

The Clinical Management of Individuals who Present with Mild Traumatic Brain Injury

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Thank you

- Everyone in my office including clinical, administration, and students who have helped directly or indirectly in putting together this talk today – including Laura Smith, Daniel Seroussi, Orli Shulein, Karen Olson, Jeremiah Lum, Madeline Noland, and Zoey Chu. Lori Weisman and Patty Youngman have also been invaluable friends and colleagues.
- Many fantastic mentors over the years including my mother, Betty Glisky, Ph.D. who is a cognitive neuropsychologist, recently retired
- My husband and four sons who distracted me with multiple basketball games over the past week, and then understood when I wanted to spend some of mother's day finishing my talk
- The neuropsychology community including all of you here – some of you may especially not recognize how much help you have been to me. Sometimes it is those that disagree with you most, that provide the most motivation and stimulation, and keep us questioning and thus growing as neuropsychologists.





A Relevant Quote:

“It is not only the kind of injury that matters, but the kind of head that is injured that determines recovery of function.”

Sir Charles Symonds (1937)



Mild Traumatic Brain Injury/ Concussive Brain Injury

NOMENCLATURE:

Mild traumatic brain injury (mTBI)

Concussion

Concussive Brain Injury (CBI)

Head Injury

Closed Head Injury (CHI)

Focus of this presentation

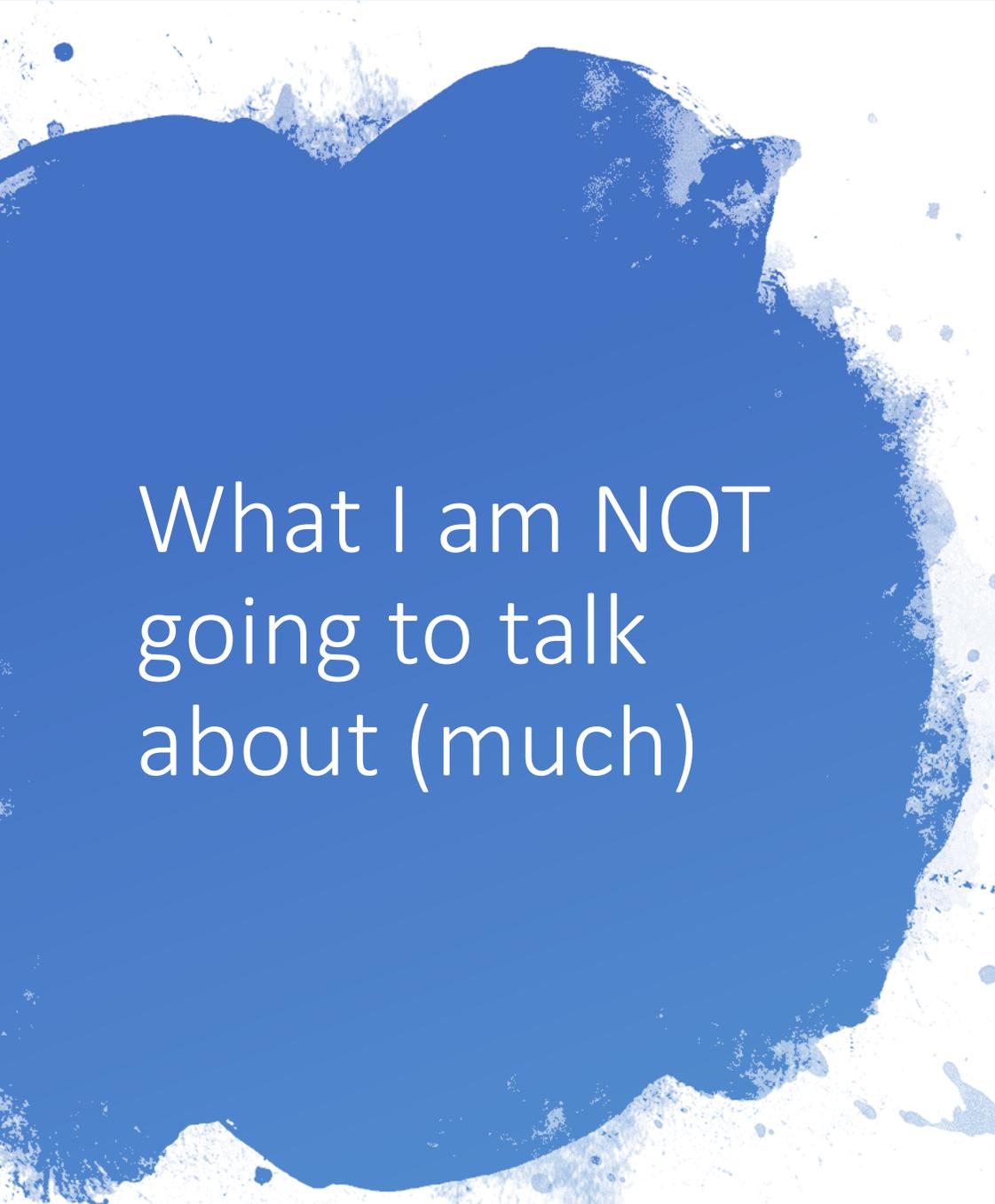
Clinical management – how can we best evaluate and treat those individuals who present with mTBI

