From Fatigue to Brain Fog: Academic Implications of Concussions, Long COVID, & More

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Regional Assessment Resource Centre (RARC)

www.queensu.ca/rarc

Our vision is to enable students with neurodevelopmental disabilities to thrive in post-secondary education.

Services provided under 4 pillars:

Transition

Research

Training

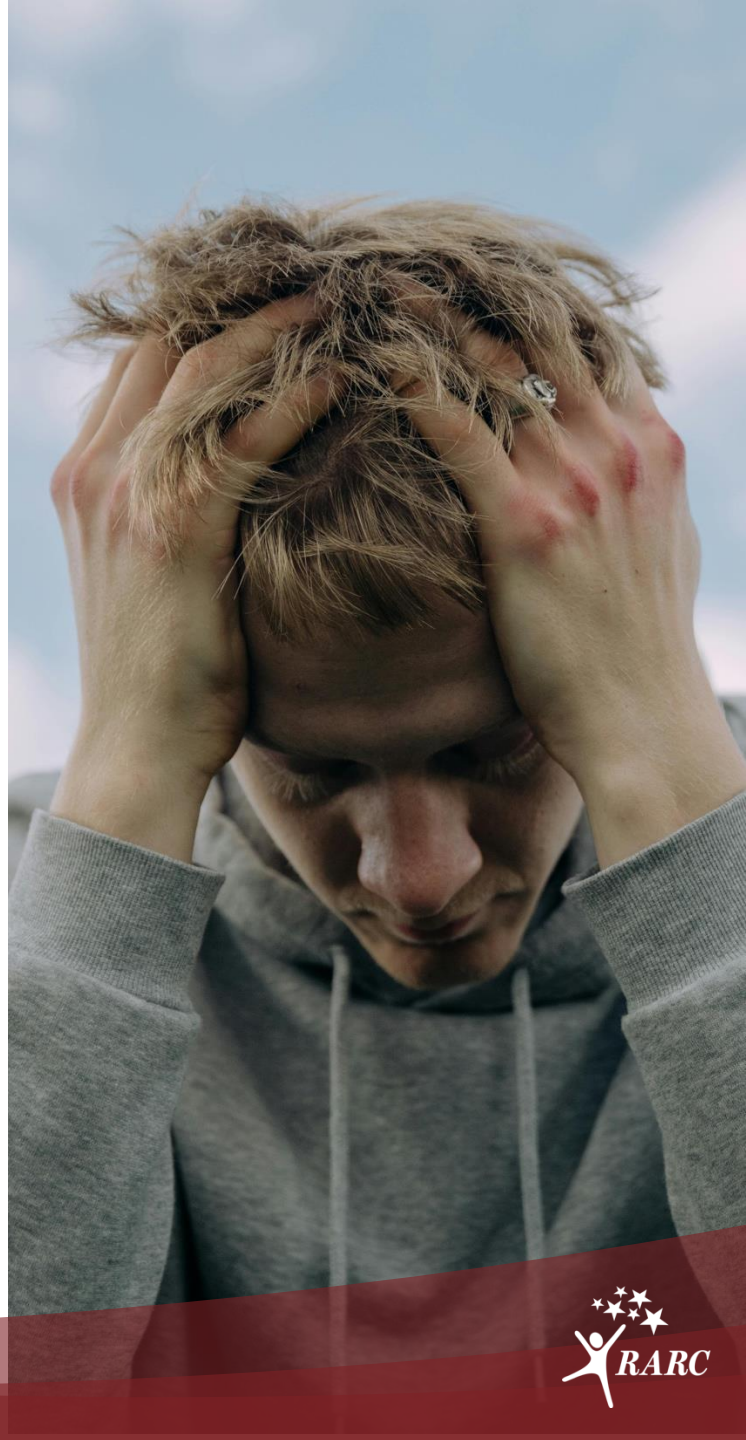
Assessment

Learning Objectives:

- Understand the **neurocognitive, psychological, and academic implications** of persistent post-concussive symptoms, Long COVID, and other chronic conditions that manifest with cognitive fatigue, brain fog, and fluctuating functional capacity.
- Appreciate **limitations in objective documentation** available with respect to these conditions.
- Translate complex clinical profiles into **concrete, individualized accommodations and supports.**

Persistent Post-Concussive Symptoms

- The brain is well protected from most damage. It sits inside a hard, bony skull and layers of membranes and fluid provide extra padding. But even with all this natural protection, injuries still happen.
- Concussions stretch and injure nerves and blood vessels in your brain. They cause chemical changes that temporarily make the brain stop working like it should.
- The brain will automatically redirect all its energy to healing itself after an injury. It will send signals to the body to slow down and avoid activities. That's where concussion symptoms come from. They're the brain's way of saying to take it easy while it heals.



