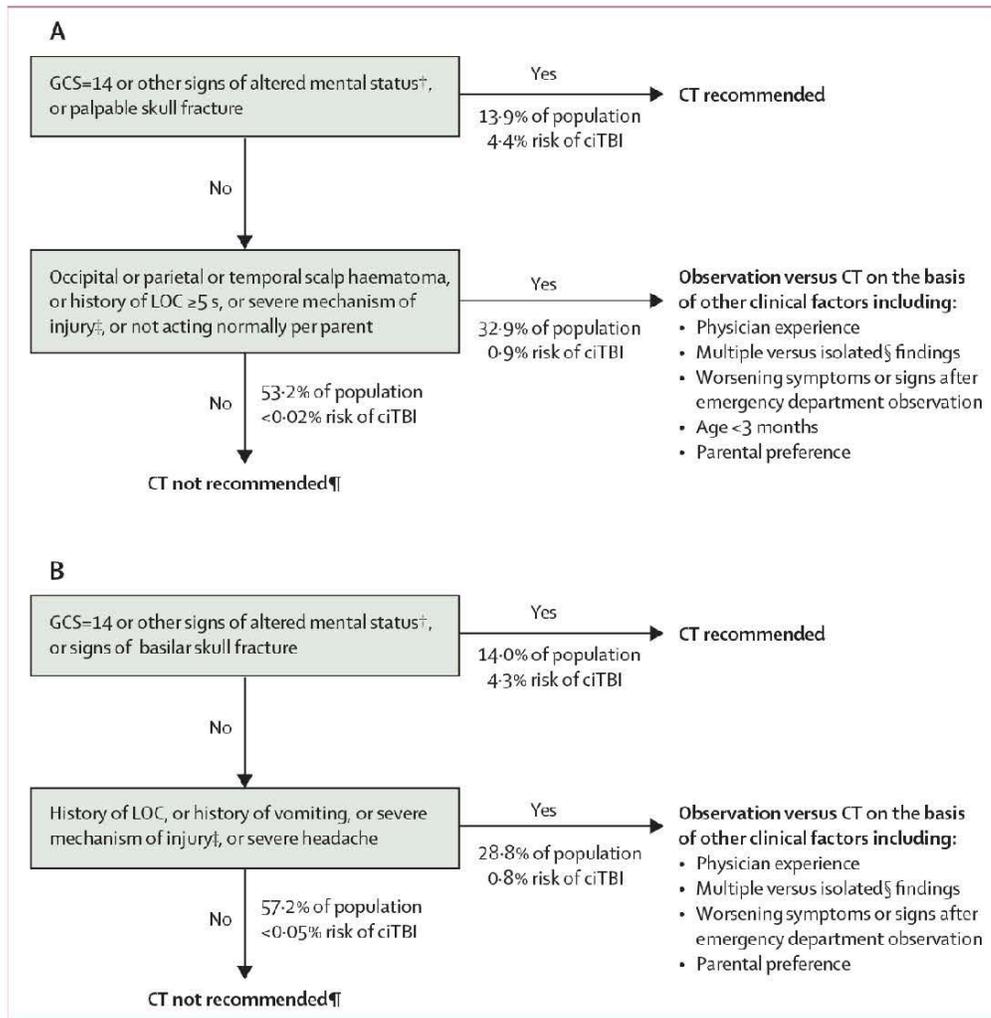


Figure 3: Suggested CT algorithm for children younger than 2 years (A) and for those aged 2 years and older (B) with GCS scores of 14-15 after head trauma*

GCS=Glasgow Coma Scale. ciTBI=clinically-important traumatic brain injury. LOC=loss of consciousness. *Data are from the combined derivation and validation populations. †Other signs of altered mental status: agitation, somnolence, repetitive questioning, or slow response to verbal communication. ‡Severe mechanism of injury: motor vehicle crash with patient ejection, death of another passenger, or rollover; pedestrian or bicyclist without helmet struck by a motorised vehicle; falls of more than 0.9 m (3 feet) (or more than 1.5 m [5 feet] for panel B); or head struck by a high-impact object. §Patients with certain isolated findings (ie, with no other findings suggestive of traumatic brain injury), such as isolated LOC,^{39,40} isolated headache,⁴¹ isolated vomiting,⁴¹ and certain types of isolated scalp haematomas in infants older than 3 months,^{31,42} have a risk of ciTBI substantially lower than 1%. ¶Risk of ciTBI exceedingly low, generally lower than risk of CT-induced malignancies. Therefore, CT scans are not indicated for most patients in this group.

Source: Kuppermann N, Holmes JF, Dayan PS, Hoyle JD Jr, Atabaki SM, Holubkov R, Nadel FM, Monroe D, Stanley RM, Borgianni DA, Badawy MK, Schunk JE, Quayle KS, Mahajan P, Lichenstein R, Lillis KA, Tunik MG, Jacobs ES, Callahan JM, Gorelick MH, Glass TF, Lee LK, Bachman MC, Cooper A, Powell EC, Gerardi MJ, Melville KA, Muizelaar JP, Wisner DH, Zuspan SJ, Dean JM, Wootton-Gorges SL; Pediatric Emergency Care Applied Research Network (PECARN). Identification of children at very low risk of clinically-important brain injuries after head trauma: a prospective cohort study. *Lancet*. 2009 Oct 3;374(9696):1160-70. Epub 2009 Sep 14. PubMed PMID: 19758692. Reproduced with permission from Elsevier.



TOOL 2.3: The Canadian Assessment of Tomography for Childhood Head injury 2 (CATCH2) rule

CT of the head is required for children with minor head injury* and any 1 of these findings:

- GCS score < 15 at 2 hours after injury
- Suspected open or depressed skull fracture
- History of worsening headache
- Irritability on examination
- Any sign of basal skull fracture†
- Large, boggy hematoma of the scalp
- Dangerous mechanism of injury‡
- ≥ 4 episodes of vomiting

Note: CT = computed tomography, GCS = Glasgow Coma Scale.

* Minor head injury is defined as injury within the past 24 hours associated with witnessed loss of consciousness, definite amnesia, witnessed disorientation, persistent vomiting (> 1 episode) or persistent irritability (in a child aged < 2 yr) in a patient with a GCS score of 13–15.

† Signs of basal skull fracture include hemotympanum, raccoon eyes, otorrhea or rhinorrhea of the cerebrospinal fluid, and Battle sign.

‡ Dangerous mechanism is a motor vehicle crash, a fall from elevation ≥ 3 ft (≥ 91 cm) or 5 stairs, or a fall from a bicycle with no helmet.

Reprinted from Osmond MH, Klassen TP, Wells GA, et al. Validation and refinement of a clinical decision rule for the use of computed tomography in children with minor head injury in the emergency department. *CMAJ*.

2018;190(27):E816–E822. <http://www.cmaj.ca/content/190/27/E816>. © Canadian Medical Association (2018).

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TOOL 2.4: Algorithm for the Management of the Pediatric Patient ≥ 2 years with Minor Head Trauma