Three objectives:

- Make sense of the mTBI and post-concussive diagnoses
- Discuss the most common physical, cognitive and emotional symptoms associated with a mTBI
- Identify and discuss treatment options and recommendations for those presenting with mTBI diagnosis.

Three important questions (to me)

- How do we explain and manage the variability, inconsistency, and heterogeneity of this population?
- How can we better apply a biopsychosocial approach to both our evaluation and treatment of these patients?
- How do we best apply our roles as neuropsychologists ... both the NEURO and the PSYCHOLOGIST part?



What I am NOT
going to talk
about (much)

- Acute phase of injury (first three months)
- Chronic Traumatic Encephalopathy (CTE)
- Forensic issues associated with mTBI
- Those that fail validity
- Pediatric mTBI
- Neurochemistry/physiology and neuroimaging
- Medical/physical treatments or alternative methods of treatment

Thus ... this talk cannot necessarily be applied to the above.



My premise(s) for this talk

- Not everyone recovers
- Many of these patients are in extreme distress
- There is not a simple answer
- There are multiple points of view
- The literature and advances are changing weekly
- We need to continue to update ourselves and our methods
- We are all trying to do the best that we can
- As neuropsychologists, we can do better

American
Congress of
Rehabilitation
Medicine (1993)
Definition of mTBI

A patient with mild traumatic brain injury is a person who has had a traumatically induced physiological disruption of brain function, as manifested by at least one of the following:

- any period of loss of consciousness;
- any loss of memory for events immediately before or after the accident;
- any alteration in mental state at the time of the accident (e.g., feeling dazed, disoriented, or confused); and
- focal neurological deficit(s) that may or may not be transient; but where the severity of the injury does not exceed the following:
 - loss of consciousness of approximately 30 minutes or less;
 - after 30 minutes, an initial Glasgow Coma Scale (GCS) of 13–15; and
- posttraumatic amnesia (PTA) not greater than 24 hours.

ACRM Definition to be updated ...
2020 Expert Panel Survey
(Silverberg, N.D., Iverson, G.L. et al, 2020)

- Surveyed experts regarding making updates – 31 members of the Expert Consensus Panel
- Areas of agreement and ongoing controversy
- Conclusion – The study “identified observable signs, symptoms, test findings, and contextual factors of perceived diagnostic important for mild TBI, many of which have not been considered in previous diagnostic frameworks”.
- AGREE: Some with TBI initially present with only subjective symptoms and this should be captured by diagnostic criteria

Centers for Disease Control (CDC) - 2003

Conceptual definition of MTBI is an injury to the head as a result of blunt trauma or acceleration or deceleration forces that result in one or more of the following conditions:

- Any period of observed or self-reported:
 - Transient confusion, disorientation, or impaired consciousness;
 - Dysfunction of memory around the time of injury;
 - Loss of consciousness lasting less than 30 minutes.

Observed signs of neurological or neuropsychological dysfunction, such as:

- Seizures acutely following injury to the head; Among infants and very young children: irritability, lethargy, or vomiting following head injury; Symptoms among older children and adults such as headache, dizziness, irritability, fatigue or poor concentration, when identified soon after injury, can be used to support the diagnosis of mild TBI, but cannot be used to make the diagnosis in the absence of loss of consciousness or altered consciousness.