Persistent Post-Concussive Symptoms

- A **concussion** is a form of mild traumatic brain injury (mTBI) produced by a direct or indirect impulsive force to the head, neck, or body that transiently alters brain function through a complex, dynamic pathophysiological process (biochemical, metabolic, and microstructural changes).
- Clinical expression is heterogeneous (somatic, cognitive, emotional, sleep symptoms; focal neurological signs are uncommon).
- Loss of consciousness is neither necessary nor required for diagnosis, and there is currently no single diagnostic biomarker or imaging test that reliably *rules in/out* concussion in routine practice.

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Persistent Post-Concussive Symptoms

- Mild traumatic brain injuries (mTBIs) account for ~80% of traumatic brain injuries with an average annual incidence of 1,153 per 100,000 in Canada.
- Up to 31.3% of adults who sustain an mTBI will continue to experience symptoms 3 months post-injury, termed persisting post-concussive symptoms (PPCS).
- Common PPCS, including fatigue, sleep disturbances, difficulty concentrating irritability, and headache, can contribute to a significant reduction in health-related quality of life
- Many pre- and peri-injury factors have been associated with PPCS, including acute symptom burden, adolescence at time of injury, female sex (neck strength, smaller diameter axons and cerebral vasculature), history of psychiatric illness, history of prior concussion, and parental distress.

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Persistent Post-Concussive Symptoms

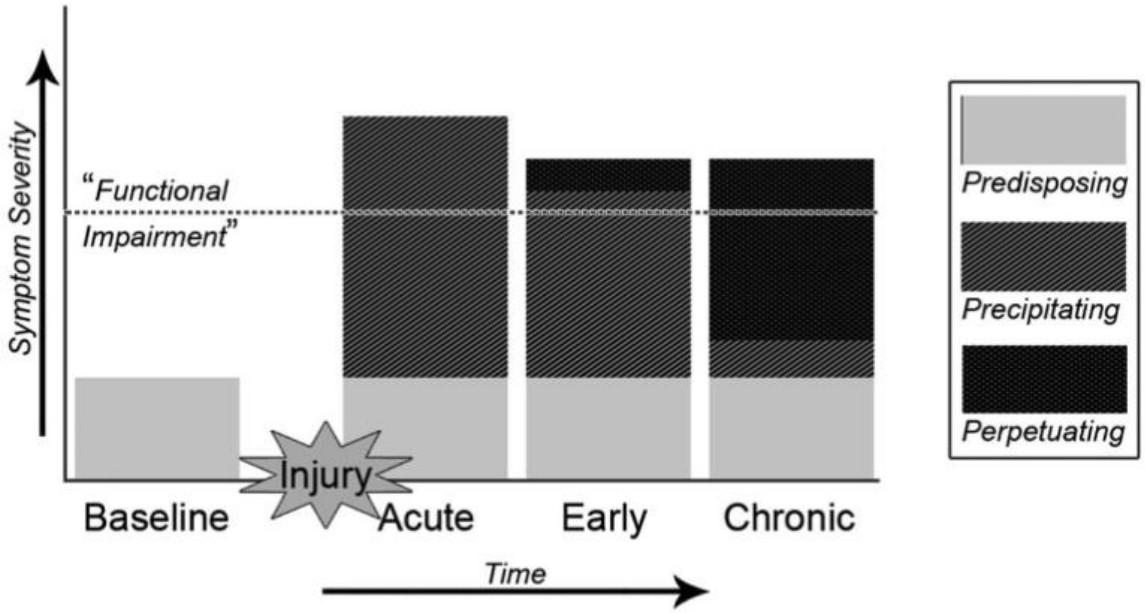

Figure 1. Predisposing, precipitating, and perpetuating factors collectively contribute to the expression of persistent post-concussive symptoms (PPCS). Predisposing factors (e.g., preexisting psychiatric conditions) are present prior to an injury. Precipitating factors (e.g., pain, acute emotional distress, somatic injury)—in the acute and early period following a mild traumatic brain injury (mTBI)—are frequently more than sufficient enough to produce clinically-significant distress. In the chronic period, however, precipitating factors may contribute relatively less to experienced impairment than perpetuating factors (e.g., sleep difficulties, ongoing litigation). While perpetuating factors are frequently targets for intervention, early identification of risk factors of PPCS may indicate earlier intervention and prevention of PPCS.

