



Mild Traumatic Brain Injury (mTBI): Silent, Subtle and Treatable

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Objectives

By the end of this presentation, you will be able to:

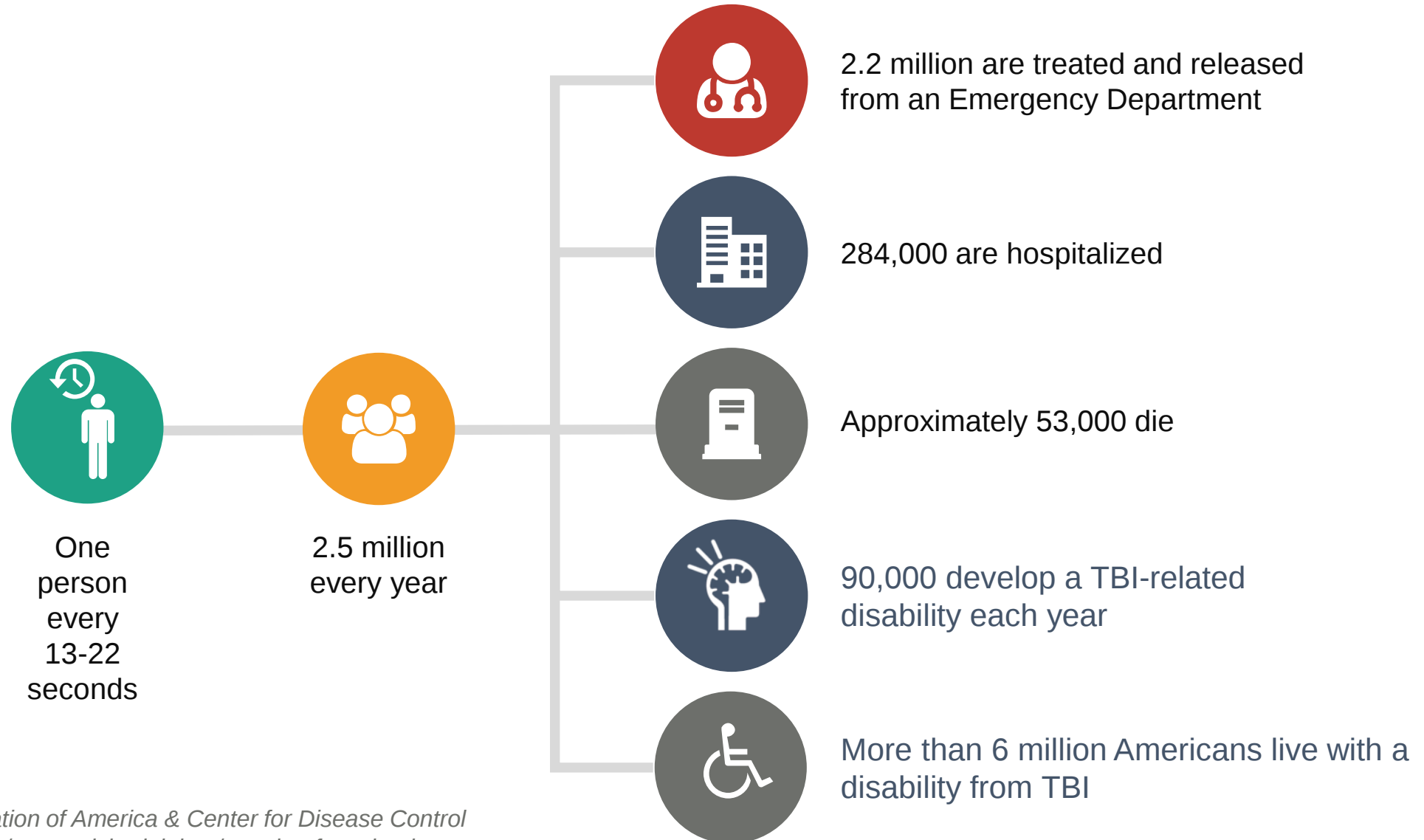
- Discuss incidence and prevalence of mild traumatic brain injury
- Describe a mild traumatic brain injury and how the condition is identified
- Discuss the physical, cognitive, and behavioral impairments that may result from mild traumatic brain injury and subsequent conditions related to the injury
- Describe evidence-based treatment approaches for management of deficits following mild traumatic brain injury
- List factors which impact outcome following mild brain injury



There is a TBI every 13
seconds in the United States

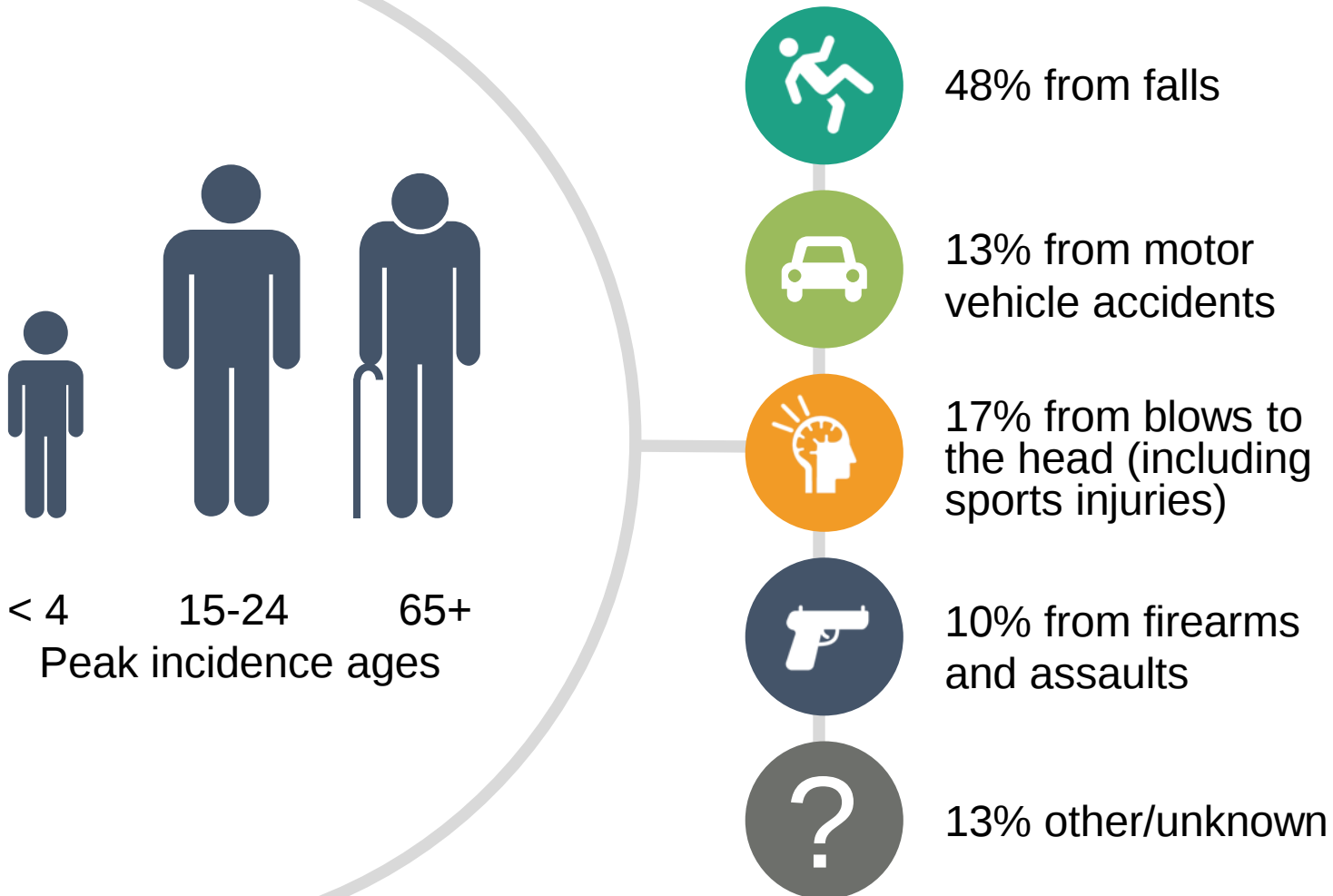
**285 traumatic brain
injuries in this hour**

Traumatic Brain Injury Incidence/Prevalence in the US



TBI Statistics – Continued

Primary causes of TBI:



- 80 – 90,000 survivors develop chronic disabilities each year (physical, cognitive, emotional) stemming from brain injury
- 5.3 million Americans live with disabilities from TBI

The Silent Epidemic



75-80% of all brain injuries are considered “mild”



Of the \$56 billion annual cost of TBI in the U.S., 44% is attributed to mild TBI



Over 1.4 million of all TBIs are treated and released from the emergency department.