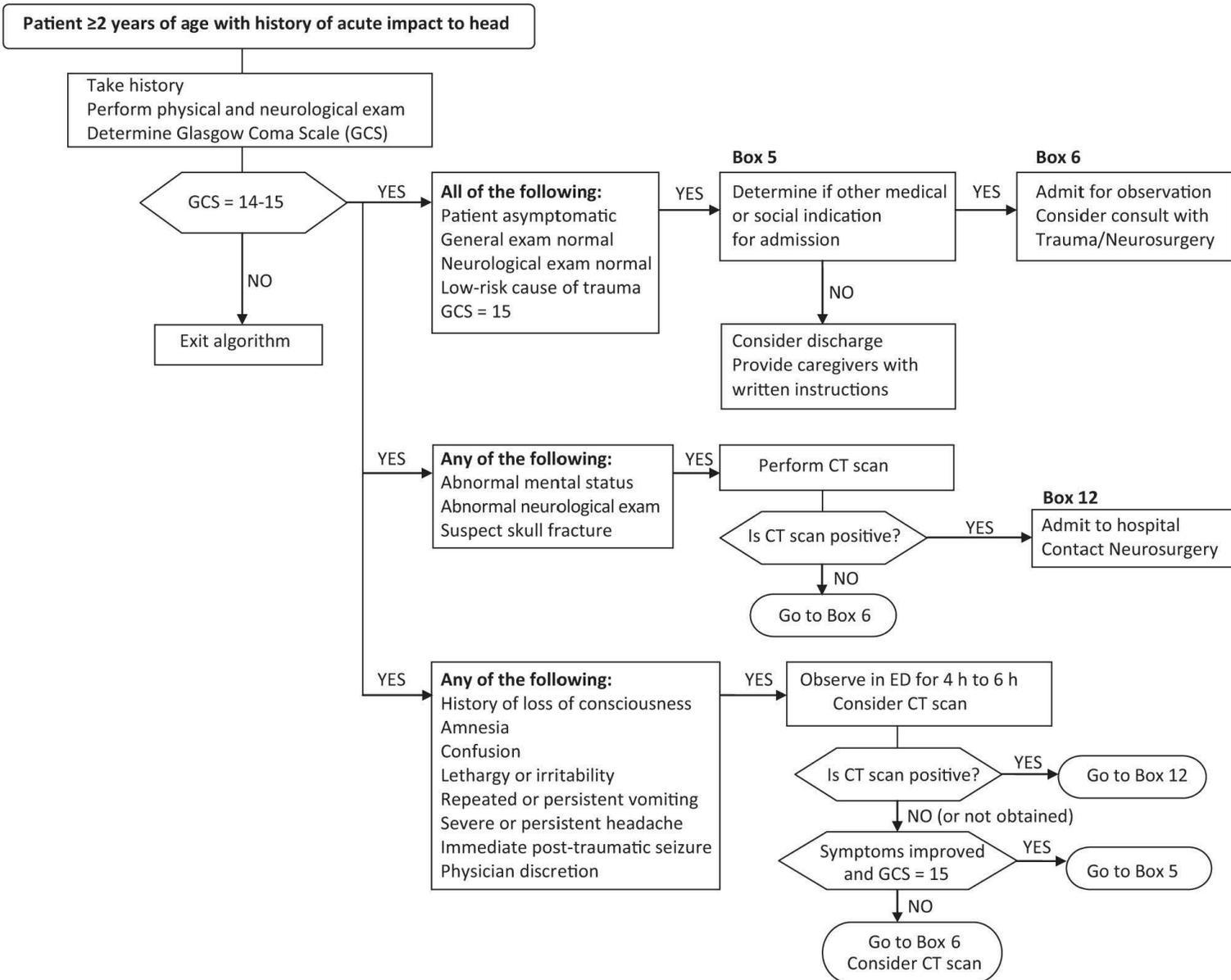


Figure 1. Algorithm for the management of the paediatric patient ≥ 2 years of age with minor head trauma.

CT Computed tomography; ED Emergency department

Source: Catherine A Farrell; Canadian Paediatric Society, Acute Care Committee. Management of the paediatric patient with acute head trauma. Paediatr Child Health 2013;18(5):253-8.



TOOL 2.5: "Four P's" – Prioritize, Plan, Pace and Position

1 PRIORITIZE What is important?

Decide: What is important? What are you able to do based on how you currently feel?

Break daily activities into:

- Urgent: must be done today.
- Important: must be done in next few days.
- For later: must be done this week or month.
- Don't need to/can't do: can it wait until you are feeling better?
- Help needed: can someone do it for you?

3 PACE How are you going to do it?

- Take breaks if you don't feel well.
- After a concussion, your brain is less able to do tasks that were once automatic (e.g. tasks you have a lot of practice doing). It may take more time to complete tasks as you recover.
- Complete the task over stages (you may not be able to finish everything all at once).
- Plan tasks throughout the day so you aren't doing too much at one time.

2 PLAN What are you going to do?

- Organize what you need to do.
- Do tasks that use more energy at times in the day when you feel best.
- Make rest breaks part of your routine.
- Planning saves mental energy and helps you avoid trying to remember what to do and when to do it during the day.

4 POSITION Where are you going to do it?

- Noisy, busy and distracting environments make it hard to concentrate and will use up more energy.
- Think about your environment and how you stand/sit in it.
- Your environment can make a difference in how you feel.

Source: [Holland Bloorview Kids Rehabilitation Hospital. Concussion & You: A Handbook for Parents and Kids. \(Page 9\)](#)



TOOL 2.6: Post-Concussion Information Sheet

What is a concussion?

A concussion is a brain injury that affects how the brain works. A concussion can't be seen on x-rays or brain scans.

What causes a concussion?

Any blow or hit to the head, face, neck, or body that causes sudden shaking of the head can cause a concussion. Concussions can happen from falling, during sports like hockey, soccer, or volleyball, or during motor vehicle collisions.

When should a concussion be suspected?

A concussion should be suspected in any child/adolescent who takes a blow to the head, face, neck, or body and shows ANY of the signs or symptoms of a concussion.

What are the symptoms of a concussion?

Symptoms of concussion describe how someone feels after they are injured. A child/adolescent does not have to be knocked out (black out or unconscious) to have a concussion. Some symptoms may not appear until the next day.

Common symptoms of a concussion are:

- Headaches or head pressure
- Dizziness
- Nausea and vomiting
- Blurred or fuzzy vision
- Sensitivity to light or sound
- Balance problems
- Feeling slow, tired or having no energy
- Not thinking clearly
- Easily upset or angered
- Sadness
- Nervous or anxious
- Feeling more emotional
- Sleeping more or less
- Having a hard time falling asleep
- Difficulty working on a computer
- Difficulty reading or remembering

What are the visible (can be seen) signs of a concussion?

Signs of concussion describe how a child/adolescent looks or acts when they are injured. Common signs of a concussion are:

- Lying still on the ground or ice
- Slow to get up
- Confusion or can't answer questions
- Emotional lability
- Blank stare
- Difficulty standing or walking
- Injury to the face or holding their head

What should a child/adolescent do if they think they or a friend has a concussion?

All children/adolescents who may have a concussion should stop the activity they are doing right away and see a medical doctor or nurse practitioner. All children/adolescents with a concussion should get permission from a doctor or nurse practitioner before returning to full contact sport or high-risk activities.

When should a child/adolescent with a concussion go back to see a doctor or nurse?

Children/adolescents with a concussion should see the doctor or nurse if they have any of the following signs or symptoms:

- Increased confusion
- Worsening headache
- Vomiting more than once
- Seizures
- Not waking up
- Trouble walking
- Difficulty talking
- Strange behaviour

What can a child/adolescent do to help recover from a concussion?

It is important that all children/adolescents with a concussion give their brain time to heal. Here are some tips:

- Return to activities that do not worsen symptoms
- Take a break if symptoms get worse
- Get regular amounts of sleep
- Avoid activities that may involve contact or falling
- Avoid activities that make symptoms worse
- Drink water and eat balanced meals
- Spend time with friends and family
- Avoid drugs and alcohol
- Go to all medical appointments
- If school is more difficult or if they feel sadder or more nervous than normal, they should tell someone they are comfortable with. This might be a trusted friend, family member, teacher, guidance counsellor, doctor, nurse, or Elder.

When can a child/adolescent return-to-school, activities, and sports after a concussion?

Begin by resting for the first 1-2 days. After this short rest, the child/adolescent should start activities (physical and thinking) that do not make symptoms worse or bring on new symptoms. These gentle activities are encouraged 1-2 days after a concussion, even if the child/adolescent still has symptoms. Avoid any activity where the child/adolescent could fall or hit their head.

It is important that all children/adolescents with a concussion make a gradual (step-by-step) return to school/activity/sport. Use the steps below to guide this gradual process. Each step should take about one day. If symptoms get worse, go back to the last step. Try it again until the child/adolescent can do it without bringing on new symptoms or making symptoms worse. It is important to get a doctor's note before returning to full contact sport or high-risk activities.

Return-to-activity/sport steps:

Steps	Activity	Example
1	Physical and cognitive activities that do not make the child/adolescent feel worse	Walking at home or in school
2	Light physical activity	Jogging or stationary cycling at slow to medium speed. No weight training.
3	Sport-specific exercise	Running or skating drills. No drills with risk of head injury.
4	Non-contact activities	Practice without body contact. Gym class activities without risk of head injury.
5	Full-contact activities	Full activities/sports practices after doing full-time school and getting a doctor's note
6	Return to all activities and sports	Normal full-contact game play

Return-to-school steps:

Steps	Activity	Example
1	Activities at home that do not make the child/adolescent feel worse	Reading, texting, screen time and other activities that do not worsen symptoms. Start at 5-15 minutes at a time.
2	School activities	Homework, reading or other activities outside of the classroom
3	Return-to-school part-time	Getting back to school for a few hours or half days
4	Return-to-school full-time	Gradual return to full days at school

How long does it take a child/adolescent to recover after a concussion?

Most children/adolescents with a concussion will recover in 1-4 weeks, but it can take longer for some people.

What can happen if a child/adolescent goes back to sports too early after a concussion?

If children/adolescents with a concussion go back to sports too early after a concussion, they can have another injury. Having another injury can lead to worse symptoms that last longer, or result in a more severe or fatal brain injury.

How can children/adolescents help prevent concussions and their consequences?

To prevent concussions, children/adolescents should follow the rules of their sport, respect their opponents, and avoid head contact. Youth should always wear helmets during outdoor activities such as skating or riding bikes, snowmobiles, or all-terrain vehicles. It is important for children/adolescents to tell parents, teachers, or coaches if they think anyone may have a concussion.