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Post-Concussive Symptoms

Physical impact:

- Sleep, sensory processing differences

Psychological impact:

- Anxiety, depression, emotional lability

Cognitive impact:

- Acutely, lower scores on measures of executive function, attention, and processing speed for more symptomatic patients, which tend to resolve over the first month post-injury.
- Lower verbal memory performance can persist up to 4 months post-injury. Research suggests that challenges relate to encoding and consolidation deficits, thought to be associated with reduced usage of efficient internally driven strategies (semantic clustering).

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Persistent Post-Concussive Symptoms

- No single test that documents the presence of PPCS.
- Often diagnosed or identified by primary physician based on reported symptoms.
- Course of recovery may be documented by psychological and/or neuropsychological testing, as warranted.
- Treatment is often tied to symptom presentation but often includes management of fatigue, with gradual return to cognitive and physical activity and psychological intervention (concussion-focused cognitive behavioral therapy).
- Current guidelines recommend minimizing absence from school, as prolonged rest lengthens recovery time.

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Long COVID

- Long COVID is defined as an infection-associated chronic condition that occurs after SARS-CoV-2 infection and is present for at least 3 months as a continuous, relapsing and remitting, or progressive disease state that affects one or more organ systems."
- Possible causes of long COVID reported in the literature include lingering SARS-CoV-2 in immune system tissues, effects of SARS-CoV-2 on microbiota, including viruses, and abnormal signaling in the brainstem and/or vagus nerve.

Long COVID

- The “Global Burden of Disease Long COVID Collaborators”, a worldwide collaboration, defined three main post-COVID condition symptoms:
  - (i) persistent fatigue with bodily pain (myalgia) or mood swings;
  - (ii) cognitive problems, often forgetfulness or concentration difficulties, commonly referred to as “brain fog;” and
  - (iii) ongoing respiratory problems (shortness of breath and persistent cough as the main symptoms)
- In data from children and youth, most commonly reported symptoms were trouble sleeping (17 %), followed by mental illnesses like anxiety, depression, and stress (16 %) and tiredness or fatigue (15 %).

Long COVID

- In a pooled study of over one million subjects, the prevalence of post-COVID condition was 0.9% after one year but was at as high as 15% for symptoms that were present at three months.
- Different factors were associated with a post-COVID condition, including age 20–49 years, female sex, and initial severity of illness (including hospitalization, intensive care unit admission, and mechanical ventilation).
- There is no single laboratory finding that is definitively diagnostic for confirming or ruling out the diagnosis of Long COVID.

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Long COVID

- Current management strategies focus on symptom-based supportive care.
- Critical considerations include energy conservation strategies and addressing comorbidities and modifiable risk factors.
- Additionally,
  - It is essential to validate the patient's experience and provide reassurance that their symptoms are being taken seriously because many patients have had their symptoms dismissed by loved ones and clinicians;
  - Recommendations should be delivered with humility because there are many persistent unknowns related to long COVID.

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Lyme Disease

- Lyme borreliosis, or Lyme disease, is an emerging tickborne disease, primarily caused by the bacterium *Borrelia burgdorferi* sensu stricto (ss) in North America and predominantly *Borrelia afzelii* or *Borrelia garinii* in Europe.

- Reported incidence has been increasing, and the clinical manifestations of Lyme borreliosis are diverse.

- Most people respond well to antibiotic therapy as recommended by treatment guidelines. However, some report post-infectious signs or symptoms, despite recommended antibiotic therapy and putative clearance of infection. These symptoms, which include fatigue, pain, and neurocognitive symptoms, may be persistent and highly disabling.