DoD – Definition of TBI 2016

- A traumatic brain injury (TBI) is defined as a traumatically induced structural injury and/or physiological disruption of brain function as a result of an external force and is indicated by new onset or worsening of at least one of the following clinical signs immediately following the event:
 - Any period of loss of or a decreased level of consciousness
 - Any loss of memory for events immediately before or after the injury (posttraumatic amnesia)
 - Any alteration in mental state at the time of the injury (e.g., confusion, disorientation, slowed thinking, alteration of consciousness/mental state)
 - Neurological deficits (e.g., weakness, loss of balance, change in vision, praxis, paresis/plegia, sensory loss, aphasia) that may or may not be transient
- Intracranial lesion
 - External forces may include any of the following events: the head being struck by an object, the head striking an object, the brain undergoing an acceleration/deceleration movement without direct external trauma to the head, a foreign body penetrating the brain, forces generated from events such as a blast or explosion, or other forces.

DoD – Classification of mild TBI

- Structural imaging is normal
- Loss of Consciousness (LOC) 0-30 min
- Alteration of consciousness/ mental state (AOC)* up to 24 hours
- Posttraumatic amnesia (PTA) 0-1 day
- Glasgow Coma Scale (GCS) (best available score in first 24 hours)** 13-15
- *Alteration of mental status must be immediately related to the trauma to the head. Typical symptoms would be looking and feeling dazed and uncertain of what is happening, confusion, and difficulty thinking clearly or responding appropriately to mental status questions, and being unable to describe events immediately before or after the trauma event.
- **In April 2015, the DoD released a memorandum recommending against the use of GCS scores to diagnose TBI.



Post- Concussive Syndrome

- A broad term that is used to describe a cluster of symptoms spanning physical, cognitive, and emotional domains
- Mayo Clinic Definition: Post-concussion syndrome is a complex disorder in which various symptoms — such as headaches and dizziness — last for weeks and sometimes months after the injury that caused the concussion.
- Some argue that this term should only be used to describe symptoms that are **only** attributable to the neurologic sequelae of the injury
- However, there is too much overlap and too many comorbid factors to fully make this a specific neurologic term

WHO definition of PCS

- The syndrome follows a head trauma
- The individual presents with at least three of the following eight symptoms:
 - Headache
 - Dizziness
 - Fatigue
 - Irritability
 - Problems with concentrating
 - Memory impairment
 - Insomnia
 - Intolerance to stress, emotion or alcohol