Content from this tool was adapted with permission from the [Parachute Canadian Guideline on Concussion in Sport](#)



TOOL 2.7: Strategies to Promote Good Sleep and Alertness

Healthy habits to promote good sleep and alertness

Make sure the child/adolescent:

- Maintains the same sleep and wake times during the week and on weekends throughout the year, including in the summer, to the best of their ability. If this is challenging to maintain on weekends and holidays, try to keep the child/adolescent within one hour of weekday bed and wake times.
- Has a fixed bedtime routine. A warm bath about one hour before bed may help to facilitate sleep through relaxation. (Note: taking a warm bath too close to bedtime may raise body temperature, which can delay sleep.) If taking a warm bath or shower close to sleep time is unavoidable, it can be followed by a cool (not cold) rinse or shower to prevent the body temperature from rising.
- Turns off the computer and electronic devices including cell phones, at least 30 minutes before bedtime. This helps to ensure that the light emitted from these devices does not affect the ability to fall asleep or maintain sleep, and, that the cognitive or thinking activities involved with screens don't affect the ability to quiet the mind in preparation for sleep.
- Gets increased sleep and naps in the first few hours/days after a concussion. During this acute period, the child/adolescent should be allowed to sleep as much as needed throughout the day and night. Consult a physician or emergency department if the child/adolescent is not easily awoken in the first few hours or days after a concussion. After this acute period, those who have night-time sleep issues should avoid naps (unless it is part of the younger child's typical routine) to promote night-time sleep and gradual return-to-activity.
- Limits naps to once a day. If the child/adolescent is sleepy during the day and cannot avoid napping, then a nap should take place before 3 pm and for no longer than 30 minutes.
- Naps in bed, and not in another room or in front on the TV.

Nutrition, exercise, and lifestyle

Make sure the child/adolescent:

- Avoids caffeine (coffee, tea, chocolate, some over-the-counter medications) within 4-6 hours of bedtime.

- Avoids energy drinks and alcohol altogether.
- Avoids eating heavy meals late in the evening.
- Avoids sugar 4 hours before bedtime. Try a bedtime snack containing proteins.
- Has a balanced diet. Foods such as Goji berries, walnuts, almonds, pineapple, bananas and oranges all contain substantial amounts of melatonin, a hormone produced in the brain that promotes sleep.
- Has an adequate amount of magnesium and zinc in the diet or by supplement. Zinc is known to regulate sleep and magnesium is also directly involved in sleep and relaxation. Magnesium and Zinc-rich foods include:
 - Dark leafy greens
 - Seeds and nuts, including sunflower and sesame seeds, cashews and almonds
 - Squash, broccoli, and other vegetables (magnesium)
 - Potatoes (zinc)
 - Legumes
 - Dairy products
 - Meat
 - Unprocessed whole grains.
- Does 30-60 minutes of vigorous exercise a day, when tolerated and medically indicated, and at least 2 hours before bedtime. Exercise during the 2 hours before bedtime can delay sleep while regular exercise earlier in the day can promote sleep.
- Gets some natural light during the day, especially in the morning.
- Gets 15-30 minutes of quiet time after periods of cognitive activity, if he/she has significant cognitive fatigue (not sleepiness) during the day. Ideally, quiet time should be in an environment with natural light and no electronic devices. This can also promote night-time sleep.
- Avoids loud music with a strong beat before bedtime. If the child/adolescent is used to listening to music before bed, make sure that it is music that promotes relaxation.

Sleeping environment

Make sure the child/adolescent:

- Has a dark, cool and comfortable sleeping area.
- Removes all sources of light in the bedroom while sleeping.
- Opens the curtains and has natural light immediately upon awakening.
- Keeps the bedroom clean, tidy and quiet. Neutral or natural sounds can help to block out distracting sounds.
- Reserves the bed and bedroom for sleep, and does other activities (reading, watching TV, using the internet, playing games) 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 turned off or are in —“sleep” mode.
- Turns any digital clocks with numbers that light up away from the bed during sleep.

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



TOOL 6.1: Post-Concussion Headache Algorithm

Medical follow-up and referral to healthcare professionals/interdisciplinary concussion team

(1-4 weeks following acute injury)

- Focused headache history, physical examination, determine need for imaging
- Post-injury education and guidance on use of over the counter analgesics
- Headache and medication diary
- Refer to healthcare professionals/interdisciplinary concussion clinic if symptoms last longer than 4 weeks post-concussion (or sooner as needed/using clinical judgment), or if the child has modifiers that may delay recovery
- Consider trial of conservative management or prophylactic or abortive headache medication

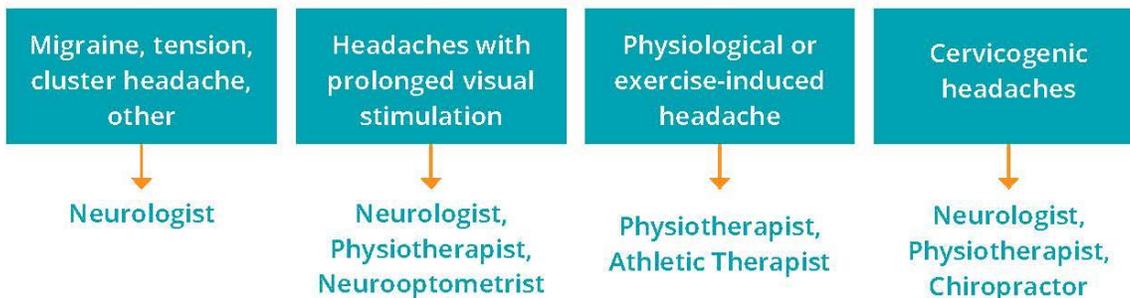
Consider early referral (< 4 weeks) if child/adolescent has modifiers that may delay recovery/high risk of prolonged post-concussion symptoms

Not yet recovered

Headache > 4 weeks post-concussion

Healthcare professionals/interdisciplinary concussion team

- Medical assessment by physician with expertise in concussion
- Adjunctive testing (graded aerobic exercise testing)
- Interdisciplinary management of post-concussion headache subtypes





TOOL 6.2: General Considerations Regarding Pharmacotherapy

- Address significant psycho-social stressors before starting treatment ([Heads Up Checkup: Mental Health and Behavioral Risk Screening System](#)).
- Review current medications, including over-the-counter medicines and supplements, before starting treatment. If possible, minimize or withdraw agents that may exacerbate or maintain symptoms. Screen for overmedication headaches.
- Ideally a psychiatrist would be involved in the prescribing of psychotropic medication but an experienced family doctor or paediatrician, may initiate and monitor treatment. In severe cases, a psychiatrist should be consulted.
- Change only one medication at a time.
- Target drug therapy to specific symptoms (example: dysphoria, anxiety, mood swings, irritability, fatigue, sleep, headache and pain), and monitor during the course of treatment.
- Consider waiting until 12 weeks before starting a mood-altering medication unless the clinical scenario dictates otherwise.
- Choose therapies that minimize the impact of adverse effects on awakening, cognition, sleep and motor coordination, as well as on seizure threshold-domains in which children/adolescents with concussion may already be compromised.
- Start at the lowest effective dose and titrate slowly upwards, monitoring tolerability and clinical response, and also aiming for adequate dose and duration. Treatment often fails because either are insufficient. At times, you may have to prescribe the maximum tolerated doses.
- Aim to use a single agent to alleviate several symptoms. However, as individual symptoms may not show a coupled response to treatment, you may have to try a combination of strategies.
- Offer limited quantities of medications to those at a higher risk of suicide.
- Continue successful pharmacotherapy for at least 6 months, preferably 9 to 12 months for SSRIs, before tapering off on a trial basis.
- Use a specific SSRI as first-line treatment for mood and anxiety syndromes. Avoid using benzodiazepines as first-line therapy for anxiety. Avoid opiates.
- Follow-up regularly.

Adapted from Silver JM, Arciniegas DB, Yudovsky SC. Psychopharmacology. In: Silver JM, Arciniegas DB, Yudovsky SC, eds. Adapted with permission from the Textbook of Traumatic Brain Injury, (Copyright ©2005). American Psychiatric Association. All Rights Reserved.



TOOL 6.3: Approved Medications for Pediatric Indications

Medications may be used as indicated or as off-label use for symptoms related to features of concussion (i.e., migraine headache, muscular discomfort, sleep, cognitive, and mood disorders) or for patients with an acute or prolonged concussion who also have co-existing medical diagnoses that may have been prescribed medications for other indications.

Use clinical judgment and discretion at all times when prescribing medication.

