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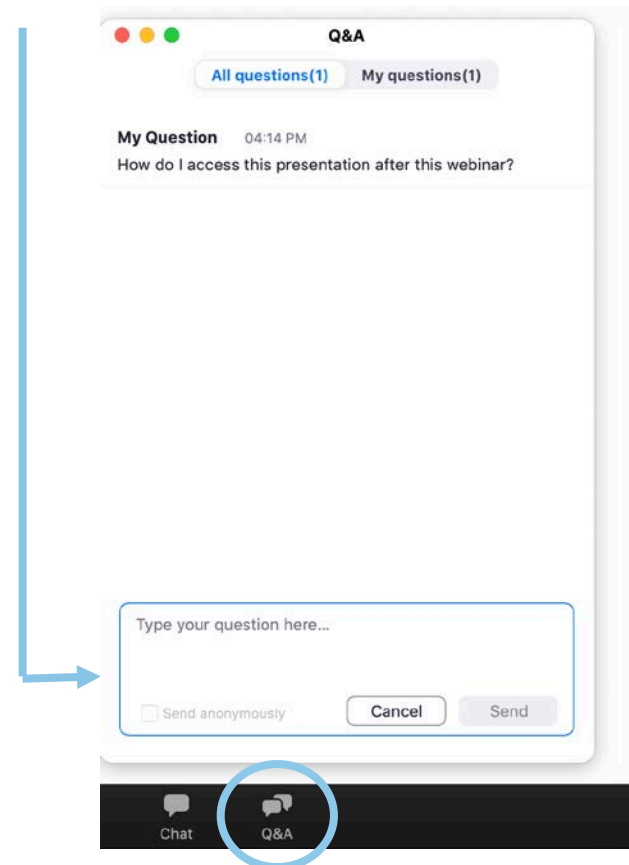
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Concussions/ Mild TBIs: Early Intervention to Achieve the Best Outcomes



Today's Speakers



Elizabeth Sandel, MD

Medical Director

Paradigm Catastrophic Care Management

- ▶ Board certified physician in PM&R and Brain Injury Medicine
- ▶ Author of *Shaken Brain: The Science, Care, and Treatment of Concussion* (Harvard University Press, February 2020)
- ▶ Holds an academic appointment at the University of California/Davis, School of Medicine
- ▶ Championed expansion of brain injury and other rehabilitation programs in health systems in PA, NJ, and CA for over 35+ years



Deborah M. Benson, PhD, ABPP

Associate Vice President, Clinical Services

Paradigm Catastrophic Care Management

- ▶ Board certified Rehabilitation Psychologist; PhD in clinical neuropsychology
- ▶ Co-editor of *Acquired Brain Injury: An Integrative Neuro-Rehabilitation Approach* (Springer, 2007)
- ▶ Background in neuroscience research, undergraduate/graduate teaching, clinical supervision, and clinical practice with patients and families
- ▶ Supervises/supports Paradigm teams to develop clinical management plans that ensure positive outcomes for patients with catastrophic injuries

Objectives

At the conclusion of the presentation, participants should be able to:

- ▶ Define the **terms**: concussion, mild traumatic brain injury (mTBI), and post-concussion syndrome (PCS)
- ▶ Review the **epidemiology** of these disorders, including major causes, symptoms, and prognoses
- ▶ Identify **conditions** that often accompany mTBI and make diagnosis and treatment challenging
- ▶ Describe **care management strategies** that are most likely to lead to the best outcomes for patients with mTBI

Define the Terms

**Mild Brain Injury, Concussion, and
Post-Concussion Syndrome**

Concussion, Mild Traumatic Brain Injury, and PCS

These terms are not well-defined, causing confusion among patients, families, and providers

- ▶ **Concussion**

- ▶ Most experts would agree that a concussion is a **mild traumatic brain injury (mTBI)**

- ▶ **Post-concussion syndrome (PCS)**

- ▶ A set of symptoms after a concussion/mTBI that fail to resolve quickly (usually defined as within 2-4 weeks)