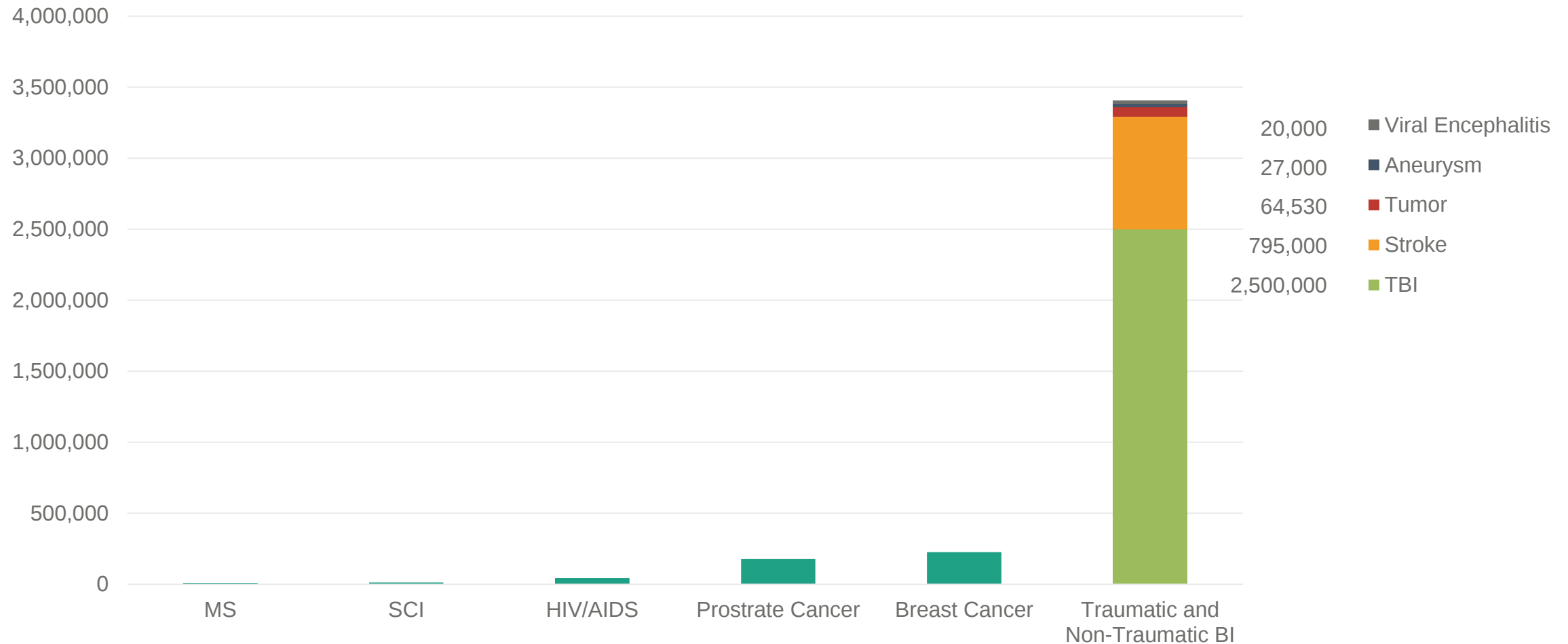
Traumatic Brain Injury Risk Factors





Comparison to Other Leading Injuries & Diseases

Comparison of Annual Incidence



Definition of mTBI



Glasgow Coma Scale

Eye Opening

No opening	1
To pain	2
To speech	3
Spontaneous	4

Verbal Response

No response	1
To sounds	2
Nonsense	3
Confused	4
Conversation	5

Basic Motor Response

Response to pain stimulus:	
No response	1
Generalizing	2
Arm extension	3
Arm flexion	4
Localizing	5
To command	6

GCS Total: 3-15

3-8	Severe
9-12	Moderate
13-15	Mild

Critical score: 8/15

Coma or comatose: 8 or below

Emerging from coma: above 8

GCS less than 8 at 6 hours: 50% die

GCS 3: deep coma, no eye opening, verbal response nor following commands

- American Congress of Rehabilitation Medicine
 - Traumatically induced disruption of brain function
 - Loss of consciousness or altered mental status
 - Injury severity does not exceed:
 - Loss of consciousness of about 30 minutes or less
 - Glasgow Coma Scale (GCS) less than 13-15 at 30 minutes
 - Post-trauma amnesia (PTA) greater than 24 hours
 - Blow or no blow to the head
 - Diagnosis does not include: CVA, anoxia, tumors, infection

Definition of mTBI

Organization	Loss of Consciousness	Post-traumatic amnesia	Glasgow Coma Scale	Focal Neurologic Deficits	Other
American College of Rehabilitation Medicine	±, lasting 0-30 min	< 24h	13-15 after 30 min	±, may be transient	Alternation of mental state (e.g., confusion, disorientation)
Centers for Disease Control	±, lasting 0-30 min	Not required		±	Headache, dizziness, fatigue
World Health Organization	±, lasting 0-30 min	< 24h	13-15 at presentation	±	
Department of Veteran Affairs	±, lasting 0-30 min	< 24h	Best score 13-15 in first 24h	±	Alteration of consciousness < 24h, normal structural imaging

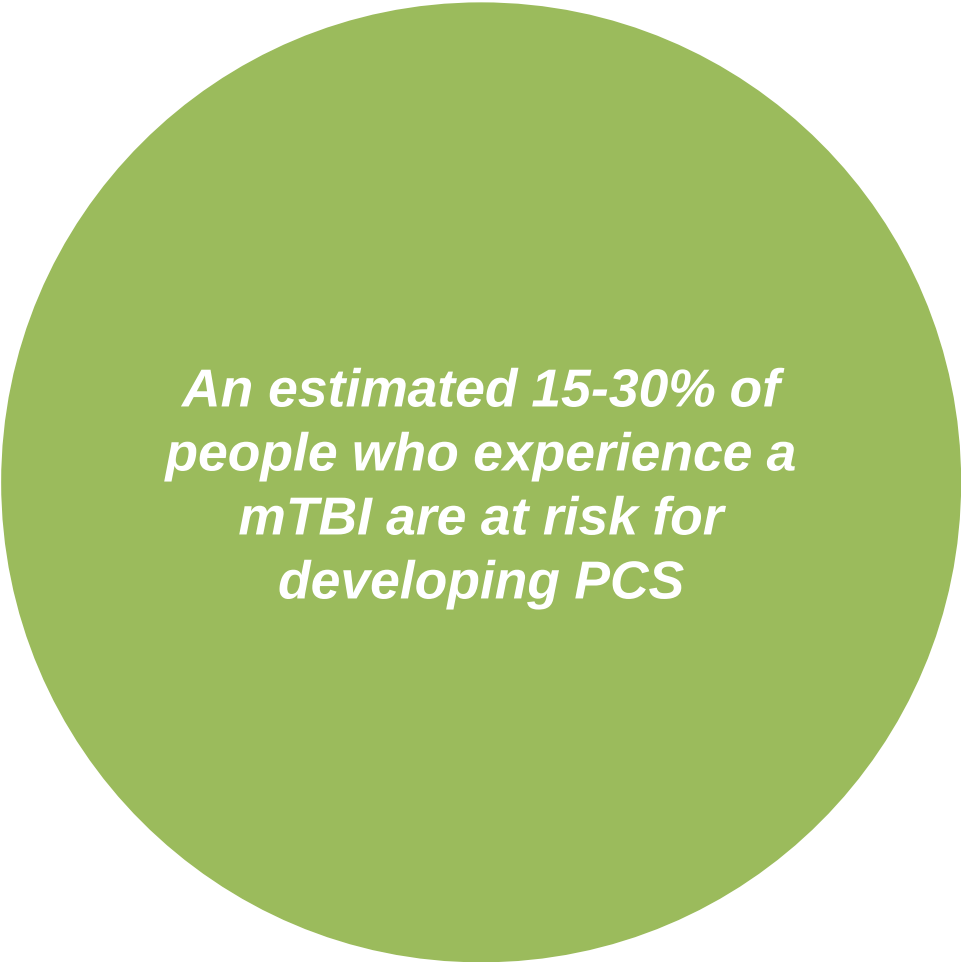
What is Post Concussive Syndrome (PCS)?