Drug	Health Canada Approval	FDA Approval	Dosage#
Headache or Muscular Strain			
> Acetaminophen	Treatment of mild/moderate pain and fever. All ages.	All ages for mild to moderate pain and fever	10-15 mg/kg/dose orally/rectal every 4h as needed (maximum 75 mg/kg/day or 4,000 mg/day)
> Ibuprofen	Pediatric patients for mild to moderate pain. Fever in pediatric patients.	Mild to moderate pain in patient's ≥ 6 months old. Reduction in fever in patient's ≥ 6 months old. Juvenile arthritis in pediatric patients.	5-10 mg/kg/dose orally every 6-8h as needed (max 600 mg/dose or 40 mg/kg/day)
> Naproxen	Children ≥ 2 years of age: 1) osteoarthritis, ankylosing spondylitis, juvenile rheumatoid arthritis 2) aches/pains and mild to moderate pain due to sprains/strains 3) primary dysmenorrhea	> 2 years of age for analgesia, inflammatory disease	5 mg/kg/dose orally twice daily. Max 500 mg/dose, 1,000 mg/day (usual adult dose: 250-500 mg)
Migraine Headache			
> Amitriptyline	None	None	Chronic pain: 0.1 mg/kg, increase as needed to 0.5-2 mg/kg (off label dosing)
> Diclofenac powder for oral suspension (Cambia®)	No indication <18 years of age. Acute treatment of migraine attacks with or without aura in adults 18 years of age or older.	No indication <18 years of age. Acute treatment of migraine attacks with or without aura in adults 18 years of age or older.	Adult: 50 mg q24 hrs prn (max 15 doses/ month). *Note: the safety of taking a second dose has not been studied, as per the manufacturer.
> Triptan (example: rizatriptan, sumatriptan)	Almotriptan: acute treatment of migraine headache with or without aura in patients 12-17 years of age. Naratriptan: None Rizatriptan: None Sumatriptan: None Zolmitriptan: None	Almotriptan: acute treatment of migraine headache with or without aura in patients 12-17 years of age. Naratriptan: None Rizatriptan: > 6 years of age for acute treatment of migraine with or without aura Sumatriptan: None Zolmitriptan: None	Almotriptan: 6.25-12.5 mg, may repeat dose after 2 hours if needed (max 25 mg/day) Rizatriptan: ≤ 40 kg: 5 mg/24 hrs, ≥ 40 kg: 10 mg/24 hrs

Tool 6.3: Approved Medications for Pediatric Indications (cont'd)

Drug	Health Canada Approval	FDA Approval	Dosage#
> Beta-blockers- Propranolol	migraine prophylaxis	Adult-approved indication for migraine	0.5-4 mg/kg/day
> Topiramate		Adult- approved prevention of migraine headaches	2-16 years: initial dose: 1-3 mg/kg/day orally, increase every 1-2 weeks by 1-3 mg/kg/day divided twice per day. Maintenance dose 5-9 mg/kg/day divided twice per day. ≥ 17 yrs. 50 mg daily. Increase each week by 50 mg/day. Max dose 600 mg/day (Off label dosing)
Sleep Disorders			
> Trazodone	None	None	
> Zopiclone	None	None	
> Magnesium Oxide	Classified as a natural health product. For hypomagnesemia/dietary supplement. No age restrictions.	Magnesium supplement. No age restriction.	20-40 mg/kg/day
> Melatonin	Licensed Natural Health product –no Health Canada monograph	None	0.5-3 mg every night at bedtime (Max. 12 mg)
> Zinc	Licensed Natural Health Product – no Health Canada monograph	Treatment and prevention of zinc deficiency states.	Recommended dietary allowance: infants 5 mg/day, 1-10 years: 10 mg/day, > 11 years: 12-15 mg/day
> Tryptophan	None	None	
Mood Disorders			
> Fluoxetine	none	Major depressive disorder (≥ 8 years) Obsessive compulsive disorder (≥ 7 years)	Major depressive disorder: 10-20 mg/day Obsessive compulsive disorder: 10-30 mg/day. Up to 60 mg/day in higher weight children/ adolescents
> Sertraline	None	Obsessive-compulsive disorder (≥ 6 years)	6-12 years: 25 mg daily, increase as needed to a max of 200 mg/day 13-17 years: 50 mg/day, increase as needed to 200 mg
> Fluvoxamine	None	Obsessive-compulsive disorder (≥ 8 years)	8-17 years: 25 mg daily, increase as needed to a max of 200 mg in 8-11 years and 300 mg/day in adolescents
> Paroxetine	None	None	

Tool 6.3: Approved Medications for Pediatric Indications (cont'd)

Drug	Health Canada Approval	FDA Approval	Dosage#
> Citalopram	None	None	
> Escitalopram	None	Major depressive disorder ≥ 12 years	10 mg daily, increase as needed to a max of 20 mg
> Duloxetine	None	Generalized Anxiety Disorder: 7-17 years	Starting dose: 30mg daily Recommended dose: 30mg daily; max dose: 120mg daily
> Venlafaxine	None	None	
> Mirtazapine	None	None	
> Lurasidone	Depressive episodes associated with bipolar I disorder: 13-17 years Schizophrenia: 15-17 years	Depressive episodes associated with bipolar I disorder: 10-17 years Schizophrenia: 13-17 years	Bipolar I depression starting dose: 20mg po daily; recommended dose 20mg-80mg daily. Schizophrenia starting dose: 40mg daily; recommended dose: 40mg-80mg daily
> Prochlorperazine	≥ 2 years for or > 9 kg 1) psychotic disorders (agitation, confusion, delusion, tension, and anxiety) 2) nausea and vomiting 3) relief of excessive anxiety associated with psychoneurotic or somatic conditions	≥ 2 years or children > 9 kg for 1) nonsurgical nausea and vomiting 2) psychosis	Antiemetic: 0.4 mg/kg/day Psychosis: 2.5 mg orally increase as needed to 20 mg/day (off label dosing)
Cognitive Problems			
> Methylphenidate, extended release (Concerta®, Biphentin®)	Treatment of ADHD in children 6 years of age and older.	Treatment of ADHD in children 6 years of age and older for Concerta® only; Biphentin® not marketed in the USA.	<i>Concerta®</i> Children and adolescents: Initial - 18mg once a day. Increase daily dose by 18 mg at weekly intervals. Maximum of 54 mg in children and 72 mg in adolescents. <i>Biphentin®</i> Children and adolescents: Initial - 10-20 mg once daily. Increase daily dose by 10 mg/day at weekly intervals. Typical maximum of 60 mg/day. However, manufacturer states in some children, higher doses up to a maximum of 1 mg/kg/day may be necessary.

Tool 6.3: Approved Medications for Pediatric Indications (cont'd)

Drug	Health Canada Approval	FDA Approval	Dosage#
> Concerta (OROS Methylphenidate Hydrochloride)	ADHD	ADHD	Children and adolescents between 6-18 years old. Starting dose: 18mg po qAM, with increases weekly as needed and as tolerated to a max of 54mg.
>Dextroamphetamine (Dexedrine®) Dextroamphetamine, sustained release (Dexedrine Spansules®)	Treatment of ADHD and in the adjunctive treatment of narcolepsy in children 6 years of age and older.	Treatment of ADHD and in the adjunctive treatment of narcolepsy in children 6 years of age and older.	<p><i>ADHD</i></p> <p>Children 6 years of age or older: Initial - 5 mg once or twice daily. Increase the daily dose by 5 mg at weekly intervals. *Dexedrine Spansules® may be used for once-a-day dosing where appropriate.</p> <p>Typical maximum of 40 mg/day, but may go up to 60 mg/day if needed.</p> <p><i>Narcolepsy</i></p> <p>Children 6-12 years: Initial- 5 mg daily. Increase daily dose by 5 mg at weekly intervals. Maximum of 60 mg/day.</p> <p>Adolescents 12 years or older: Initial - 10 mg daily. Increase daily dose by 10 mg at weekly intervals. Maximum of 60 mg/day.</p>
> Lisdexamphetamine (Vyvanse®)	Treatment of ADHD in children 6 years of age and older.	Treatment of ADHD in children 6 years of age and older.	Children and adolescents: Initial – 20-30 mg once a day in the morning. Increase daily dose by 10-20 mg at weekly intervals. Max of 60 mg/day (Canada). Max of 70 mg/day (US).
> Clonidine (Catapres®)	<p>No indication <18 years of age.</p> <p>No approved indications for ADHD at any age.</p> <p>Used off-label in children 6 years of age and older for ADHD treatment as monotherapy or adjunctive to stimulant medications.</p>	<p>Extended-release clonidine (Kapvay®) approved for ADHD treatment in children 6 years of age and older.</p> <p>*note: extended-release clonidine is not available in Canada.</p>	<p>Off label dosing:</p> <p>Children less than 45 kg: Initial – 0.05 mg at bedtime. Increase every 3-7 days in 0.05 mg/day increments given as 0.05 mg BID, then TID, then QID. Maximum daily dose for 27-40.5 kg = 0.2 mg/day. Maximum daily dose for 40.5-45 kg = 0.3 mg/day.</p> <p>Children and adolescents greater than 45 kg: Initial – 0.1 mg at bedtime. Increase every 3-7 days in 0.1 mg/day increments given as 0.1 mg BID, then TID, then QID. Max daily dose of 0.4 mg/day.</p>

Tool 6.3: Approved Medications for Pediatric Indications (cont'd)