- ▶ **Repeated concussions and second impact syndrome**

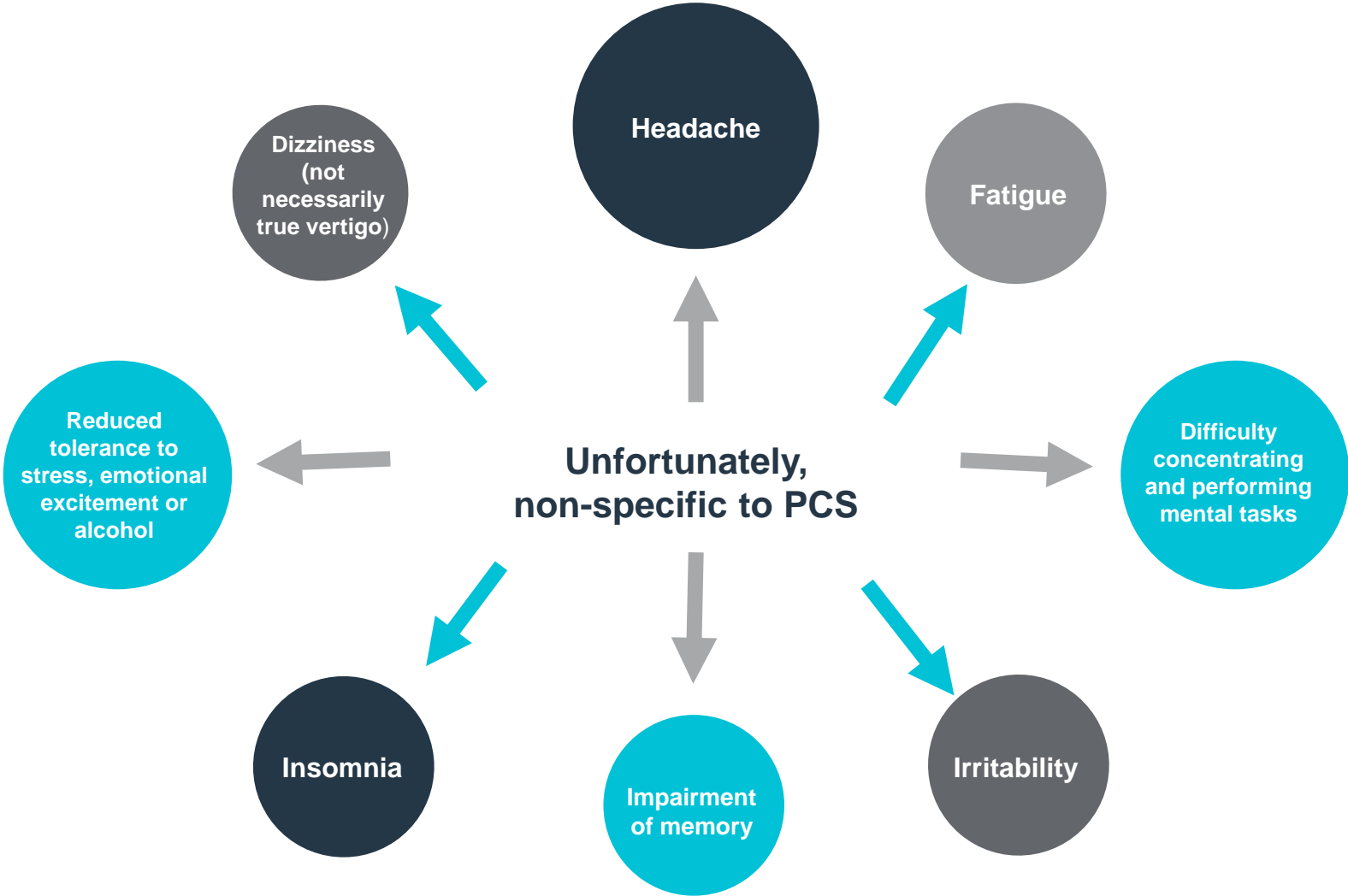
Mild Brain Injury Has Certain Characteristics

CDC and American Congress of Rehab Medicine

Criteria	Mild	Moderate	Severe
Neuroimaging (CT, MRI)	Normal* (*except 'complicated' mTBI)	Normal or abnormal	Normal or abnormal
Loss of consciousness	<30 minutes	30 minutes to 24 hours	>24 hours
Post traumatic amnesia	0-1 day	>1 and < 7 days	> 7 days
Glasgow Coma Scale (best available score in 24 hours)	13-15	9-12	3-8

Sources: Brasure, M., Lamberty, G.J., Sayer, N.A., et al. Multidisciplinary postacute rehabilitation for moderate to severe traumatic brain injury in adults. *Agency for Healthcare ReSource: search and Quality (AHRQ) Comparative Effectiveness Reviews*, 2012; 72, ES1–ES20. ACRM; Mild Traumatic Brain Injury Committee. Definition of mild traumatic brain injury. *J Head Trauma Rehabil* 1993;8:86-7.