An assemblage of physical, cognitive, and emotional symptoms that persist in a small percentage of patients who suffer from a concussion or mild TBI

Presence of persistent symptoms following a concussion:

- Physical
 - Headache, Dizziness, Fatigue, Visual disturbances, Noise/Light sensitivity, Insomnia
- Cognitive
 - Memory deficits, Decreased Speed of Processing, Attention or Concentration deficits, Executive Function deficits
- Emotional
 - Irritability, Depression, Anxiety

Potential Predisposition Factors to PCS

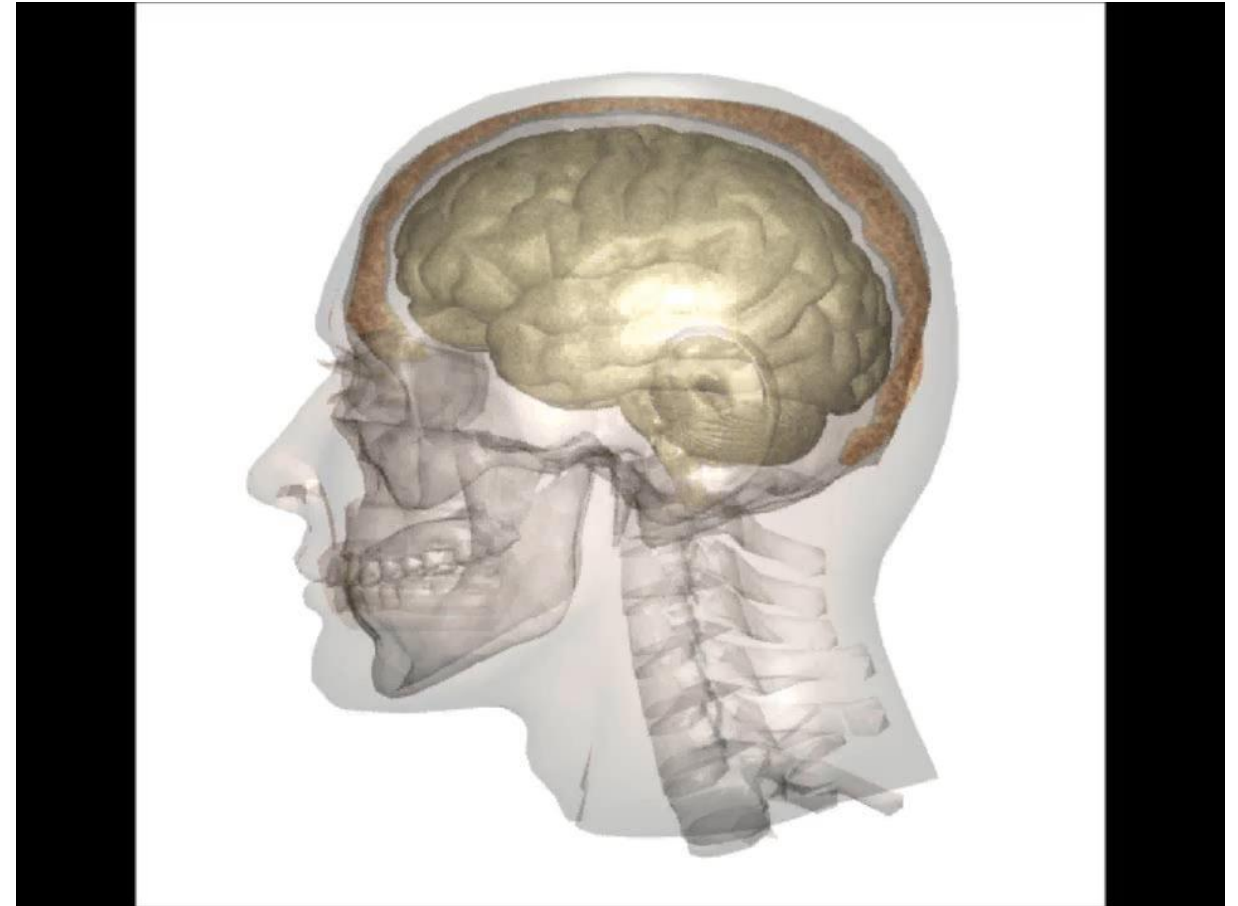


An estimated 15-30% of people who experience a mTBI are at risk for developing PCS

- Premorbid psychopathology
- Comorbidity of anxiety and depression
- Negative illness perceptions
- Expectation and compensation or litigation
- Delayed receipt of medical management of symptoms following mTBI

What physical changes occur in mTBI?

- What Happens Inside the Head?
 - Coup Contrecoup
 - Diffuse Axonal Injury
 - Chemical cascade
 - Energy crisis



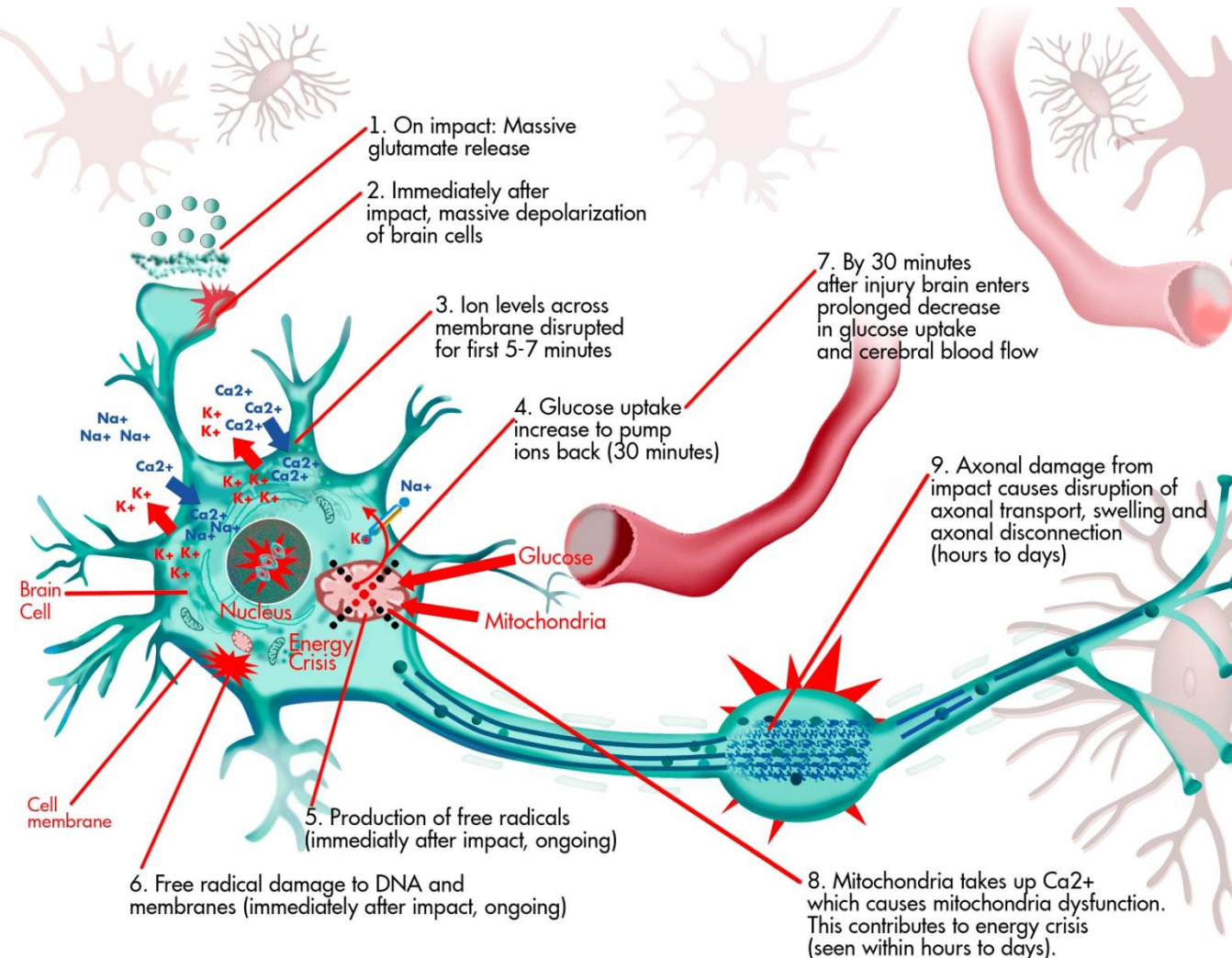
Animation

Metabolic Alterations



- What Happens Inside the Brain?
 - Chemical cascade
 - Glutamate
 - Sodium and Potassium
 - Energy crisis
 - Compromised ADP production
 - Restricted blood flow

Chemical Cascade (Can we “See” the Damage?)



Cell death /damage=MRI, biomarkers?