Drug	Health Canada Approval	FDA Approval	Dosage#
> Amphetamine Mixed Salts, extended-release (Adderall XR®)	Treatment of ADHD in children 6 years of age and older.	Treatment of ADHD in children 6 years of age and older.	<p>Children 6-12 years of age: Initial – 5-10 mg daily in the morning. Increase daily dose by 5-10 mg at weekly intervals. Maximum of 30 mg/day.</p> <p>Adolescents 13-17 years of age: Initial – 10 mg once a day in the morning. Increase daily dose by 5-10 mg at weekly intervals. Maximum of 30 mg/day.</p>
> Atomoxetine (Strattera®)	Treatment of ADHD in children 6 years of age and older.	Treatment of ADHD in children 6 years of age and older.	<p>Children up to 70 kg: Initial: 0.5 mg/kg/day for 7-14 days. If tolerated, increase to 0.8 mg/kg/day for 7-14 days, then increase to 1.2 mg/kg/day given once daily or divided BID. Maximum 1.4 mg/kg/day or 100 mg, whichever is less.</p> <p>Adolescents greater than 70 kg: Initial – 40 mg/day for 7-14 days. If tolerated, increase to 60 mg/day for 7-14 days, then increase to 80 mg/day given once daily or divided BID. Maximum 100 mg/day.</p>
> Guanfacine, extended-release (Intuniv XR®)	Monotherapy or as adjunctive to stimulant medications for the treatment of ADHD in children 6 years of age and older.	Monotherapy or as adjunctive to stimulant medications for the treatment of ADHD in children 6 years of age and older.	<p>Children 6-12 years of age: Initial – 1 mg once daily. Increase daily dose by 1 mg at weekly intervals. Maximum of 4 mg/day.</p> <p>Adolescents 13-17 years of age: Initial – 1 mg once daily. Increase daily dose by 1 mg at weekly intervals. Maximum of 7 mg/day for monotherapy, or 4 mg/day for adjunctive therapy to stimulants.</p>

Tool 6.3: Approved Medications for Pediatric Indications (cont'd)

Drug	Health Canada Approval	FDA Approval	Dosage#
> Amantadine	No indications less than 18 years of age for ADHD.	No indication less than 18 years of age for ADHD.	(off label use in children 5 years of age and older as an adjunctive agent to stimulants for ADHD treatment, and to target irritability and hyperactivity in ASD) ADHD Children 5 years of age and older: Initial – 50 mg/day. Increase daily dose by 50 mg at 4-7 day intervals. Typical range: 50-150 mg/day in divided doses 1-3 times daily. Maximum of 100 mg/day in children less than 30 kg. Maximum of 150 mg/day in children and adolescents 30 kg and greater.

Abbreviations: Attention deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD); Per os (po); bis in die (two times a day- BID); hour (h); IV (intravenous); omne in die -once a day (od); every morning (qAM); ter in die- three times a day (TID); as needed dosing (prn).

Dosages from Sick Kids 2013/2014 Drug Handbook and Formulary, Lexicomp Pediatric Dosage Handbook 19th Edition, CHEO Pediatric Doses of Commonly Prescribed Medications 2011, <https://www.accessdata.fda.gov/scripts/cder/daf/>, Clinical Handbook of Psychotropic Drugs for Children and Adolescents, 4th ed. 2019.



TOOL 7.1: Prolonged Post-concussion Sleep Disturbances Algorithm

Medical follow-up

(Sleep disturbances >1-4 weeks)

- Screen for medical conditions, current medication use, comorbid psychopathology, and risk factors for sleep disturbances (Sidebar 1)
- Reinforce the importance of sleep hygiene and physical and cognitive activity
- Assess return to school and return to sport status
- Consider treating with cognitive behavioural therapy (CBT) or refer to interdisciplinary concussion team if symptoms last longer than 4 weeks (or sooner as needed/using clinical judgment)

Sleep disturbances persist > 4 weeks post-concussion

Cognitive behavioural therapy or referral to healthcare professionals/ interdisciplinary concussion team

1. Cognitive behaviour therapy (CBT): treatment of choice
2. Daily supplements: magnesium, melatonin, and zinc
3. If CBT is not available: monitor behavioural interventions weekly, consider referral to an interdisciplinary concussion clinic or occupational therapist

Sleep disturbances persist > 6 weeks post-concussion and interventions at 4-weeks have been unsuccessful

Referral to healthcare professionals/ interdisciplinary concussion team

Refer to a sleep specialist for consultation

Particularly if sleep hygiene can't be optimized and poor sleep quality is impacting ability to return to school or ability to recondition.

Ideal specialist: a specialist who has experience with mTBI and polysomnography.

Pharmacological treatment

Consider prescribing medication on a short-term basis if sleep has not improved > 6 weeks post-injury. Ensure that medications do not result in dependency and that patient has minimal adverse effects. The aim is to establish a more routine sleep pattern. (Sidebar 2)

SIDEBAR 1

Factors that may influence the child/adolescent's sleep/wake cycle

> Medical conditions

- Endocrine dysfunction
- Metabolic dysfunction
- Obesity
- Enlarged tonsils
- Obstruction
- Sleep-related breathing disorders
- Early morning headaches

> Current medication use

Verify if patient's prescribed or non-prescribed medications impact sleep:

- Inadequate medication
- Dosage
- Timing of administration
- Screen for stimulants

> Comorbid psychopathology

- Mood and anxiety disorders
- Post-traumatic stress disorder (PTSD)
- Query nightmares and/or night terrors

> Unhealthy habits

- Lack of exercise
- Variable sleep-wake schedule
- Excessive napping
- Excessive time spent in bed
- Exercising close to bedtime
- Screen time
- Use of nicotine, caffeine, energy drinks, processed foods, processed sugars, alcohol and drugs

SIDEBAR 2

Potential medication options – short-term basis only

- Trazodone 12.5 mg
- Amitriptyline 5.0 – 10.0 mg



TOOL 7.2: Factors that may Influence the Child/Adolescent's Sleep/Wake Cycle

Examples of factors and considerations

Medical Conditions	<ul style="list-style-type: none">• Endocrine dysfunction• Metabolic• Obesity• Enlarged tonsils• Obstruction• Sleep-related breathing disorders (possibly sleep apnea)• Early morning headaches
Current Medication Use	<p>Verify if prescribed or non-prescribed medications that are being taken have an impact on sleep and screen for stimulants.</p> <p>Factors to consider:</p> <ul style="list-style-type: none">• Type of medication (adequate/inadequate type)• Dosage• Timing of administration
Comorbid Psychopathology	<ul style="list-style-type: none">• Mood and anxiety disorders (Domain 8: Mental health considerations)• Post-traumatic stress disorder (PTSD)• Query nightmares and/or night terrors
Unhealthy Habits	<ul style="list-style-type: none">• Lack of exercise• Variable sleep-wake schedule• Excessive napping• Excessive time spent in bed• Exercising close to bedtime• Screen time (hours per day)• Use of nicotine, caffeine, and/or energy drinks• Diet: Consumption of processed foods, processed sugars, alcohol, and/or drugs

Adapted from Guidelines for Concussion/Mild Traumatic Brain Injury and Persistent Symptoms, Third Edition



TOOL 8.1: Post-concussion Mental Health Considerations Algorithm

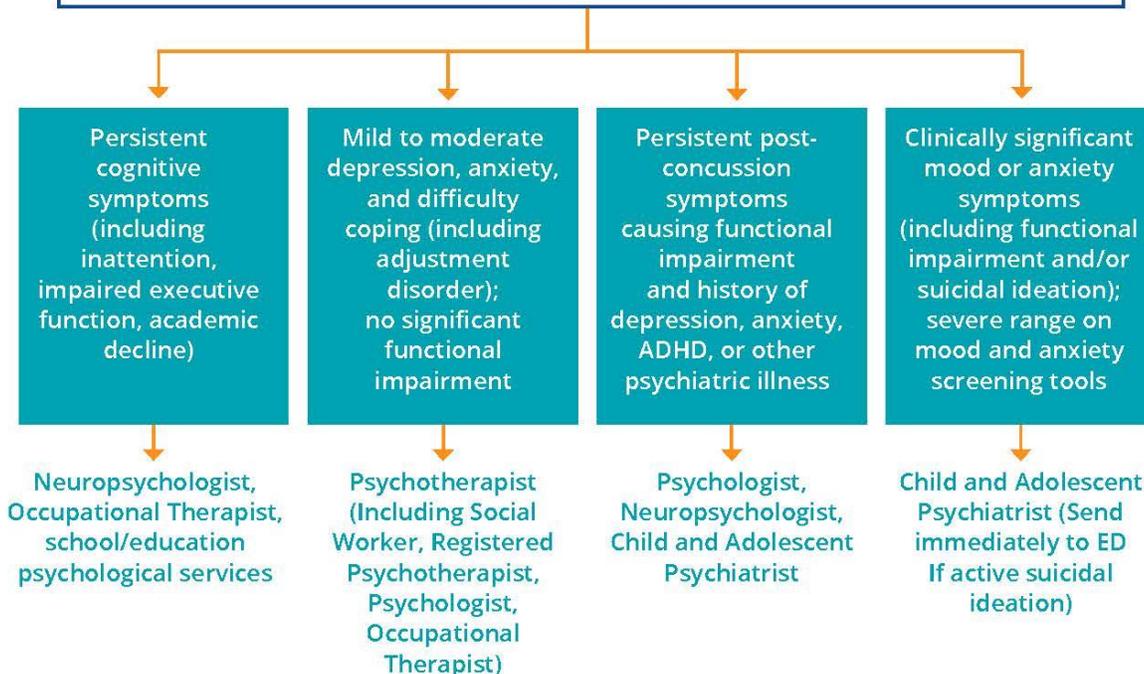
Medical follow-up and referral to healthcare professionals/interdisciplinary concussion team (1-4 weeks following acute injury)