ICD-10: Post-Concussion Syndrome Definition



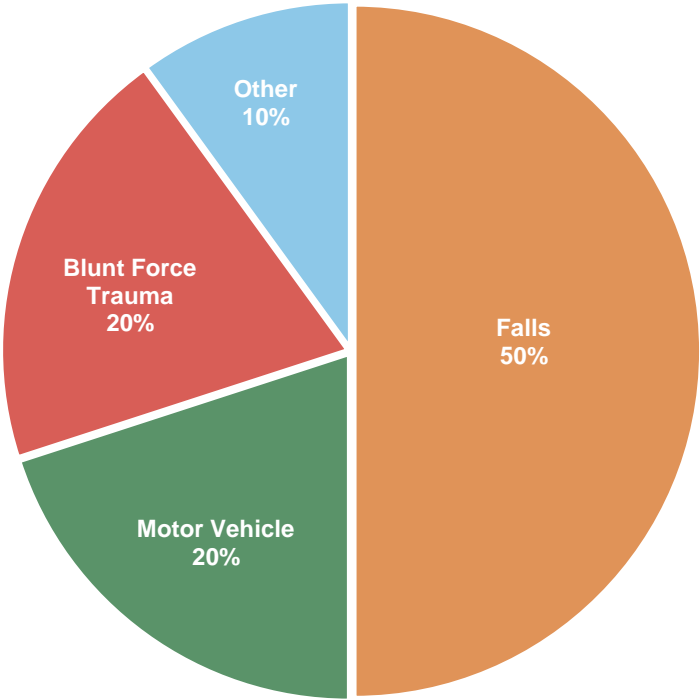
Source: <http://www.icd10data.com/>

Epidemiology and Outcomes

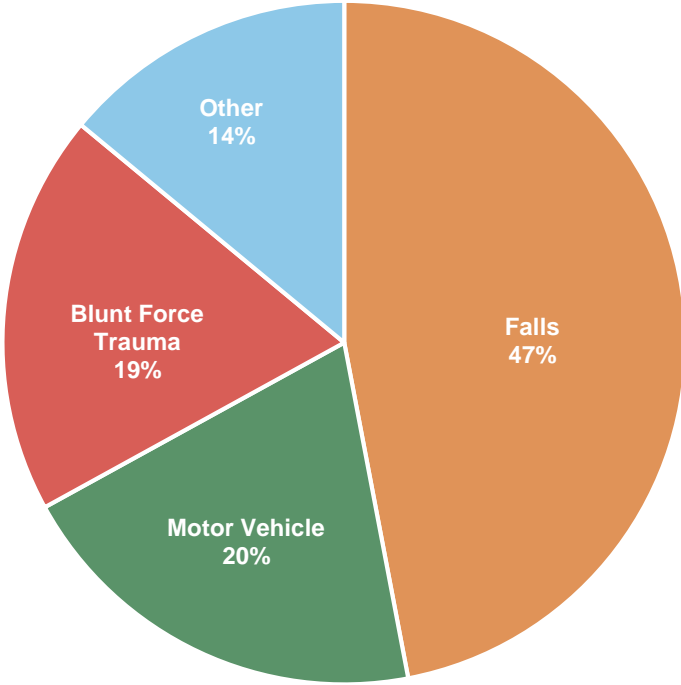
Occupational TBIs (All Severities)

Mechanism of injury

Benchmark



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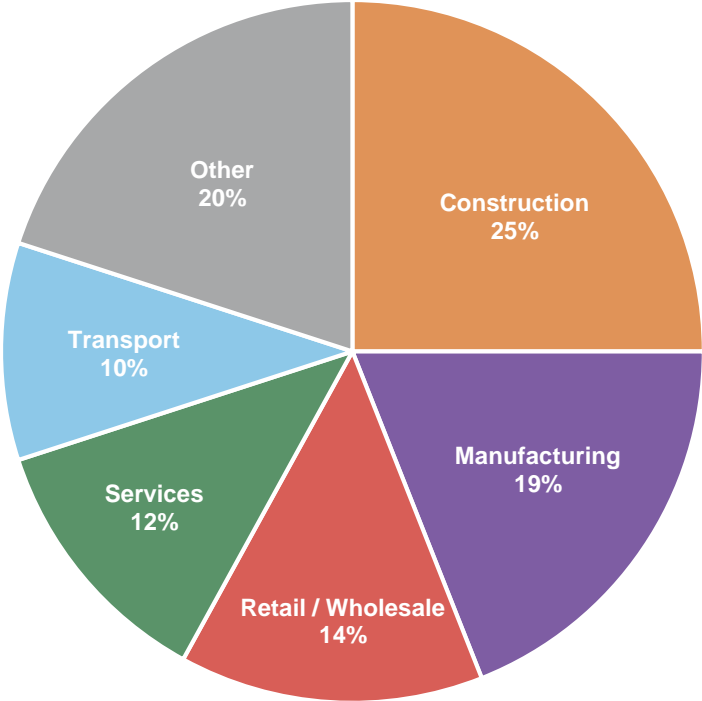


Source: Wrona RM. The use of state workers' compensation administrative data to identify injury scenarios and quantify costs of work-related traumatic brain injuries. J Safety Res 2006;37:75-81.

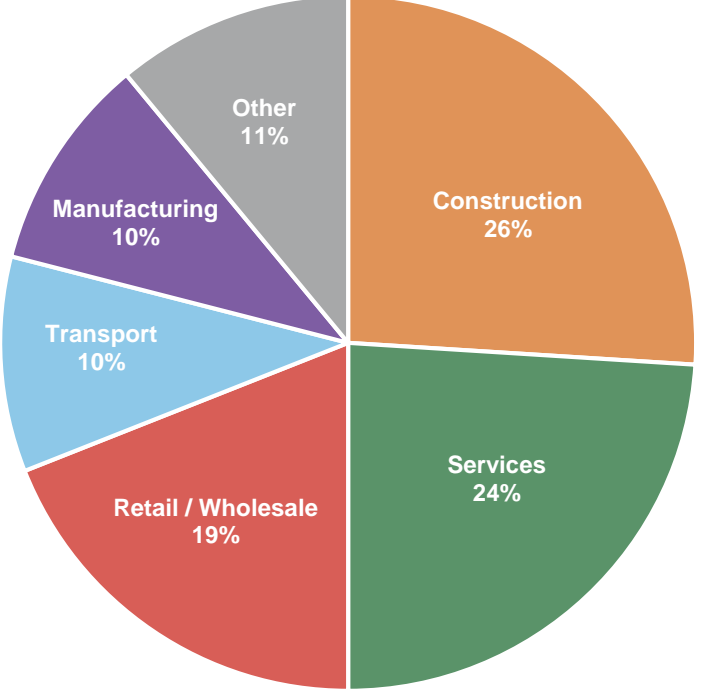
Occupational TBIs (All Severities)