ICD-10 Definition of PCS

- **F07.2 Postconcussional syndrome**

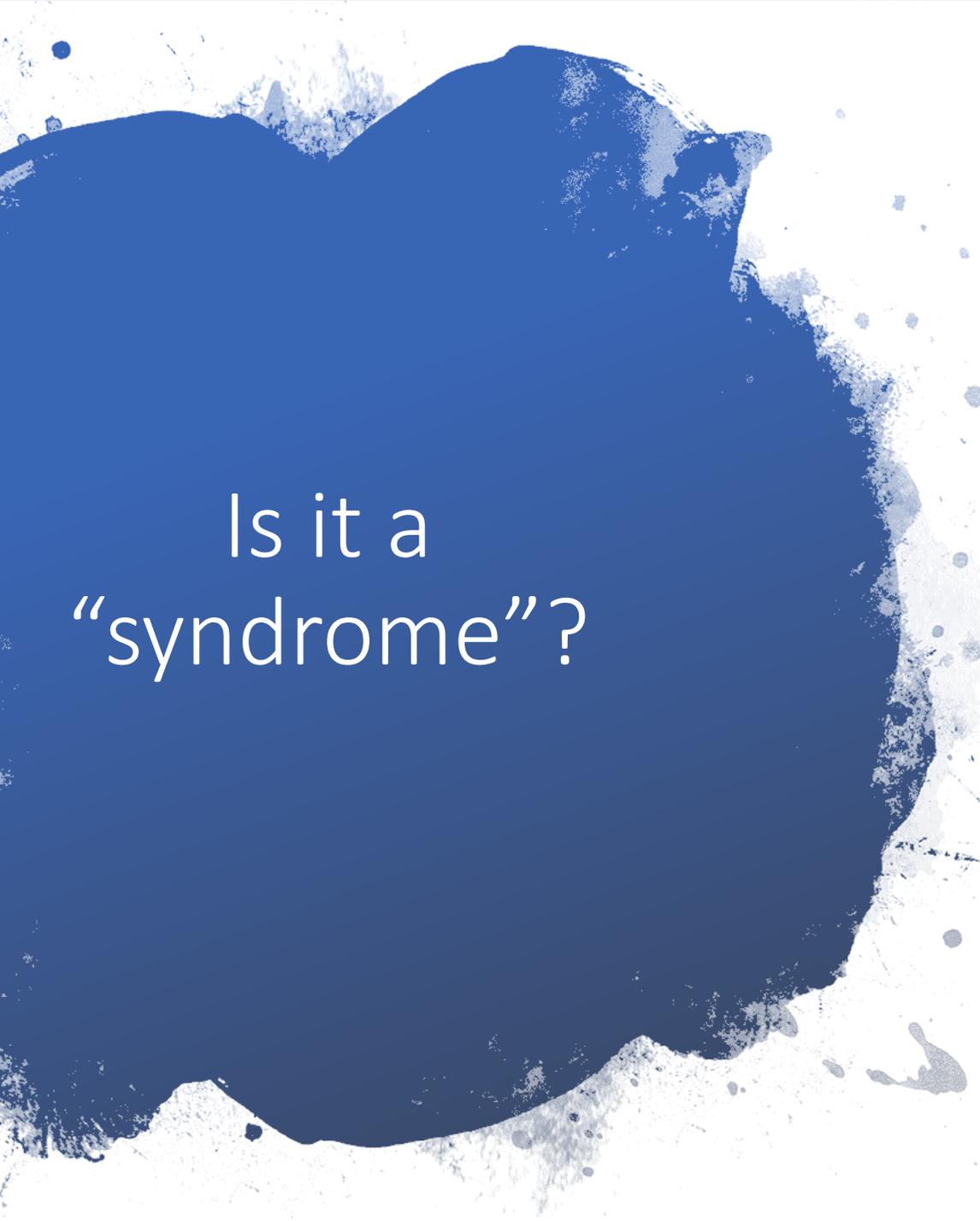
- A syndrome that occurs following head trauma (usually sufficiently severe to result in loss of consciousness) and includes a number of disparate symptoms such as headache, dizziness, fatigue, irritability, difficulty in concentration and performing mental tasks, impairment of memory, insomnia, and reduced tolerance to stress, emotional excitement, or alcohol.
- Clinical Information: The organic and psychogenic disturbances observed after closed head injuries (head injuries, closed). Post-concussion syndrome includes subjective physical complaints (i.e. Headache, dizziness), cognitive, emotional, and behavioral changes. These disturbances can be chronic, permanent, or late emerging.

DSV-IV Definition of PCS

- A constellation of cognitive, somatic, vegetative, behavioral and emotional symptoms that develop following a mTBI
- There must be evidence on NP testing of declines in cognitive function (such as attention, learning and memory)
- Must have 3+ of subjective symptoms (present for at least 3 months) including fatigue, sleep dysfunction, headache, dizziness, irritability, anxiety/depression/affective lability, personality changes, apathy
- There is no diagnosis or definition of PCS in the DSM-5

Other info about PCS

- Some believe this should not be diagnosed until symptoms have persisted for 3 months or more ... this is not an Emergency Room diagnosis
- Should not apply to those with moderate or severe TBIs
- Very heterogenous – some have a single clinical symptom (such as headache). Others have the whole list of symptoms.
- Typically factors other than the mTBI explain at least some of the variance in the symptoms



Is it a
“syndrome”?

- Non-specific cluster of symptoms
- These symptoms can also occur in a number of other pre-existing or pre-morbid conditions
- Even healthy individuals report similar symptoms
- Studies show 72-79% of healthy adults report experiencing 3+ symptoms of PCS

** I will use PCS to mean Post-Concussive Symptoms**

Problems with calling it a “syndrome”

- Can result in misattribution of symptoms
- Can delay proper treatment – lumping all together
- Can convey or increase feelings of hopelessness
- Can contribute to somatization and potential somatoform disorders
- Can be inaccurate in regards to healing time frames
- No consistency across practitioners

What is a co-morbid disorder vs symptom?