- Focused clinical history, physical examination, determine need for imaging
- Screen for possible complicating factors that may impede recovery e.g. previous mental illness, family history of mental illness, migraine, current stress level, and any other modifiers that may delay recovery. Consider early referral to specialist or interdisciplinary team.
- Screen for mood, anxiety, and cognitive symptoms
- Send immediately to the emergency department (ED) if active suicidal ideation
- Review pre-injury mental health status (including pre-injury symptoms or diagnoses of depression, anxiety disorders, ADHD, and behavior disturbances)
- Review previous school history (attendance, learning, behavior) using information from school records if possible
- Post-injury education and guidance on symptom management (including advice regarding pacing of activities and general recovery expectations within the context of pre-existing circumstances)
- Refer to healthcare professionals/interdisciplinary concussion team if symptoms last longer than 4 weeks (or sooner as needed/using clinical judgment)

Consider early referral (< 4 weeks) if child/adolescent has modifiers that may delay recovery/high risk of prolonged post-concussion symptoms

Not yet recovered ↓ Symptoms lasting > 4 weeks post-concussion

Specialist or interdisciplinary concussion team

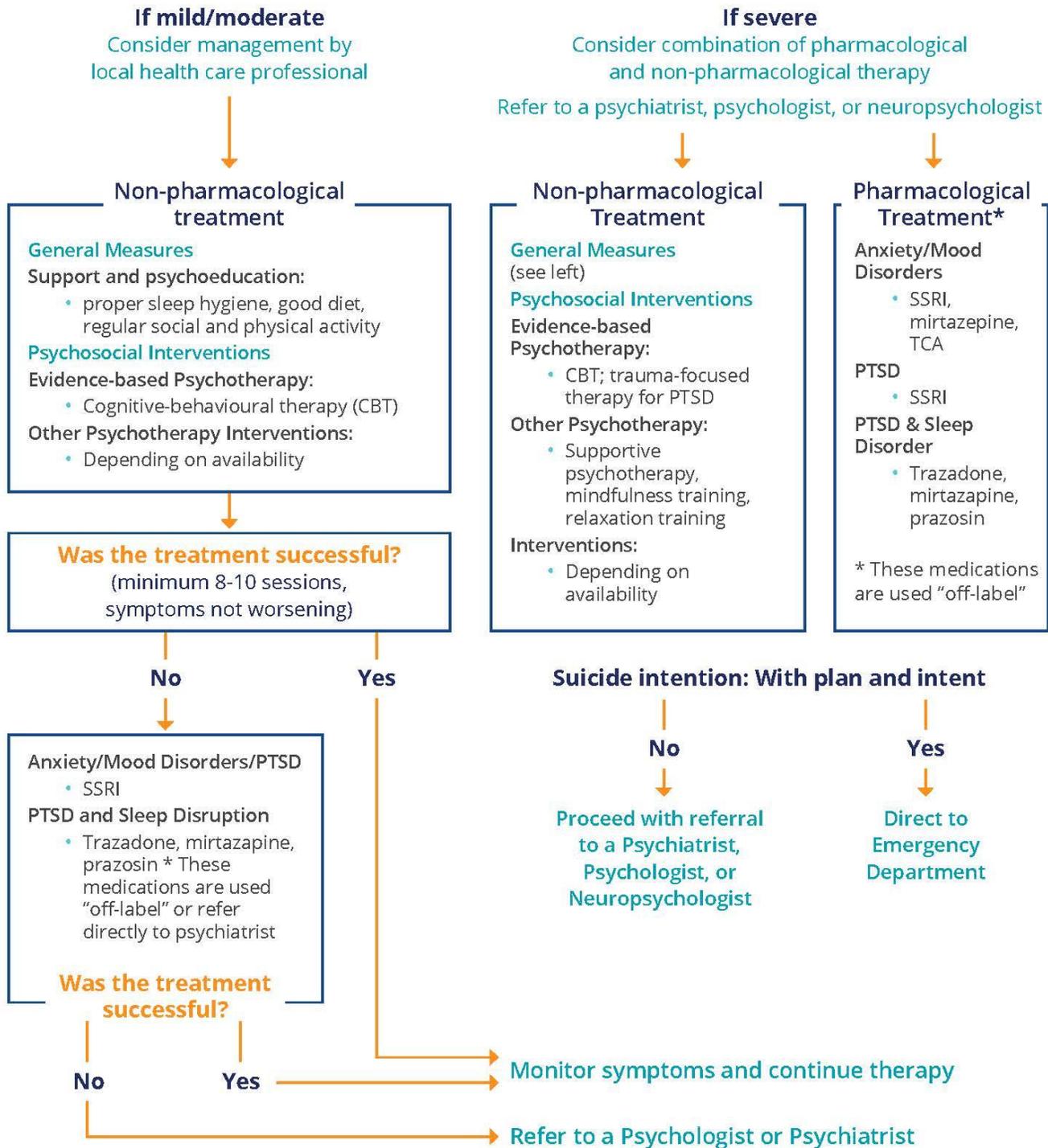


Acronyms: attention deficit hyperactivity disorder (ADHD)

Living Guideline for Diagnosing and Managing Pediatric Concussion



TOOL 8.2: Management of Prolonged Mental Health Disorders Algorithm



Adapted from *Guideline for Concussion/Mild Traumatic Brain Injury and Persistent Symptoms*, Third Edition
Acronyms: Post-traumatic stress disorder (PTSD); Selective serotonin reuptake inhibitors (SSRI); Tricyclic antidepressants (TCA)



TOOL 10.1: Post-concussion Vision, Vestibular, and Oculomotor Disturbances Algorithm

Medical follow-up and referral to healthcare professionals/interdisciplinary concussion team

(1-4 weeks following acute injury)

- Focused vision and vestibular history, physical examination, determine need for imaging
- Post-injury education and guidance on symptom management
- Refer to healthcare professionals/interdisciplinary concussion team if symptoms last longer than 4 weeks (or sooner as needed/using clinical judgment), or if the child has modifiers that may delay recovery
- Consider particle re-positioning for BPPV (e.g. Epley)

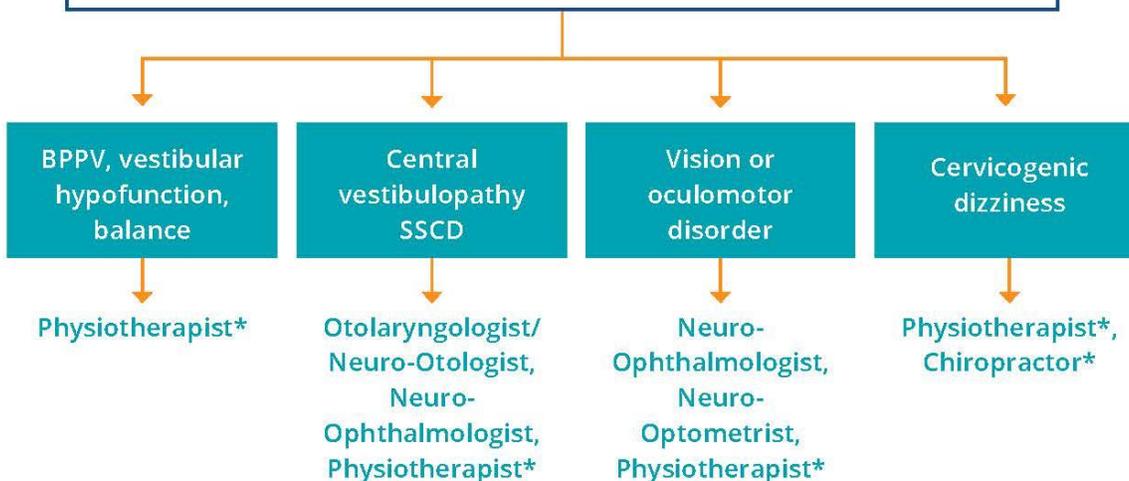
Consider early referral (< 4 weeks) if child/adolescent has modifiers that may delay recovery/ high risk of prolonged post-concussion symptoms

Not yet recovered

Symptoms lasting >4 weeks post-concussion

Healthcare professionals/interdisciplinary concussion team

- Medical assessment by physician with expertise in concussion
- Adjunctive testing (graded aerobic exercise testing, formal vestibular testing, automated visual field testing)
- Interdisciplinary management of vision and vestibular disorders



Acronyms: paroxysmal positional vertigo (BPPV); superior semicircular canal dehiscence syndrome (SSCD)

*denotes health care professional with competency-based training in vestibular or visual system rehabilitation



TOOL 12.1: Concussion Implications and Interventions for the Classroom

Area of concern after concussion	Possible classroom behaviour that indicates difficulty	Proactive solution for student
> Physical	Headaches in school	Allow for rest breaks; hydration; quieter location.
	Dizziness	Provide calm environment without multiple distractions.
	Fatigue: Sleeping more or less than usual	Allow for rest breaks; plan daily schedule with a variety of classes with different levels of difficulty interspersed (e.g. difficult vs less difficult).
	Vision problems with sensitivity to lights	Avoid fluorescent lights when possible; decrease brightness on computers, smart phones, tablets; limit time on computers; electronic gaming devices.
	Hearing issues with noise (gyms, concerts, music causing irritability)	Avoid loud activities, including gym classes, loud music from headphones, dances or parties.
> Cognitive-communication	Unable to concentrate	Provide information in smaller chunks; assign less material for task completion.
	Forgetting recently learned information or conversations	Allow for written and verbal cues; use note taker or provide written notes for reference.
	Slow to process information (verbally or written)	Allow additional time for response; provide alternative methods for test taking; breakdown complex directions into simple steps; decrease length of assignments or do not give any.
	Asks for repeats	Provide written and verbal cues and notes; post schedule and assignments.
	Word finding/naming (vocabulary) difficulty	Pre-teach new vocabulary; cue using categorization and association.
	Poor social interactions with others (easy to anger, rude, interrupts with irrelevant information)	Do not punish unacceptable behaviours; work on social skills one on one.