Industry distribution

Benchmark



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Source: American Journal of Industrial Medicine 58:353-377 (2015); *Epidemiology of Work-related Traumatic Brain Injury: A Systematic Review*; Vicky C. Chang, MPH, Niki Guerriero, Bsc (hon), and Angela Colantonio PhD.

Work-Related Concussions

- ▶ **SFM Report on Concussions (2016)**

- ▶ **78%** of concussion claims **lost time from work**, compared to 15% of non-concussion claims

- ▶ **Minnesota COMPACT Newsletter (June/July 2019)**

- ▶ Escalation in number of indemnity claims over time
 - ▶ **10x higher in 2018** compared to 2006
- ▶ More **common in women** (55% vs 37% for other injuries)
- ▶ **14%** due to slips/falls
- ▶ **13%** due to workplace violence
- ▶ **13%** due to being struck by object or equipment
- ▶ **Health care** industry had highest percentage (19%), followed by educational services and retail trade
- ▶ **Transport**, material moving occupations had highest percentage (14%), followed by education/training/library, sales and health care support

Recovery Following Post-Concussive Syndrome

- ▶ **US TRACK TBI Study (McMahon)—375 subjects**
 - ▶ **80%** had at least **one PCS symptom** at 6 and at 12 months
- ▶ **Canadian Study (Hiploylee)—285 subjects**
 - ▶ On average, subjects had **eight PCS symptoms that lasted 7 months**
 - ▶ Only **27%** fully recovered
 - ▶ About **67%** of those who recovered did so within the first year
 - ▶ No patients who had symptoms at **three years** recovered
- ▶ **New Zealand Studies (Theadom)—341 subjects; 245 subjects**
 - ▶ **50%** had continuing symptoms at one year
 - ▶ **17%** had exited the workforce and **15%** had reduced hours at 4 years
 - ▶ **“taking longer to think”** at one year predicted work loss at 4 years
 - ▶ Being **female** or from a **non-white** ethnic group: poorer outcomes

Sources: McMahon, P., A. Hricik, J. K. Yue, et al. 2014. “Symptomatology and Functional Outcome in Mild Traumatic Brain Injury: Results from the Prospective TRACK-TBI Study.” *Journal of Neurotrauma* 31:26–33.

Hiploylee, C., P. A. Dufort, H. S. Davis, et al. 2017. “Longitudinal Study of Postconcussive Syndrome: Not Everyone Recovers.” *Journal of Neurotrauma* 34:1511–1523.

Tator, C. H., H. S. Davis, P. A. Dufort, et al. 2016. “Postconcussion Syndrome: Demographics and Predictors in 221 Patients.” *Journal of Neurosurgery* 125(5):1206–1216.

Theadom, A., V. Parag, T. Dowell, et al. 2014. “Persistent Problems 1 Year after Mild Traumatic Brain Injury: A Longitudinal Population Study in New Zealand.” *British Journal of General Practice* 66(642):e16–e23.

Theadom, A., N. Starkey, S. Barker-Collo, et al. 2018. “Population-Based Cohort Study of the Impacts of Mild Traumatic Brain Injury in Adults Four Years Post-Injury.” *PLoS One* 13(1):e0191655.