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Lyme Disease

- The reported prevalence of persistent symptoms, such as musculoskeletal pain, fatigue, and cognitive complaints varies considerably, between 0% and 48%.
- In a prospective study, 36% patients self-reported ongoing symptoms at six months after treatment of erythema migrans. In 11%, subjective symptoms were associated with functional disability, while none had microbiological or clinical evidence for ongoing infection.
- Another prospective study among 128 US patients with culture confirmed erythema migrans followed for >10 years found a 10.9% incidence of self-reported ongoing symptoms, predominantly memory or concentration difficulties, fatigue, and joint pain.

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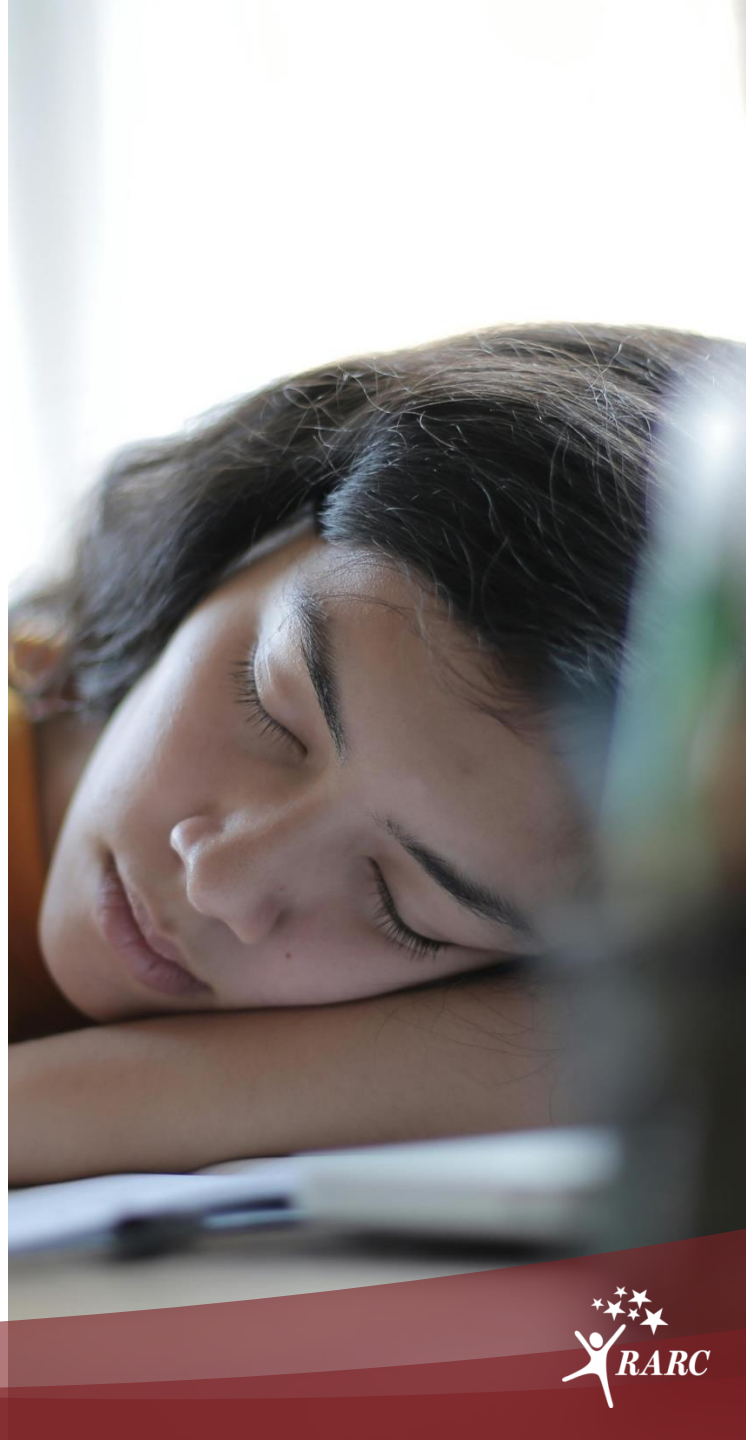
Lyme Disease

- While many patients report cognitive problems such as memory loss, word-finding difficulties, and lack of concentration, subjective memory complaints were not associated with impaired objective test performances in a prospective study on 279 patients with persistent symptoms attributed to Lyme borreliosis.
- Only 3% of patients included in that study were classified as having clinically impaired cognitive performance compared with normative data.
- It has been hypothesized that chronic pain and fatigue syndromes may be part of a central sensitization syndrome that follows non-infectious or infectious diseases, perhaps explaining experiences of cognitive changes.