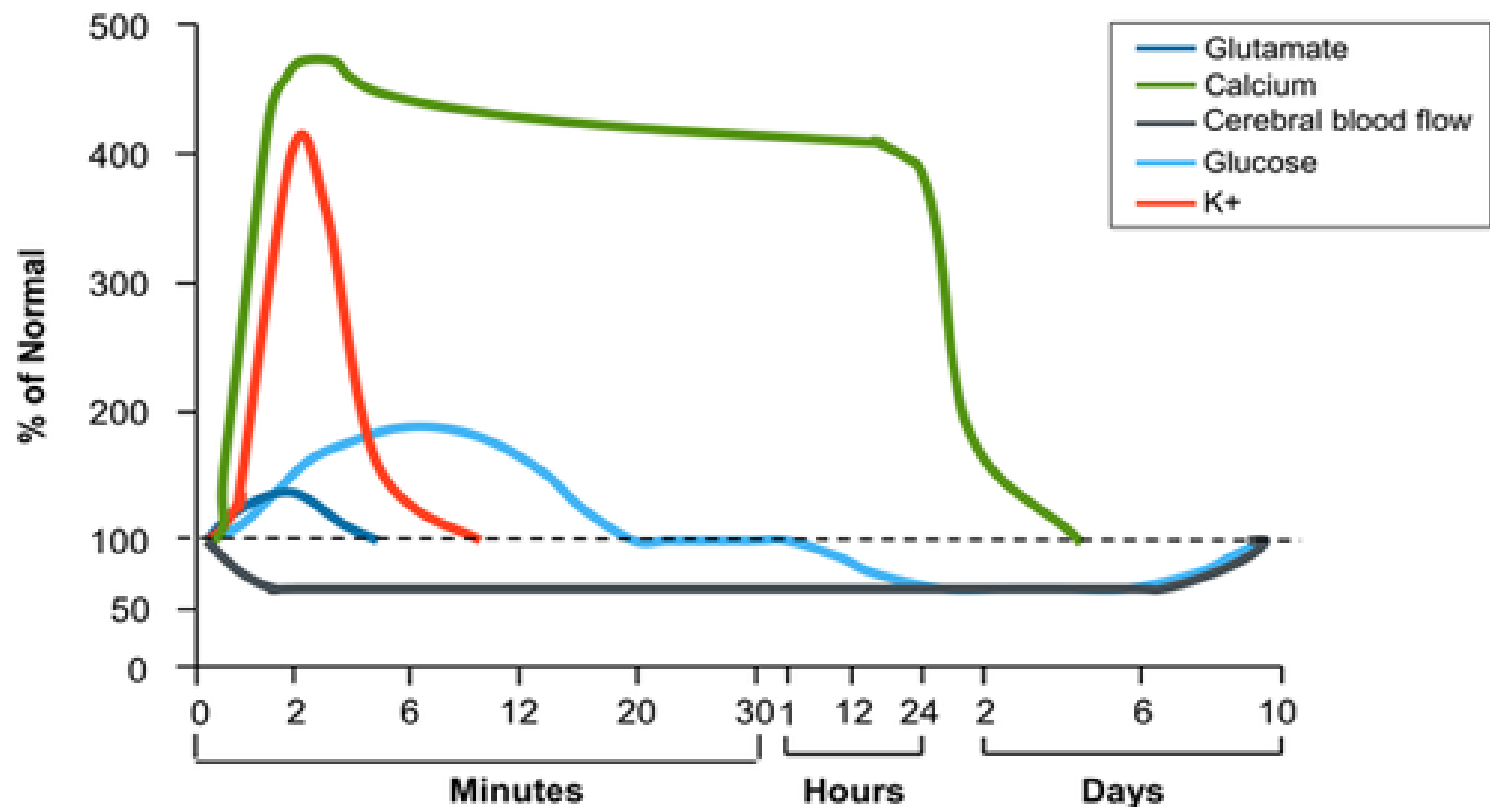
Energy crisis= PET

Altered neurotransmission=fMRI

Axonal damage=DTI

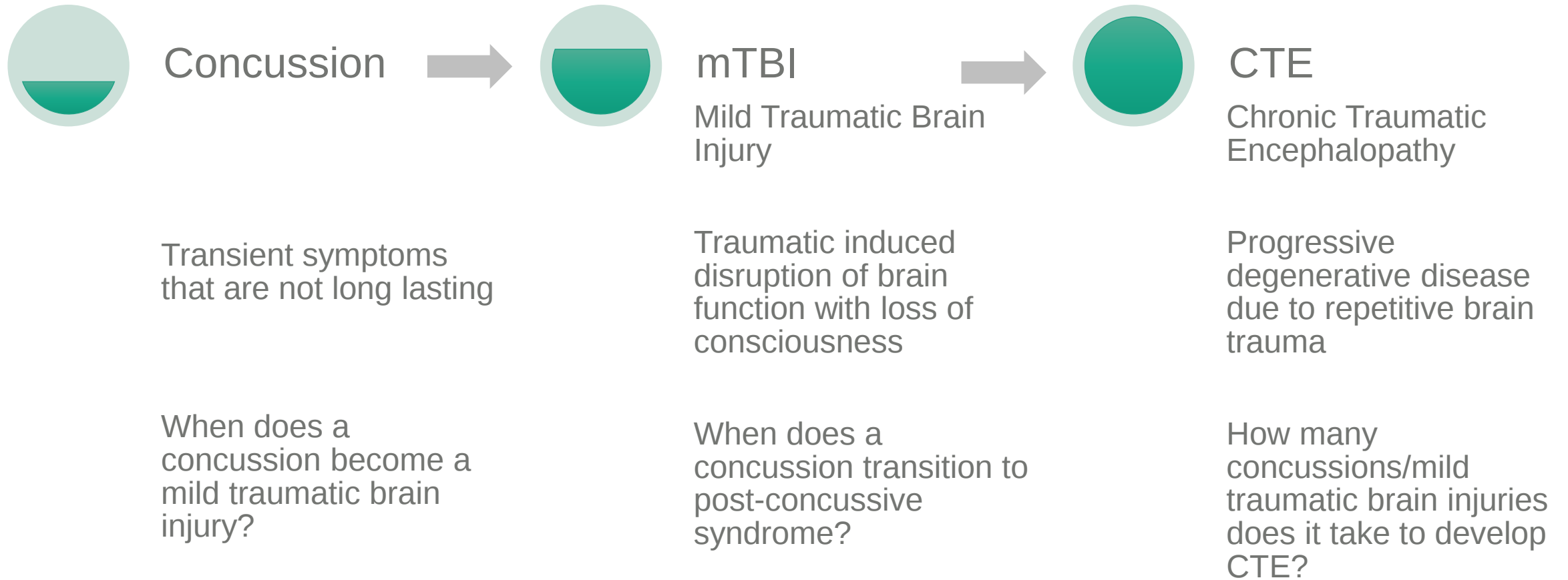
Energy Crisis Following mTBI

Neurometabolic Cascade Following Cerebral Concussion/mTBI

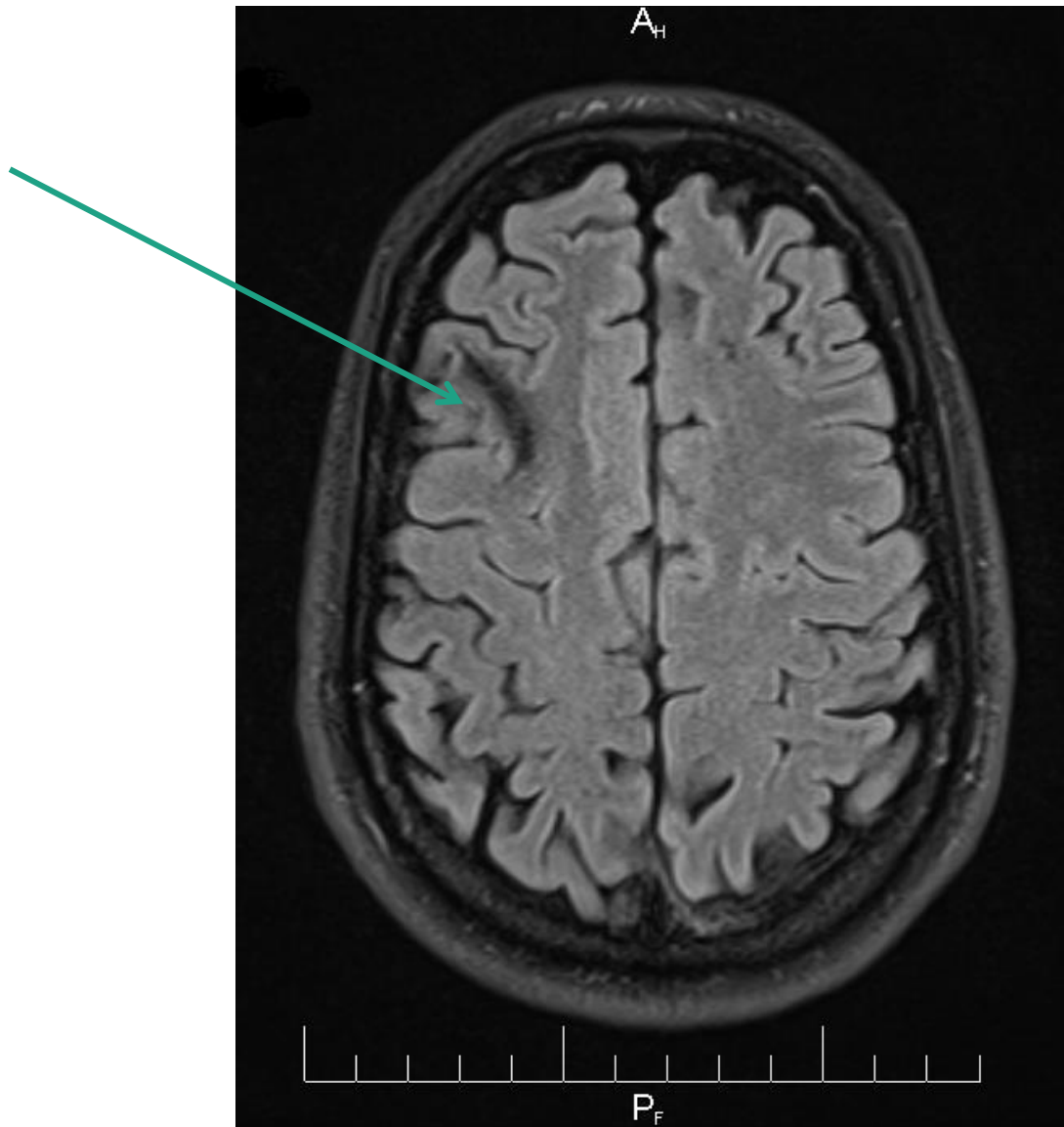


From Giza CC, et al.^[10]