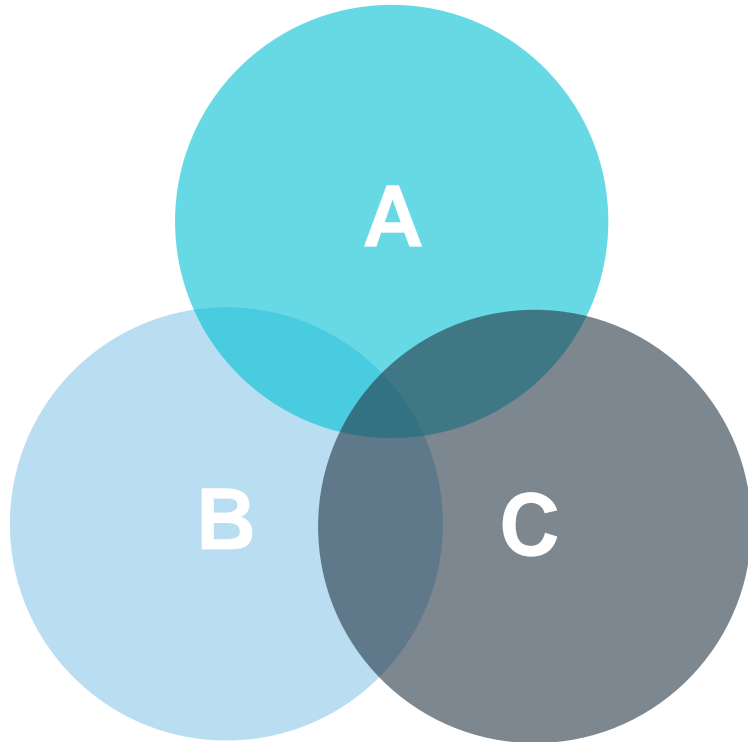
Factors Associated with Poorer Outcomes

- ▶ Female
- ▶ Teenage or older
- ▶ “Complicated mTBIs”—CT or MRI findings
- ▶ More severe acute symptoms
- ▶ History of prior brain injury, including concussion
- ▶ Pre-existing conditions
 - ▷ Pain (including headaches)
 - ▷ Substance abuse
 - ▷ Psychological conditions (depression, anxiety, PTSD)
 - ▷ ADHD, developmental disabilities
- ▶ Lower educational level
- ▶ Litigation



Source: Iverson, G. L., A. J. Gardner, D. P. Terry, et al. 2017. “Predictors of Clinical Recovery from Concussion: A Systematic Review.” *British Journal of Sports Medicine* 51 (12): 941–48. Ponsford, J., P. Cameron, M. Fitzgerald, et al. 2012. “Predictors of Postconcussive Symptoms 3 Months after Mild Traumatic Brain Injury.” *Neuropsychology* 26(3):304–313.

Neuroimaging and Mild TBI



**Of mTBI patients scanned in EDs,
3-10% have abnormal CTs**

**25% of patients admitted to EDs with
mTBI diagnosis did not get a CT
scan, but when scanned, 16-21% had
abnormal CTs**

MRI—10-57% positivity in mTBI

Source: National Center for Health Statistics; Iverson, Brain Injury, 2006; Bazarian, Academy of Emergency Medicine, 2006

Diagnostic Approaches and Challenges

Initial Medical Evaluation

Current practice approaches are variable

- ▶ **Emergency Departments:** evaluation and discharge only, unless multiple injuries or medical conditions that require hospitalization; many do not get education or follow-up
- ▶ **Primary Care Physicians:** evaluation, reassurance, referral for persistent symptoms to a physiatrist, neurologist, or mental health provider
- ▶ **Concussion Clinics:** vary in terms of team members, clinical leadership, treatment modalities (may include those without an evidence basis)
- ▶ **PM&R/BIM Model:** PM&R and neuropsychology in leading roles, and other treatment disciplines, such as ST, PT, and OT as required in individualized treatment plans

PM&R/BIM Specialist Evaluation

If symptoms do NOT resolve within two to four weeks, consider referral to BIM specialist

- ▶ **History:** patient description of injury and symptoms; medical record documentation; pre-injury diagnoses/conditions; work history; litigation
- ▶ **Psychological screening:** for acute stress reaction (initial 30 days) or PTSD diagnosis (after 30 days); depression and anxiety symptoms
- ▶ **Head and neck exam:** musculoskeletal and neurologic causes for pain and headache
- ▶ **Dix-Hallpike test:** r/o benign paroxysmal positional vertigo (BPPV)
- ▶ **Cognition:** Montreal Cognitive Assessment or other screening tool
- ▶ **Balance:** Romberg test
- ▶ **Ocular (visual) function:** visual scanning
- ▶ **Other specialist referrals/evaluations**

Post-Concussion Symptoms (Beyond ICD-10)

Cognitive	Physical	Psychological
▶ Attention/concentration	▶ Pain/headache	▶ Irritability
▶ Memory	▶ Dizziness; vertigo	▶ Anxiety
▶ Executive function	▶ Disequilibrium	▶ Depression
▶ Information processing	▶ Balance deficit	▶ Mood instability
▶ Initiation	▶ Nausea/vomiting	▶ Lability
▶ Goal direction	▶ Hyperacusis	▶ Fear of “going crazy”
▶ Communication	▶ Tinnitus	▶ Frustration
▶ Word-finding	▶ Photophobia	▶ Decreased libido
▶ Metacognition	▶ Diplopia	▶ Suicidal ideation or behaviors
	▶ Focusing problems	▶ Feelings of helplessness or being overwhelmed
	▶ Anosmia or dysosmia	
	▶ Sleep disturbance	
	▶ Fatigue	
	▶ Poor coordination	

Source: Ref: Cicerone K, Kalmar K. Persistent post-concussive syndrome: Structure of subjective complaints after mild traumatic brain injury. Journal of Head Trauma Rehabilitation 1995;10:1-17.