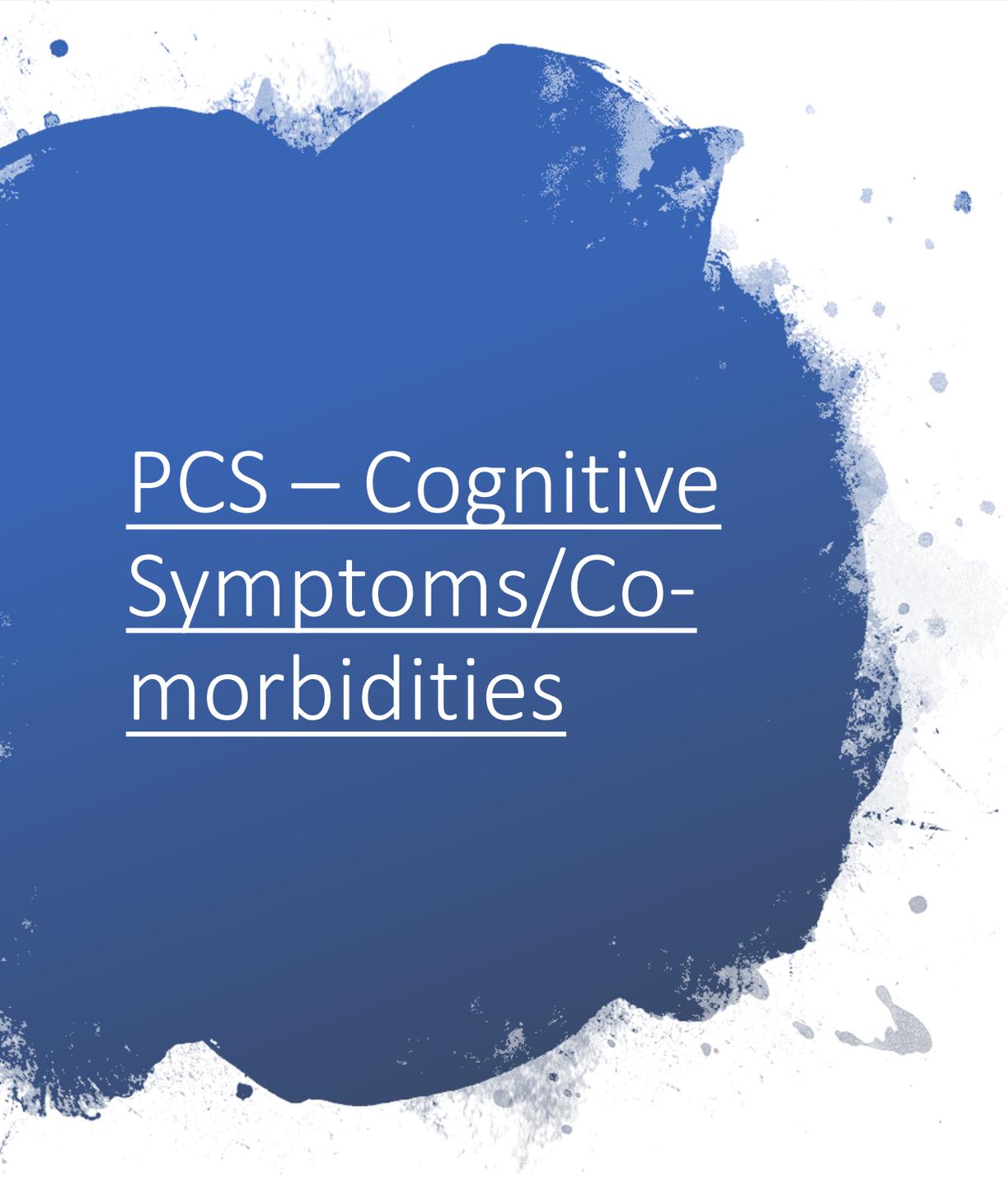
- *Dictionary definition:* the simultaneous presence of two chronic diseases or conditions in a patient.

From Latin – “co” means together; “morbus” means disease

- What is a separate condition/disease and what is just a symptom of the disorder?
- It can be impossible to separate these and it may or may not matter for treatment purposes

Physical Symptoms/Comorbidities

- Headache
- Light/noise sensitivity
- Fatigue/sleep disruption
- Vestibular/balance/dizziness
- Pain
- Pituitary dysfunction
- Medication effects



PCS – Cognitive Symptoms/Co- morbidities

- Slowed thinking
- Attention difficulties
- Memory problems
- Word finding
- Indecisiveness
- Planning/Organization/Executive functions
- Decreased multi-tasking



Psychological Symptoms/Co- morbidity

- Depression
- Anxiety
- Irritability
- PTSD
- Adjustment Disorder
- Somatization
- Personality Change
- Bipolar/Psychotic

Understanding PCS

In most cases, all these symptoms are not directly attributable to the neurologic component of the injury per se