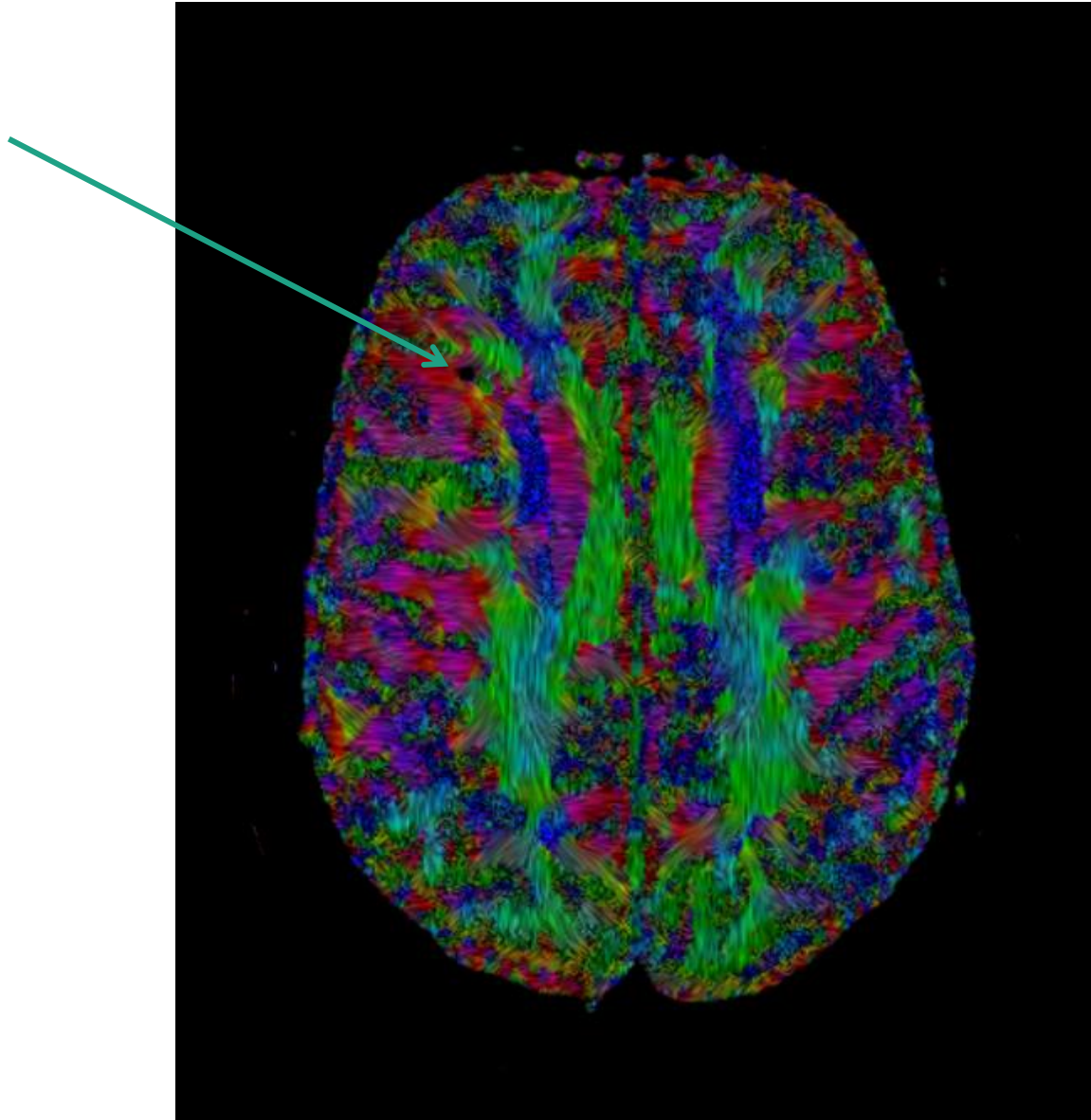
Concussion – mTBI Continuum



3.0 Tesla MRI Scan

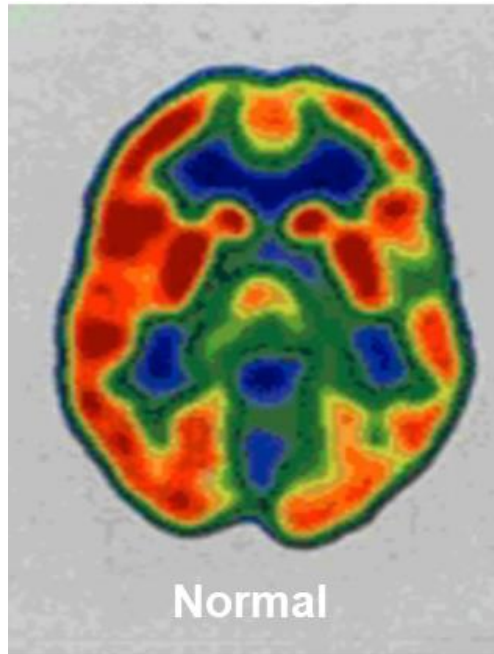


Diffuse Axonal Injury



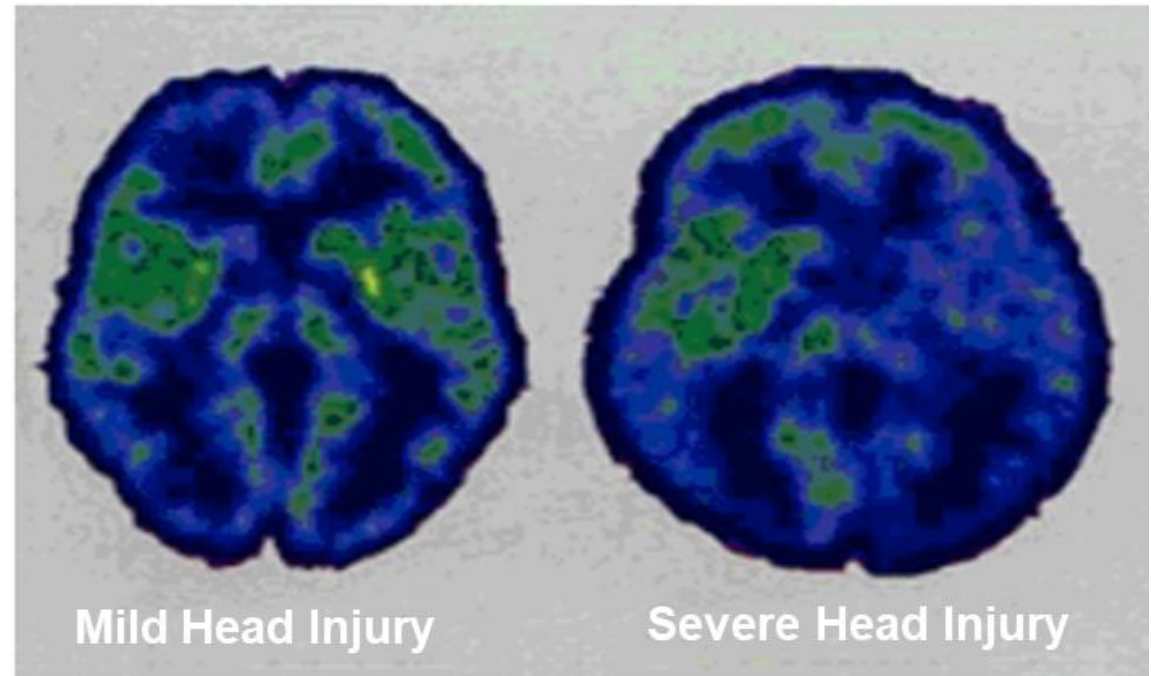
Diagnostic Tools

Clinical Use of SPECT and PET



Normal

Normal SPECT



Mild Head Injury

Severe Head Injury

Single photon emission computed tomography (SPECT) and positron emission tomography (PET) are functional nuclear medicine techniques which allow for accurate non-invasive in vivo measurements of a wide range of regional tissue functions . (Valotassiou, 2011, p.1)]⁹