Neurocognitive Assessment Tests

Current practice approaches

Screening tools:

- ▶ ImPACT
- ▶ SCAT
- ▶ Military Acute Concussion Evaluation (MACE)
- ▶ Montreal Cognitive Assessment Test (MoCA)

For patients presenting with symptoms potentially related to concussion/mTBI, these tools are **NOT recommended** for routine diagnosis and care

-Department of Defense clinical practice recommendation

Comprehensive Neuropsychological Evaluation

Practice considerations

Recommended if cognitive or associated symptoms *persist longer than 30 days*:

- ▶ **Comprehensive history** (record review, interviews, timeline, functional impact)
- ▶ Formal assessment of **cognitive function** across variety of domains
- ▶ Assessment of **personality, emotional functioning**
- ▶ **Symptom validity** testing
- ▶ **Analysis/interpretation**
 - ▶ **Potential impact** of pre-morbid conditions, psychological, physical vs. neurological factors
 - ▶ **Causality**

Source: Refs: VA/DoD Clinical Practice Guidelines: Management of Concussion-mild Traumatic Brain Injury (mTBI) (2016); Ontario Neurotrauma Foundation: GUIDELINE FOR CONCUSSION/MILD TRAUMATIC BRAIN INJURY & PROLONGED SYMPTOMS, 3RD ED.

Complexities in Diagnosis

There may be various contributors to symptom presentation



Cumulative Stressor concept:

- ▶ Various/multiple setbacks due to injury (e.g., cognitive, physical, psychological, psychosocial, financial, vocational), interacting with personality and premorbid health factors

*mTBI is as much about **what the patient brings to the injury**,
as it is **what the injury brings to the patient**.*

Source: Ref: Ruff, R. M. (2005). Two decades of advances in understanding of mild traumatic brain injury. *Journal of Head Trauma Rehabilitation*, 20, 5–18.

Symptom Magnification/Suboptimal Effort

Is it malingering?

Intentional production of false or greatly exaggerated symptoms for the purpose of secondary gain

Other contributory factors:

- ▶ Misattribution: real symptoms, other causes
 - ▷ Attention deficit
 - ▷ Mild cognitive impairment
- ▶ Co-morbid conditions
 - ▷ Pain
 - ▷ Anxiety/depression
 - ▷ Sleep disorder
- ▶ Expectancy bias/stereotype threat
- ▶ Medico-legal
 - ▷ Stress
 - ▷ Anger/revenge/trust issues

Take home messages:

- ▶ Consider variety of issues that may be driving unusual symptom presentation
- ▶ Intervene to educate, treat, and address these contributory factors
- ▶ Include family to ensure they are adopting a positively supportive role



Source: Jonathan M. Silver; Effort, exaggeration and malingering after concussion; <http://jnnp.bmj.com/> on 11/2/17 – published by group.bmj.com .

Care Management Strategies

Systematic, Biopsychosocial Approach

Clarify the Diagnosis

- ▶ Confirm a concussion/mTBI has occurred, proximity of symptoms to accident, and symptom progression/persistence
- ▶ Document objective cognitive deficits
- ▶ Clarify the nature of other symptoms (physical, emotional)
- ▶ Identify other contributing factors
- ▶ Clarify the nature of psychosocial factors in recovery

Facilitate Evidence-Based Treatment

- ▶ Provide graded therapies toward measurable goals
- ▶ Choose providers with specific expertise; avoid providers with “dismissive” approach, or “chronicity bias”
- ▶ Promote self-management

Manage Psychosocial Factors

- ▶ Provide education and reassurance regarding recovery
- ▶ Implement psychosocial support and resources