Myalgic Encephalomyelitis/ Chronic Fatigue Syndrome

- Myalgic Encephalomyelitis or Chronic Fatigue Syndrome (ME/CFS) is a complex disorder characterized by physical exertion intolerance, fatigue, cognitive problems, and symptoms derived from autonomic involvement.
- The diagnosis of ME/CFS is based on clinical criteria.
- The cardinal criteria imply a reduction of at least 50% in the physical/cognitive activity compared to the baseline state.
- There is no consensus regarding the etiology and pathogenesis of this condition, although the relationship with the immune system, particularly with humoral autoimmunity, is gaining acceptance.



Myalgic Encephalomyelitis/Chronic Fatigue Syndrome

- The most common precipitating factors in this pathology are infectious diseases, stressful life events or exposure to toxins.
- The prevalence of ME/CFS is unknown, although a 0.5-2.6% is established.
- The most prevalent cognitive deficits seem to be lower processing speed, worse verbal attention, and lower sustained attention, with some studies suggesting their presence in 40-50% of patients.

Neuropsychological Perspective on “Brain Fog”

What is “Brain Fog”?

- A **subjective** experience of cognitive dysfunction, commonly reported in post-injury, post-infectious and chronic inflammatory conditions.
- Not a medical diagnosis but a **descriptive term** used by patients and clinicians.
- Involves **disruptions in attention, memory, executive function, and processing speed**.

Neuropsychological Perspective on "Brain Fog"

- Whether due to inflammation, recovery, and/or sleep disturbance, often co-occurs with fatigue.
- Fatigue impacts working memory, sustained attention, and task-switching abilities.
- Mental energy is limited, resulting in a reduced capacity to engage in cognitively demanding tasks. Patients often report being unable to "push through" mentally — cognitive performance degrades rapidly with effort or duration.
- Post-exertional malaise (PEM): Cognitive fatigue can worsen hours or days after mental exertion, especially in ME/CFS, PCSS, and Long COVID.

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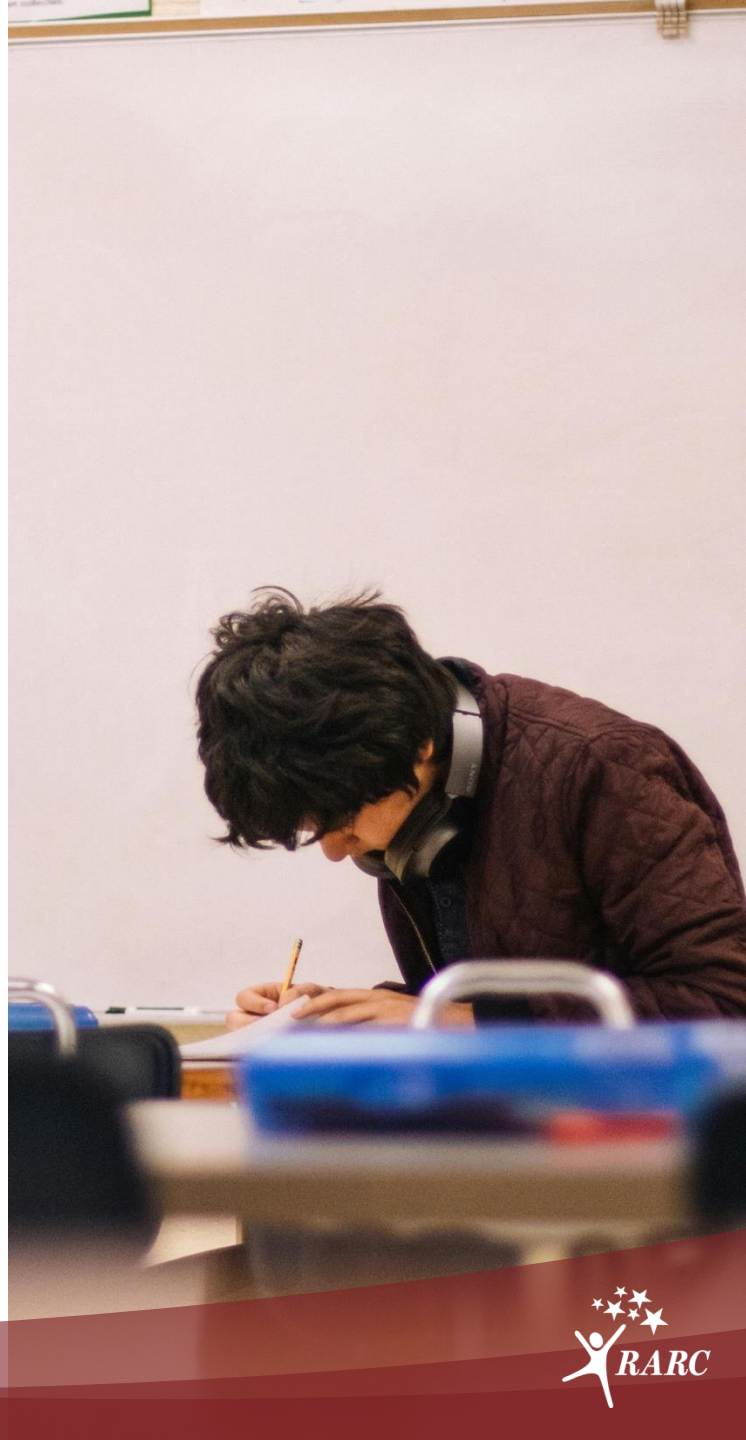
Common Accessibility Challenges