Silent Epidemic



Absence of
evidence is not
proof of
absence

Common Neurological Symptoms

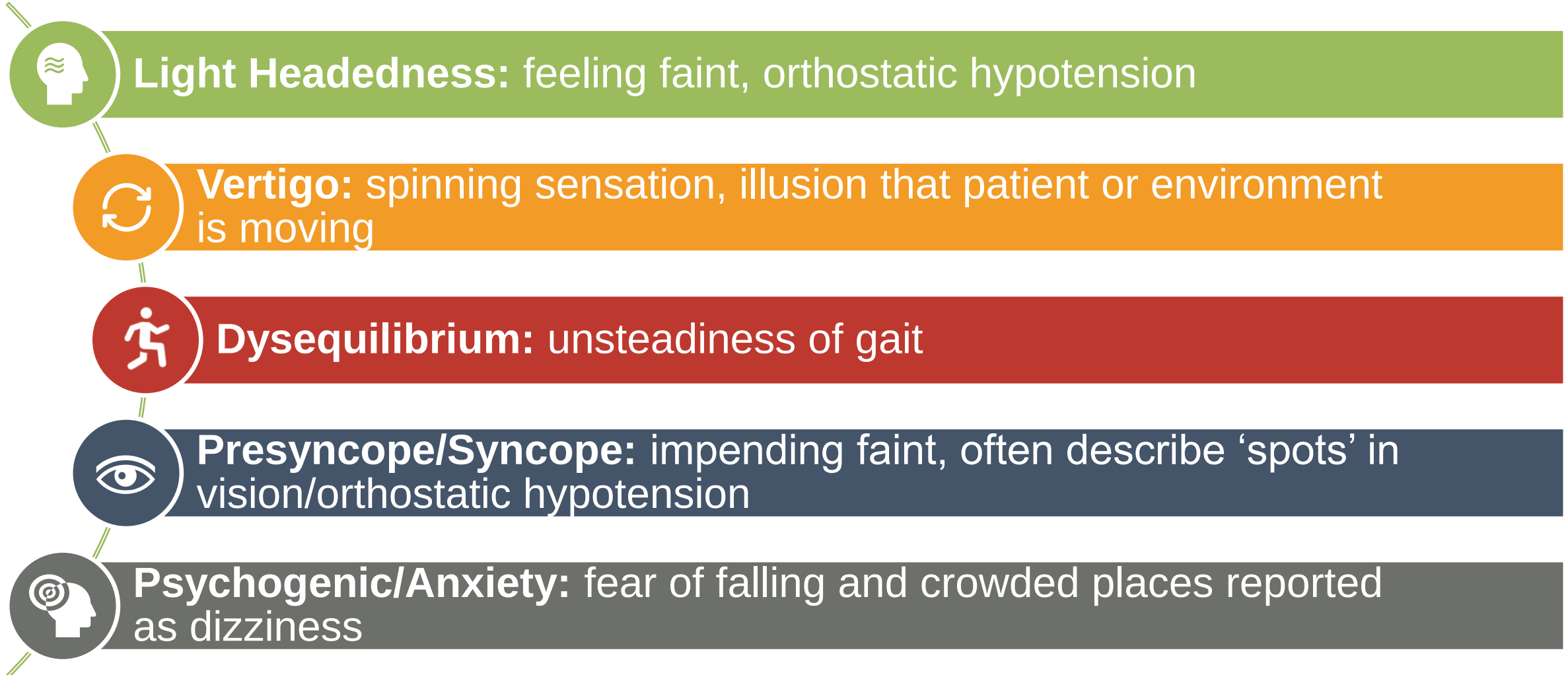
- Nausea, dizziness/vertigo
- Balance and spatial orientation disturbances
- Fatigue/sleep disturbances
- Musculoskeletal issues
 - TMJ
 - Neck & back pain
- Headaches
- Cognitive and communication deficits

Sensory Sensitivities:

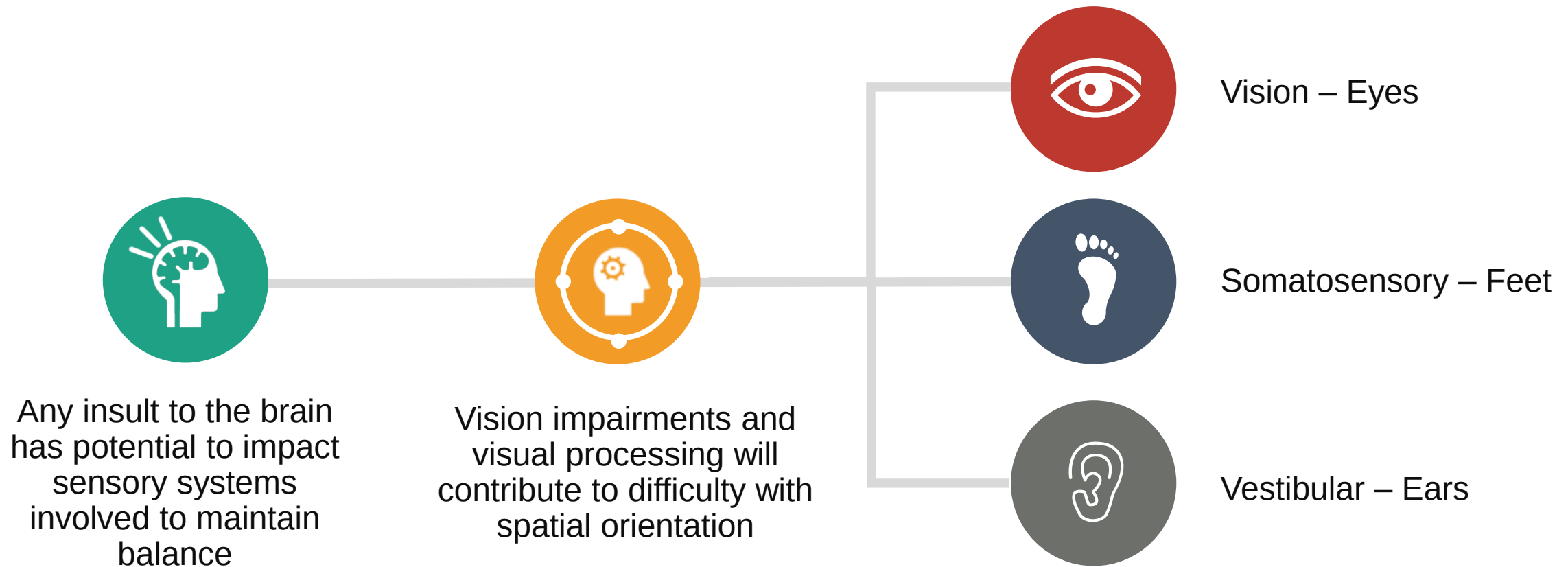
- Light
- Touch
- Sound
- Movement
- Heights



Dizziness



Balance and Spatial Orientation



Common Neurological Symptoms (cont.)



Fatigue

- Fatigue is 3rd most common symptom reported after a mild TBI
- Causes
 - Central nervous system dysfunction
 - Coexisting disorders in mTBI, such as depression, sleep disturbances, pain, headache, and many other reasons