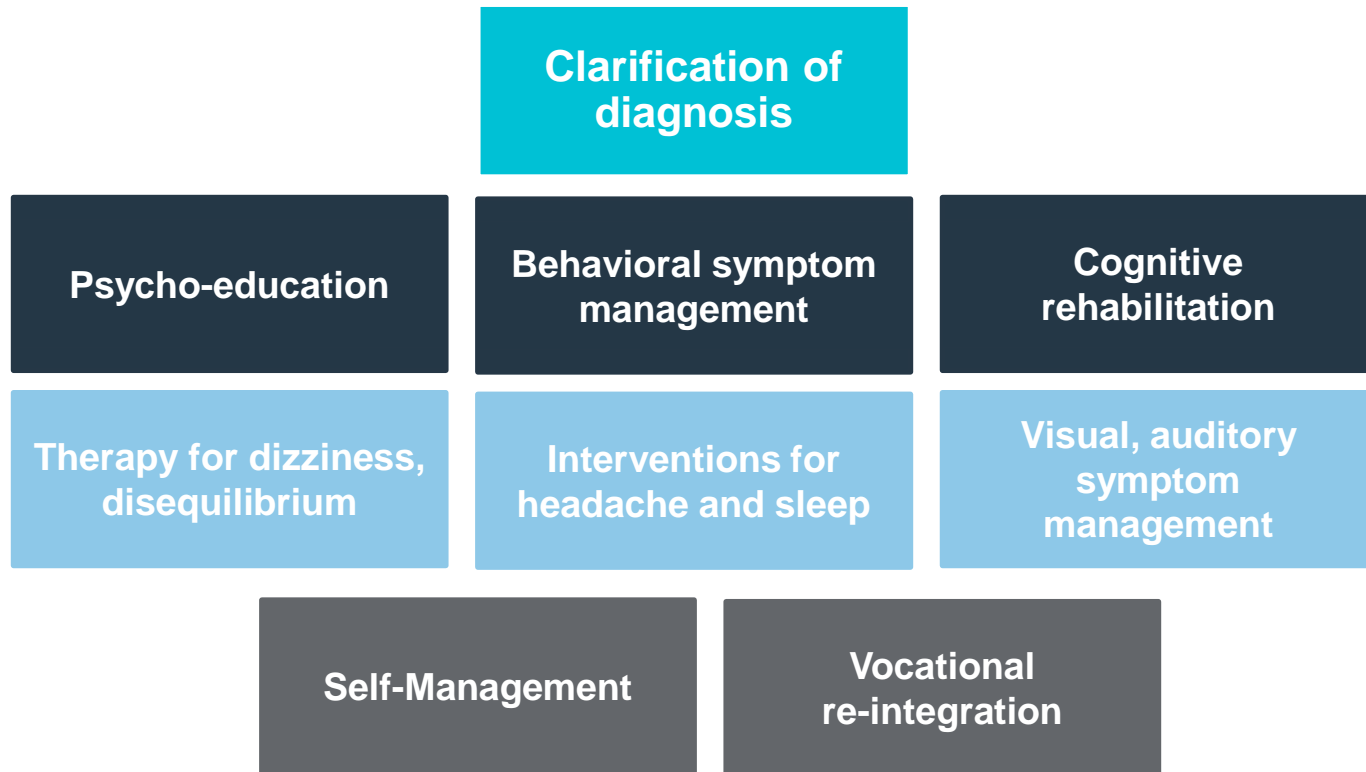
Vocational Reintegration

- ▶ Accommodations and gradual approach, as indicated, to promote success

Care Management of Post-Concussion Syndrome

Recommended practice consideration

A multidisciplinary, multifaceted, individualized care approach might include:



Evidence-Based Treatment Guidelines

Ontario Neurotrauma Foundation

- ▶ Diagnosis and assessment
- ▶ Initial management
- ▶ Post-traumatic headache
- ▶ Sleep-wake disturbances
- ▶ Mental health disorders
- ▶ Cognitive difficulties
- ▶ Balance, dizziness, and vision dysfunction
- ▶ Fatigue
- ▶ Return to activity, work or school

Additional materials

- ▶ Evaluation tools
- ▶ Questionnaires
- ▶ Advice cards
- ▶ Treatment strategies

Source: <https://onf.org/3rd-edition-guidelines-for-concussion-mild-traumatic-brain-injury-and-persistent-symptoms/>

Evidence-Based Treatment Guidelines

Veterans Affairs/ Department of Defense

Same symptom categories as Ontario Guidelines, and:

- ▶ Co-existing conditions
- ▶ Persistent pain
- ▶ Hearing difficulties
- ▶ Olfactory deficits
- ▶ Nausea, changes in appetite
- ▶ Numbness

Additional materials

Algorithms for evaluation and treatment

Links to other sites-co-existing conditions:

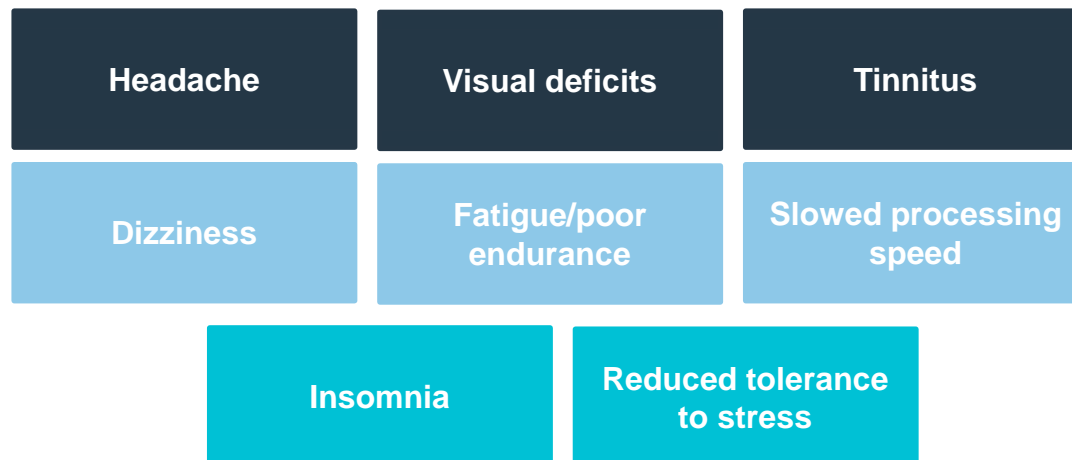
- ▶ PTSD
- ▶ Major depression
- ▶ Suicide
- ▶ Substance use disorder

Source: <https://www.healthquality.va.gov/guidelines/Rehab/mtbi/>

Paradigm Case Study

History, Injury, and Early Symptom Presentation

- ▶ 56-year-old man injured as result of a fall from ladder
- ▶ LOC for approximately 20 minutes
- ▶ Initial GCS=14
- ▶ CT showed small subarachnoid hemorrhage
- ▶ Three days in hospital, then transferred to acute rehabilitation unit for one week prior to discharge home
- ▶ Prior history of depression, anxiety, migraine, hypertension, arthritis, obesity