- “Invisible disabilities.”
- Multiple manifestations of the conditions, including physical, psychological, and cognitive features that overlap.
- Symptom severity may wax and wane over time, depending on the course of recovery and environmental demands.
- No objective measures to document the presence and severity of the condition, though neuropsychological testing may be helpful.

Accommodations & Support Strategies

- Depending on the student's symptom presentation, the following accommodations may be appropriate:
  - Reduced course load as a proactive strategy
  - Breaks during assessments and classes
  - Flexible deadlines, attendance, and participation policies
  - Audio recording, live captioning, screen readers to reduce cognitive effort
  - Addressing visual and auditory stimuli (allowing sunglasses/earplugs, lamps)



Accommodations & Support Strategies

Learning Strategies & Supports

- Energy conservation and cognitive pacing (e.g., Pomodoro + cognitive rest)
- Assistive tech: Text-to-speech, mind-mapping, voice-to-text
- Coaching/academic mentoring models
- Cognitive-behavioral tools for pacing and frustration tolerance

Case Study

- Alex (they/them), age 21, second year Kinesiology.
- Sustained a concussion in an intramural soccer game 3 months ago
- Seen by a family physician and later a sports medicine clinic

Symptoms (persistent):

- Cognitive fatigue after 30–45 minutes of mental effort
- Difficulty with concentration and reading retention
- Headaches triggered by screen use
- Sleep disruptions and light sensitivity
- Low mood, anxiety about academic performance

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Case Study

Academic Impact:

- Struggles to complete readings and assignments on time
- Requires significantly more time to write papers and study
- Can no longer pull “all-nighters” or cram effectively
- Often forgets what they’ve read unless they take extensive notes
- Has started skipping morning classes due to fatigue and sleep issues

Case Study

Documentation:

- Physician note confirms post-concussive symptoms
- Referred for a brief neuropsych screening by a rehabilitation psychologist
- **Results:**
  - Average general cognitive ability
  - Mild attention and processing speed inefficiencies
  - Significant report of fatigue-related executive dysfunction

Case Study

Recommended Accommodations:

- Reduced course load for upcoming term.
- Breaks during class and exams (every 30–45 mins).
- Exploring options for remote attendance or afternoon classes.
- Ability to record lectures.
- Use of available text-to-speech apps.