Tool 12.1: Concussion Implications and Interventions for the Classroom (cont'd)

Area of concern after concussion	Possible classroom behaviour that indicates difficulty	Proactive solution for student
> Cognitive-communication	Confused about recent activities/ experiences	Use technology (tablets, smart phones) to record cues as activities occur; use day organizer for reference.
	Unable to attend to task completion	Break tasks into smaller pieces so each portion is successfully completed.
> Social/emotional/behavioural	More irritable in the classroom	Provide clear schedule for the day; recognize beginning of irritable behaviour and provide alternative activity.
	Feeling anxious or tense	Provide time for rest during the day; provide clear schedule of activities for the day; less required work.
	Feeling depressed	Point out strengths and successes during each day.
	Easily overwhelmed by school requirements or activities	Diminish schedule to reasonable load that can be successfully accomplished; add activities only when success is demonstrated; decrease or eliminate homework.

Adapted from DePompei, R.& Blosser J. *Pediatric traumatic brain injury: proactive interventions*. (2019). Plural Press: San Diego.



TOOL 12.2: Template for Concussion Team's Letter to the Child/Adolescent's School

Name:

Date:

School:

Address:

Re: Concussed student name

DOB:

Dear _____,

This letter is to update the school regarding _____ (Student's name) recovery from a concussion sustained on _____ (Date). We take this opportunity to let you know what to expect during the recovery period.

Current best practice guidelines on concussion management emphasize the importance of recovery and return to function, and encourages students to return-to-school as soon as possible, with accommodations, even though they may still be symptomatic.

Please be aware of signs and symptoms the student may display: (Check those relevant to this student)

- | | |
|--|---|
| <input type="checkbox"/> Decreased short term memory | <input type="checkbox"/> Decreased attention span |
| <input type="checkbox"/> Slower processing speed | <input type="checkbox"/> Irritability |
| <input type="checkbox"/> Fatigue | <input type="checkbox"/> Headaches |
| <input type="checkbox"/> Photo/audio sensitivity | <input type="checkbox"/> Other _____ |

In the classroom, students with these symptoms may exhibit difficulty paying attention, difficulty following lessons, and sensitivity to noisy/busy classrooms and environments (e.g. assemblies, shop classes).

We have advised your student to pace him/herself with regards to their return-to-school and to use accommodations at school as needed. The following accommodations are recommended: (Check the recommendations for this student)

- Allowed to take short breaks from the classroom; access to a quiet workspace
- Class notes provided to assist focus and reduce writing/copying demands
- Allowed to photograph the teacher's board notes with a smartphone
- Extended deadlines; modified demands for homework/assignments
- Access to technology as needed (e.g. audiobooks, Google read and write)
- Chunking of tests/exams; allowed extra time and quiet, alternative setting
- Close monitoring and communication with the student regarding his/her progress
- Rest periods during the day as needed
- It is recommended that all non-essential missed workload expectations be forgiven to allow student to prioritize essential knowledge building areas and focus on current curriculum rather than missed work
- Other _____

Thank you for your assistance in supporting _____ (Student's name). The parents and the concussion team will monitor the student and work with the school, as accommodations need to be adjusted to support the student's recovery.

Please do not hesitate to contact us with any questions or concerns regarding this information, or if we can be of further assistance.

Sincerely,

Adapted with permission from the authors: Sinclair Elder AJ, Kadel R, O'Keefe EK. Headin' for Healin' Teacher's Letter. Colorado Springs, CO: University of Colorado Colorado.

Living Guideline for Diagnosing and Managing Pediatric Concussion



TOOL 12.3: Template for Physician's Letter to the Child/ Adolescent's School

Name

Date:

School

Address

Re: Concussed student name

DOB:

Dear _____,

_____ (Student's name) was diagnosed with a concussion on _____ (Date), and has now been medically cleared to return-to-school.

Current best practice guidelines on concussion management emphasize the importance of recovery and return to function, and encourages students to return-to-school as soon as possible, with accommodations, even though they may still be symptomatic.

Please identify a "point person" within the school environment (example: guidance counsellor, homeroom teacher, vice principal) who can help the student implement a return-to-school plan, communicate it to teachers/school staff involved in the student's activities, and modify it as needed. The attached document outlines accommodations that may be helpful while your student is reintegrating back into the school environment.

Feel free to contact me with additional questions.

Sincerely,



TOOL 12.4: Sample Letter/Email from School to Parents

Dear _____ (Parents' names)

We are happy to hear that your child is feeling well enough to start the return-to-learn process after his/her concussion. To make sure teachers and staff are prepared, we would like your insight on the following symptoms. Please check the answers that best fit your child.

Fatigue

My child tires easily has the normal amount of energy.

My child has the most energy in the morning afternoon evening.

Behaviour

My child is easily frustrated isn't easily frustrated.

My child has been acting the same different compared to before concussion.

Memory

My child's memory seems fine impaired.

Cognition

My child seems to be able to understand complex thoughts and ideas. Yes No

My child is able to read for less than ½ hour ½ to 1 hour more than 1 hour.

My child can handle different technologies (example: TV, computers). Yes No

My child can complete some homework. Yes No

Stamina

My child makes it through a day without a period of rest. Yes No

Social

My child is becoming isolated or has different friends than before the concussion. Yes No

My child can handle noisy/busy environments. Yes No

Awareness

My child feels like there is nothing wrong with him/her after the concussion. Yes No

My child understands that there have been changes and would like help. Yes No

Please elaborate on any other changes you've noticed in your child. We want to be ready to manage your child's return-to-learn process and make accommodations to ensure success.

Sincerely,

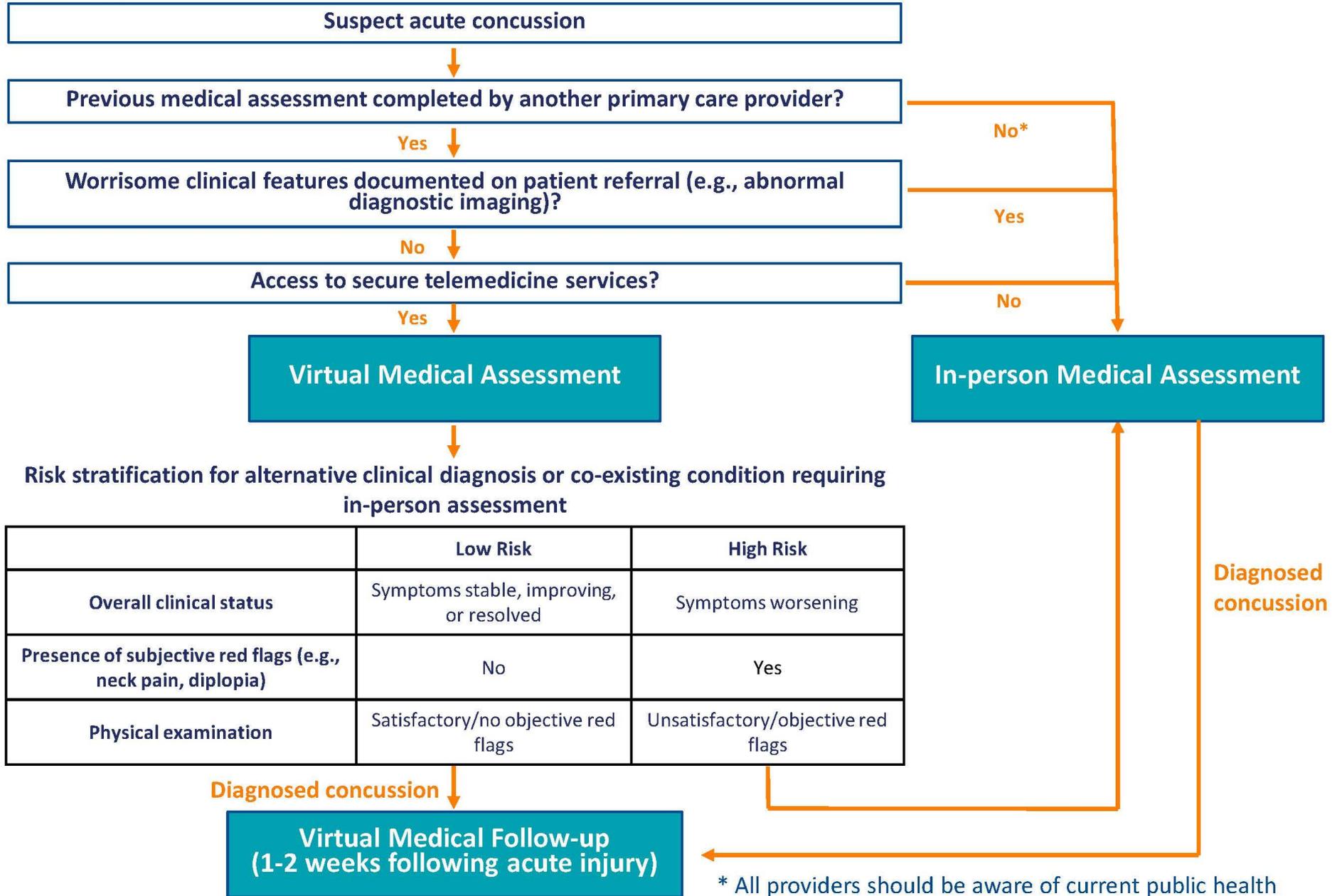
_____ (school contact person's name)