Treatment/Management Challenges

- ▶ **Late referral**—three months post-injury, persistent symptoms
- ▶ Providers **already established** when referral received
- ▶ Lived in **remote area** without access to specialized/trained providers
- ▶ **Lack of communication**/integration of care between treating providers
- ▶ **Pre-existing** medical/health/psychological factors impacting recovery
- ▶ IW extremely focused on **somatic symptoms**
- ▶ Spouse **enabling**, fostering dependent role
- ▶ Persistent **psychological** support needs
- ▶ Initial **failed vocational** reintegration attempt



Paradigm Interventions

Provider Vetting/Identification

- ▶ Engaged brain injury medicine board certified PM&R for overall management
- ▶ Neuropsychological evaluation (board-certified provider)
- ▶ Neuro-optometry
- ▶ Headache specialist
- ▶ Vestibular PT specialist
- ▶ Cognitive rehabilitation (vetted for evidence-based practice approach)
- ▶ Counseling (vetted for expertise, evidence-based practice approach)

Collaborative Engagement

- ▶ Established trusting relationship with IW and family
- ▶ Family education, support and training
- ▶ Communication with providers to monitor, ensure functional, goal-directed and integrated/holistic approach
- ▶ Distinction between claim-related and unrelated treatment needs
- ▶ Employer, provider flexibility in approach to work release

Positive Outcome

- ▶ **No home-based** care needed
- ▶ **Completed restorative rehabilitation** within 9 months post-injury
- ▶ **Symptoms largely resolved**, or self-managed with strategies/devices
- ▶ Achieved **complete functional independence** in home and community settings
- ▶ Resumed pre-injury family roles, positive relationships
- ▶ **Discharged from care** of all medical specialists with exception of PMR
- ▶ **Released to return to work** with restrictions (physical, psychological)
- ▶ Psychological counseling transitioned to health insurance



Summary

Keys to success with concussion/mTBI

Early Identification, Comprehensive Evaluation, and Treatment is Key

- ▶ **Systematic and progressive levels of evaluation** to establish diagnosis and conditions
- ▶ **Consideration of other factors** that may be impacting symptom presentation
- ▶ Referral to **physiatrist/brain injury medicine specialist** if symptoms persist longer than two to four weeks.
- ▶ Referral to **neuropsychologist for evaluation** at 30 days if symptoms persist
- ▶ Develop **comprehensive treatment plan**, primarily non-pharmacologic, with ongoing care and follow-up with experts as needed until symptoms resolve
- ▶ **Educate and reassure IW and family early in the course!**

Systematic, Biopsychosocial Approach

Clarify the diagnosis

Facilitate evidence-based treatment

Manage psychosocial factors

Vocational reintegration

CE Credits and Q&A

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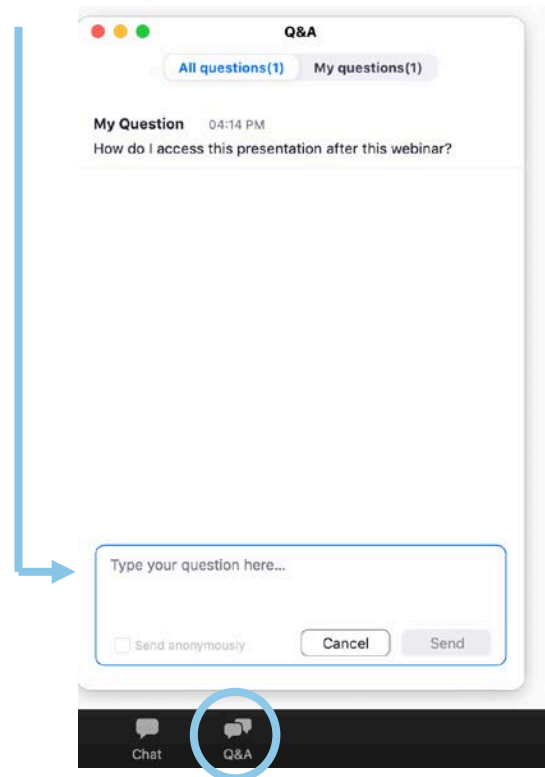
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Q&A

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Answers to Poll Questions

1. A concussion is not as serious as a mild traumatic brain injury.

True or **False**

2. Which of the following characteristics is NOT associated with poor outcomes following mTBI?

- a. Female gender
- b. **College education**
- c. History of depression
- d. History of prior concussion

3. Which of the following is NOT true of mTBI:

- a. There may be no loss of consciousness
- b. There may be no visible changes on neuroimaging
- c. **Length of post-traumatic amnesia is greater than 1 day**
- d. Best GCS score within 24 hours is greater than or equal to 13

4. Which of the following is NOT a common symptom of Post-Concussive Syndrome?

- a. Dizziness
- b. **Seizures**
- c. Insomnia
- d. Fatigue

5. A systematic, biopsychosocial approach to management of mTBI includes all of the following EXCEPT:

- a. Clarifying diagnoses
- b. Facilitating evidence-based treatment
- c. Managing psychosocial factors
- d. **Initiating medication for cognitive deficits**

Thank you

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