Learning strategies:

- Cognitive pacing with Pomodoro technique
- Chunking study sessions with rest breaks
- Weekly planning with academic coach

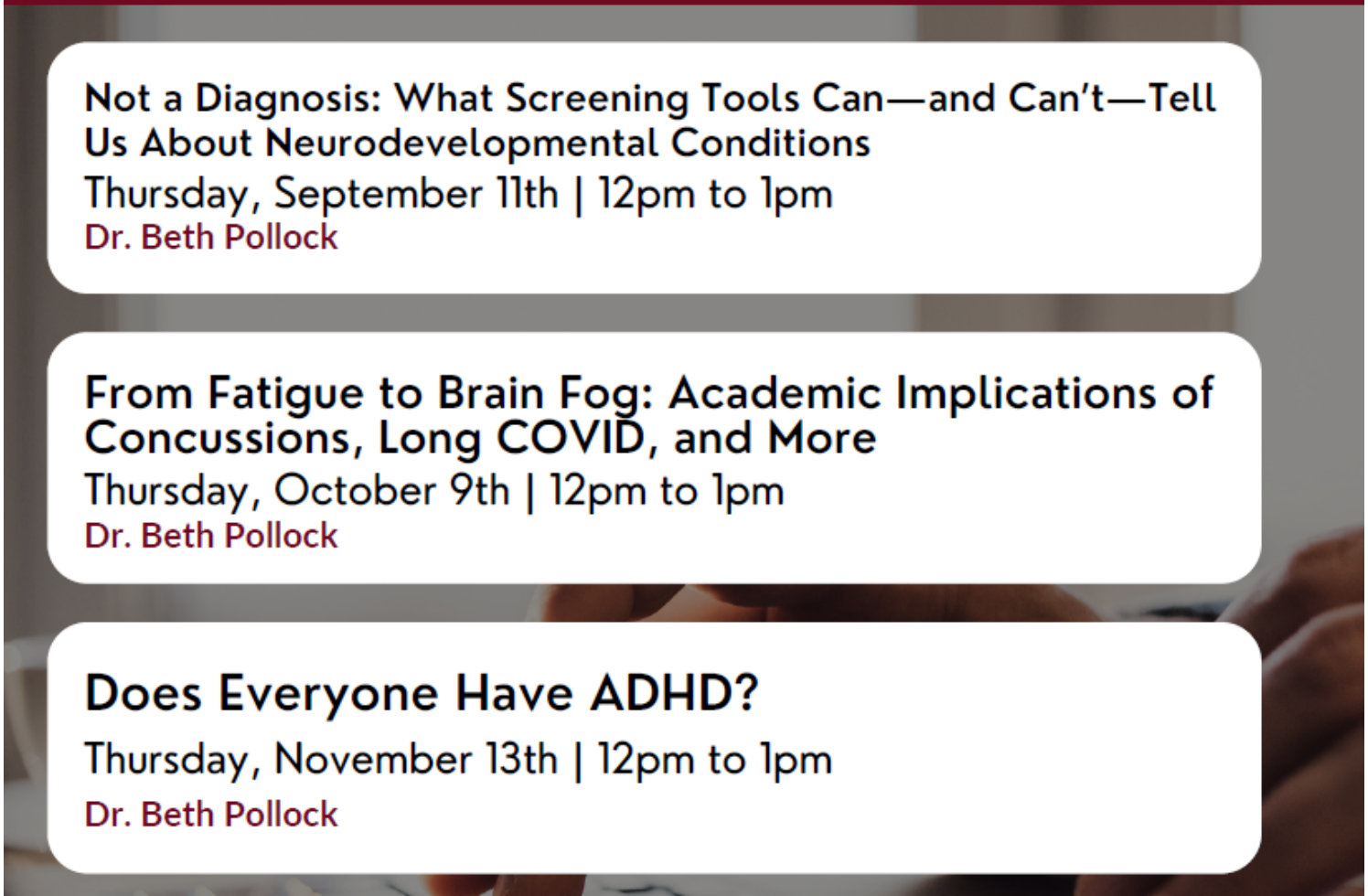
Questions?

Regional Assessment Resource Centre:

Lunch and Learn Series

Fall 2025

Free to join. No registration required.



Not a Diagnosis: What Screening Tools Can—and Can't—Tell Us About Neurodevelopmental Conditions

Thursday, September 11th | 12pm to 1pm

Dr. Beth Pollock

From Fatigue to Brain Fog: Academic Implications of Concussions, Long COVID, and More

Thursday, October 9th | 12pm to 1pm

Dr. Beth Pollock

Does Everyone Have ADHD?

Thursday, November 13th | 12pm to 1pm

Dr. Beth Pollock

Thank You!

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