Sleep Disturbances

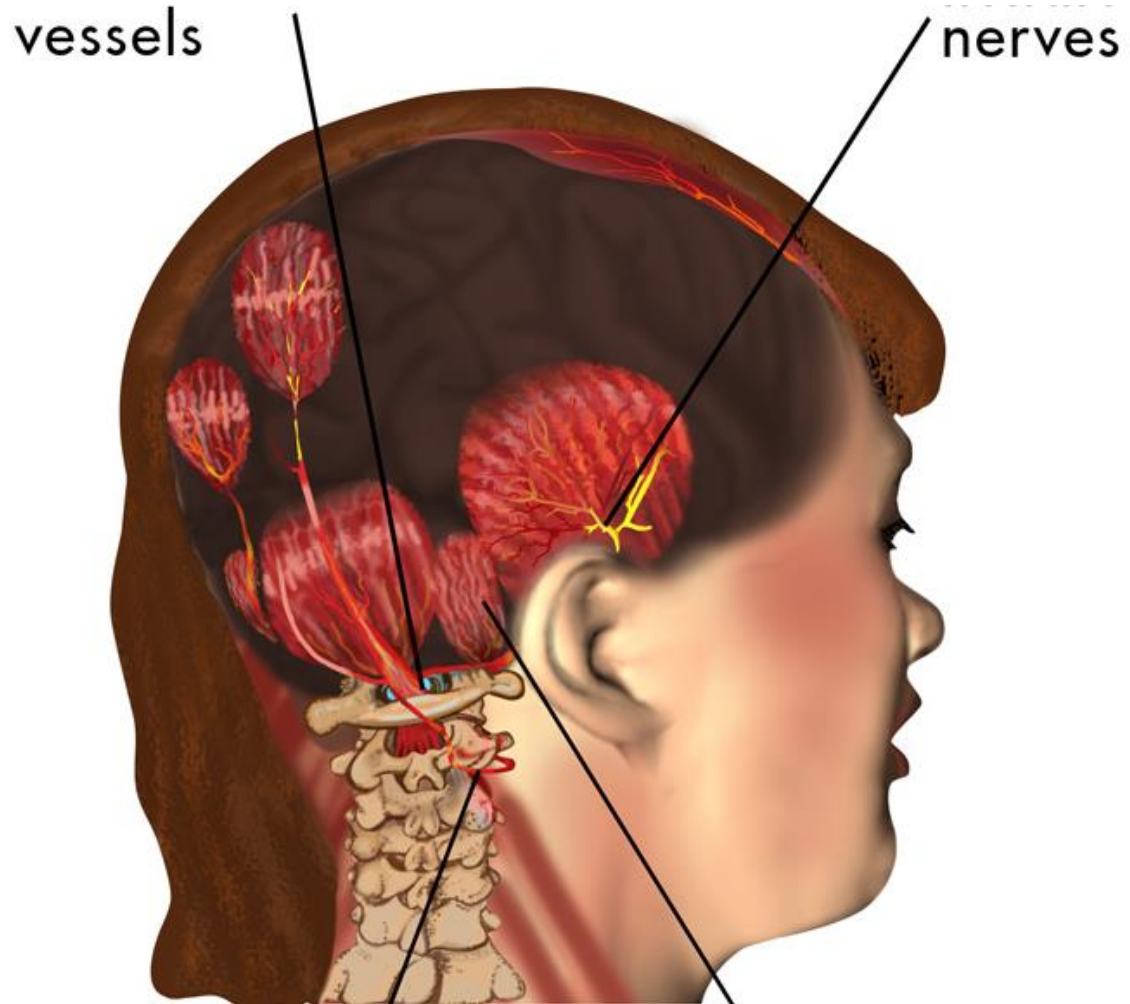
- Sleep disturbances may include:
 - Sleeping more or less than usual
 - Difficulty falling or staying asleep
 - Delayed sleep phase syndrome
 - Irregular sleep-wake patterns
- Pharmacological sleep interventions may help

Post-Traumatic Headache (PTHA)

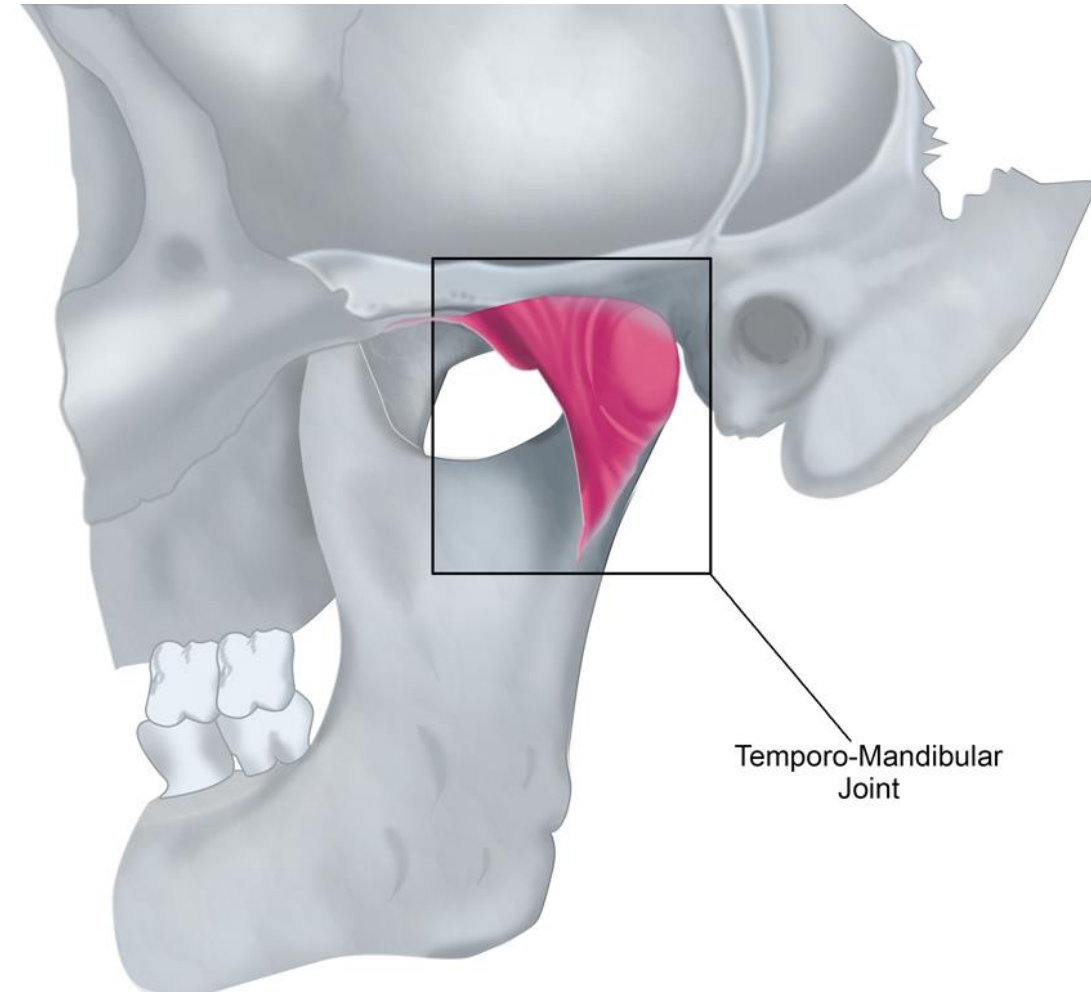


- Symptom profile
 - Onset
 - Location
 - Frequency and duration
 - Triggers and relief
- Sources of pain
 - Inside the head
 - Outside the head
- Common Patterns of PTHA
 - Tension-type with cervicogenic component
 - Migraine
 - Mixed migraine and tension-type

Musculoskeletal Issues



Traumatic Brain Injury



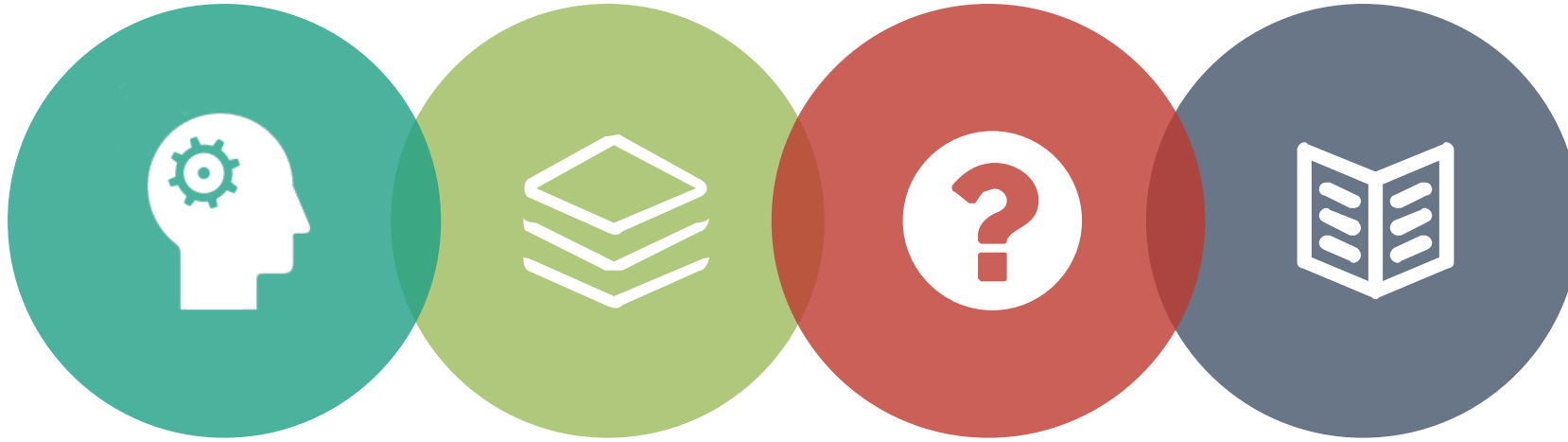
Temporo-Mandibular Joint

Common Behavioral/Emotional Symptoms



- Depression
- Anxiety
- Agitation/irritability
- Impulsivity/disinhibition
- Lability
- Aggression

Common Cognitive Symptoms



- Decreased attention/concentration
- Memory problems
- Decreased speed or efficiency in processing information
- Social pragmatics