Telephone/email _____

Source: [Developed by Vermont's concussion task force, used with permission from the Brain Injury Association of Vermont.](#)



Tool 15.1 Considerations for Telemedicine and Virtual Care Algorithm



* All providers should be aware of current public health recommendations when providing care for their patients

Adapted with permission from: Ellis M, Mendez, Russell K. (2020). Preliminary clinical algorithm to optimize delivery of remote pediatric concussion care in Canada's North. *International Journal of Circumpolar Health* (published online October 22, 2020) <https://doi.org/10.1080/22423982.2020.1832390>



Tool 15.2: Considerations for a virtual physical examination for medical assessment and follow-up of concussion patients

All patients presenting with a suspected acute concussion should undergo a complete physical examination that includes a neurological examination and cervical spine examination, as well as examination for any other traumatic injury. Depending on the patient's presenting or prolonged symptoms, supplementary physical examination tests can be considered. This also depends on the healthcare professional's experience in performing and interpreting these objective tests.

See [Tool 2.1: Physical Examination](#) for a comprehensive list of tests for the neurological and cervical spine examination.

Due to conditions such as the visual quality of in-person videoconferencing and environmental factors (e.g., lighting, examination room size and configuration) some of the components of the virtual physical examination recommended here may not be able to be performed during all patient assessments. **Providers should use their clinical discretion when performing and interpreting components of the virtual physical examination.**

Mental status and speech:

Mental status: Document if patient is alert and oriented to date and place.

- Alternatively document Glasgow Coma Scale score.

Speech: Speech may be assessed during clinical interview or on examination.

- Abnormal: document any evidence of dysarthria, word finding difficulty, apraxia, aphasia etc.

Modified cranial nerve exam:

Extraocular movements: Ask the patient to position themselves close to the camera. Ask the patient to look directly at the camera. Observe ocular alignment in the primary position and assess for any evidence of ptosis or nystagmus. Ask the patient to keep their head still and hold their finger up at eye level approximately half an arm's length away from their face. While following their finger with their eyes, ask the patient to slowly move their finger to the right and left and then trace an "H" allowing the examiner to evaluate the six cardinal positions of gaze. Ask the patient if they experience any diplopia during gaze in any direction. Then ask the patient to visually track their finger by moving it slowly back and forth in the horizontal direction with the head stationary, making sure not to go more than about 30 degrees from neutral to avoid eliciting end-gaze nystagmus. This can also be repeated in the vertical plane.

- *Abnormal:* Note any abnormal alignment of the eyes in the primary position or any restriction in eye movement during testing. Note any patient-reported diplopia during testing.

Smooth Pursuits: Ask the patient to position themselves close to the camera. Ask the patient to look directly at the camera. Ask the patient to visually track his/her finger by moving it slowly back and forth in the horizontal direction with the head stationary, making sure not to go more than about 30 degrees from neutral to avoid eliciting end-gaze nystagmus. The patient may be cued to move closer to or farther from the camera or vary the plane of their finger to enable optimal viewing of the patient's eyes. This may also be repeated in vertical visual plane.

- **Abnormal:** Abnormal findings include sustained beats of nystagmus, staccatic (i.e., jerking) eye motion, loss of conjugate vision, corrective (catch-up or back-up) saccades, loss of visual fixation OR symptom provocation (dizziness, nausea or headache).

Facial symmetry: Ask the patient to look directly at the camera. Ask the patient to smile. Ask the patient to elevate their eyebrows and then close their eyes tightly.

- **Abnormal:** Note any facial asymmetry at rest or during testing.

Facial sensation: Ask the patient to take the index finger of each of their hands and lightly touch their face along the ipsilateral V1, V2, and V3 distributions of the trigeminal nerve. Ask the patient to indicate whether sense of touch is perceived in all distributions and is equal when comparing both sides.

- **Abnormal:** Note any evidence of decreased sensation.

Movement of palate and tongue: Ask the patient to position themselves close to the camera. Ask the patient to open their mouth and say “ah”. Ask the patient to stick out their tongue, move it to the right and left, and retract it.

- **Abnormal:** Note any asymmetry or abnormal findings. Note any restricted movement of the jaw/mouth opening.

Motor/coordination:

Pronator drift: In a standing position, ask the patient to raise their arms forward to shoulder level (90 degrees of shoulder flexion) and position their hands with palms facing upwards. Ask the patient to close their eyes and maintain this position.

- **Abnormal:** Note any pronation of the hand or downward drift of the arm.

Rapid alternating hand movements: In a standing position, ask the patient to place one hand palm upwards in front of them and place the opposite hand palm down on top of the other hand. Ask the patient to rapidly flip the top hand quickly back and forth from a palm up and down position. Ask the patient to switch hands and repeat the same movements.

- **Abnormal:** Note any differences in speed or coordination between sides.

Cervical spine

In a standing or seated position ask the patient to slowly flex their neck forward, extend their neck backward, and bend their neck to the left and right as far as comfortably possible. Ask the patient to slowly rotate their neck to the left and right as far as comfortably possible. Ask the patient whether they experience any pain during any movements.

- **Abnormal:** Note any restricted range of motion or any reported pain.

Balance

Balance tests may be performed near a supporting caregiver or object (e.g., chair/wall).

Feet together stance: With the patient positioned so their entire body is visible to the examiner, ask the patient to stand with their feet together and their hands on their hips. Ask the patient to close their eyes and hold the position for 20 seconds.

- **Abnormal:** Note any instability, stumbling out of position or eye opening.

Tandem stance: With the patient positioned so their entire body is visible to the examiner and near a supporting caregiver or object (e.g., chair/wall), ask the patient to stand with their

dominant foot slightly in front of their non-dominant foot with their hands on their hips. Ask the patient to close their eyes and hold the position for 20 seconds.

- *Abnormal:* Note any instability, stumbling out of position or eye opening.

Tandem gait (eyes open): With the patient positioned so their entire body is visible and positioned perpendicular to the examiner, ask the patient to walk in the forward direction heel-to-toe with their eyes open for 5 paces.

- *Abnormal:* Note any instability or stumbling out of position

Tandem gait (eyes closed): With the patient positioned so their entire body is visible to the examiner, ask the patient to walk in the forward direction heel-to-toe with their eyes closed for 5 paces.

- *Abnormal:* Note any instability, stumbling out of position or eye opening.
- *Note:* Consider if tandem gait is normal.

Memory:

Explain to the patient that you are going to test their memory. Provide the patient with a list of five items. Ask the patient to immediately repeat the items back in any order. Record the number of correctly repeated items out of five (immediate recall). After a set time period (e.g., five minutes) has elapsed, ask the patient if they can remember the five items provided. Record the number of correctly repeated items out of five (delayed recall).

Vestibulo-ocular:

Horizontal saccades: Ask the patient to position themselves close to the camera. Ask the patient to hold up their index fingers and place them at half arm length away from the face and 30 cm apart from each other. While keeping their head still, ask the patient to look quickly and accurately back and forth between each index finger for a total of 10-15 repetitions. Ask the patient whether performing these eye movements worsen or elicit any concussion symptoms (e.g., dizziness, headache)

- *Abnormal:* Note evidence of over- or undershooting of the target or saccadic corrections. Note slowed or delayed initiation of saccades.
- *Symptomatic:* Note whether the movements elicit or worsen any concussion-like symptoms (e.g., dizziness, headache)

Gaze stabilization: Ask the patient to hold their thumb up at the level of the eyes and at arm length distance from the face. Ask the patient to fix their eyes on their thumb and quickly but comfortably shake their head back and forth within 15-20 degrees of rotation for 10 repetitions.

- *Symptomatic:* Note whether the movements elicit or worsen any concussion-like symptoms (e.g., dizziness, nausea)
- *Note:* Do not perform test unless patient has full and painless range of motion of the cervical spine.

Reference

Modified from: Ellis M, Mendez, Russell K. (2020). Preliminary clinical algorithm to optimize delivery of remote pediatric concussion care in Canada's North. *International Journal of Circumpolar Health* (published online October 22, 2020)
<https://doi.org/10.1080/22423982.2020.1832390>