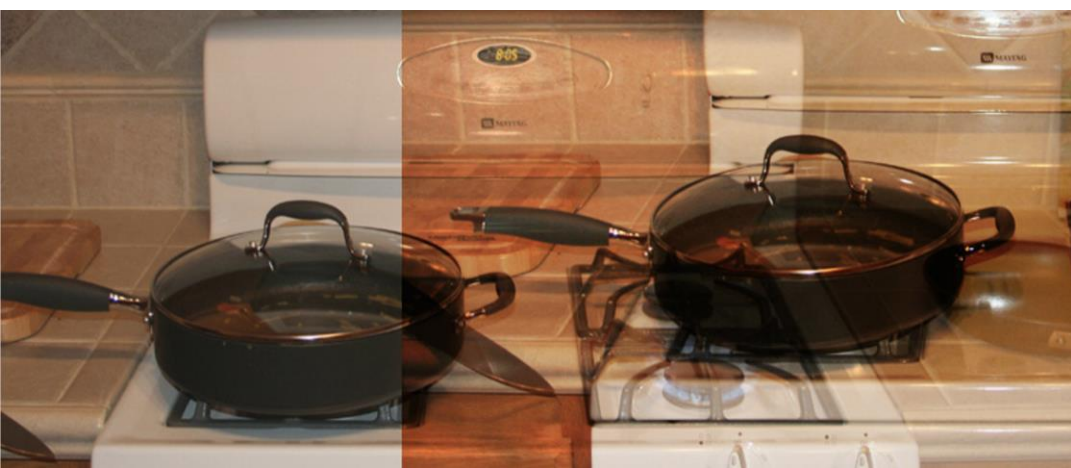
- Deficits in executive functions
 - Thought organization
 - Planning and sequencing
 - Initiation and execution
- Reading comprehension
- Onset of psychosocial issues

Common Sensory Symptoms



- Pain
- Altered or absent taste/smell
- Changes in hearing (e.g. tinnitus)
- Changes in vision(e.g. scanning, perception, reading comprehension)

Common Vision Symptoms



Exotropia: Severe w/ vertical misalignment



Bi-temporal hemianopsia

- Diplopia
- Blurred vision or nystagmus
- Decreased conjugate gaze
- Field cuts, neglect or inattention
- Visual perceptual deficits

Symptom Overlap

Symptom	Concussion	Stress	Anxiety	Depression	PTSD
Headache	X	X	X	X	X
Drowsiness	X	X	X	X	X
Irritability	X	X	X	X	X
Depressed mood	X	X	X	X	X
Poor Memory	X	X	X	X	X
Attention deficit	X	X	X	X	X
Fatigue	X	X	X	X	X
Poor Sleep	X	X	X	X	X
Nausea	X	X	X	X	X
Worry	X	X	X		X
Dizziness/Balance	X		X		
Hearing deficit	X				X
Blurred Vision	X				

Comprehensive Assessments & Treatments



Occupational Therapy

- Clinical assessments and observations
- Upper extremity function
- Ophthalmology or optometry referrals
- Vision therapy
 - Visuomotor Function
 - Visuospatial and visual perception
- ADLs and IADLs

Dynavision / Bioness Vision Training

Comprehensive Assessments & Treatments



Balance Training

Physical Therapy

- Clinical assessments and observations
- Musculoskeletal complaints
- Upright stability
 - Vestibular dysfunction
 - Cerebellar function
 - Knowing status of visual system
 - Somatosensory changes

Comprehensive Assessments & Treatments



Cognition Module

Speech Therapy

- Clinical assessments and observations
- Memory
- Attention
- Speed of processing
- Problem-solving
- Executive Functioning
- Expressive/Receptive Language

Comprehensive Assessments & Treatments



Psychotherapy/Counseling

Psychotherapy or Counseling

- Counselors (LPC, MFT) or Clinical Psychologists
 - Importance of knowledge-base and experience
 - Treatment frequency
 - Assessments tools
 - Treatment issues involving the client and family
- Neuropsychology
- Psychiatry

Comprehensive Assessments & Treatments

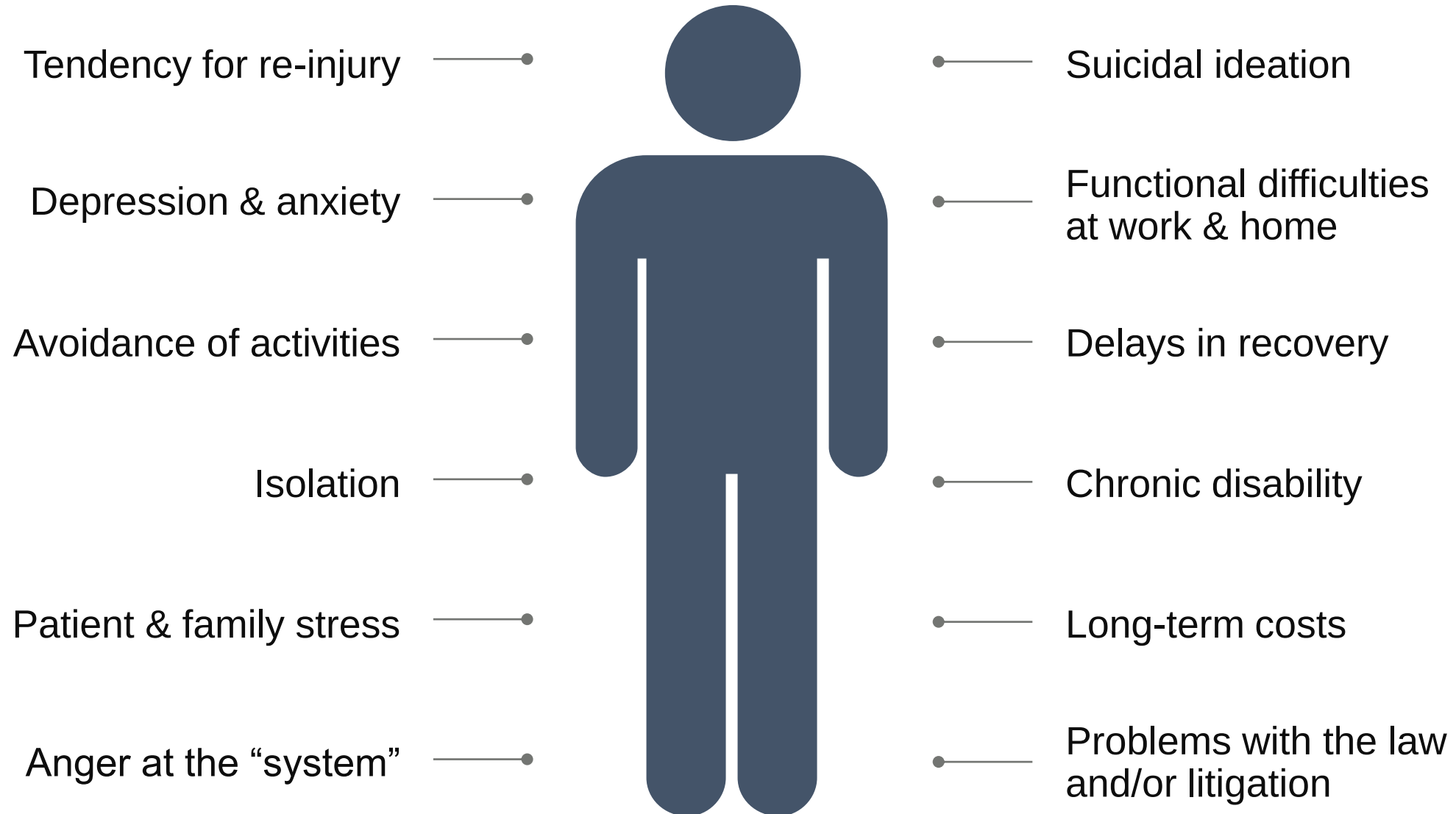


Vocational Rehabilitation

- Importance of the individual's knowledge-base and experience
- Importance of being part of the “big picture”
- A part of the comprehensive approach for community re-integration

Return to Work Skills Reacquisition

Potential Complications Following mTBI / PCS



Taking Action



Recognizing the problems – cognitive changes, visual changes, etc.



Being an advocate for experienced treatment



Being an active participant in the treatment process



Early treatment is essential for maximum recovery:

- Client and family education
- Reduced complications
- Reduced long-term costs
- Reduced litigation time and expense

Community Awareness



School-Age

- Ensuring teachers, coaches, club leaders are aware of the individual's status following an injury
- Providing education regarding slow reintegration back to school, sports or recreational activities
- Support groups for family or friends



Adult

- Consider modifications for return to work duties, if necessary
- Family/caregiver education
- Support groups for family or friends
- Follow up appointments six months post injury with involved medical professionals to manage and monitor the individual's needs



Mild traumatic brain injury is a silent epidemic that continues to require awareness and ongoing education to recognize, accurately diagnose, and effectively treat

“No head injury is so trivial that it can be ignored, and none so serious that life should be despaired of”

Hippocrates

Questions?

(hopefully, some answers)

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