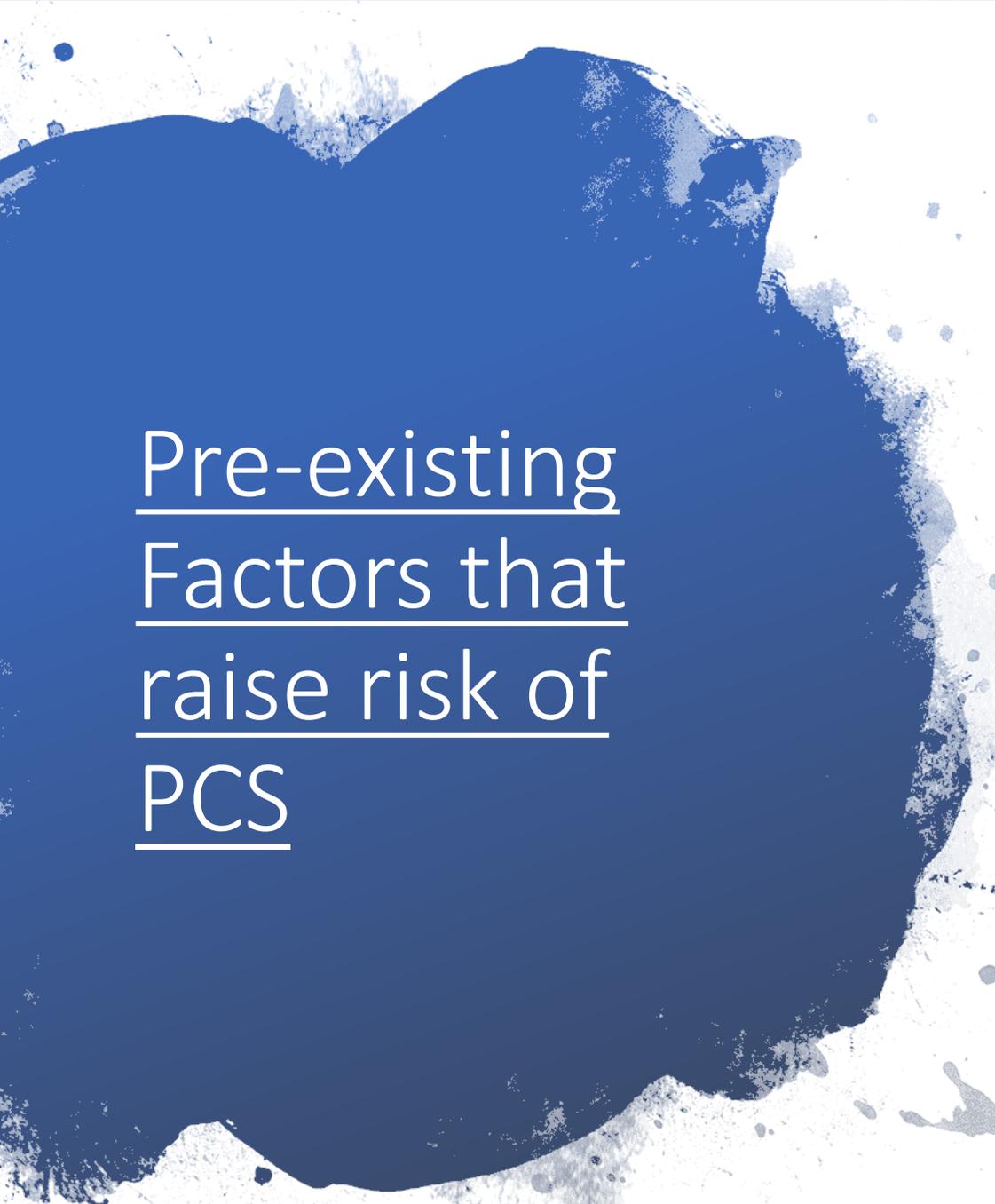
The symptoms also improve at different rates and in response to different treatments



Thus, the symptoms are not always linked to the same cause and may need to be uncoupled to provide the best treatment



Symptoms can certainly interact and be related, but are not necessarily a single and predictable “syndrome”



Pre-existing
Factors that
raise risk of
PCS

- Female gender
- Older age
- Pre-existing psychiatric disorder
- Psychiatric/psychological disorder
- Chronic pain
- Other chronic medical problems
- Stress
- Litigation seeking
- Learning Disabilities
- Abuse history
- **Worse acute symptoms at time of injury including headaches **



Not everyone
recovers

What percent does not recover? Huge range in the literature 50%-98% - Accepted maybe 20%

How do we define “recovery”?

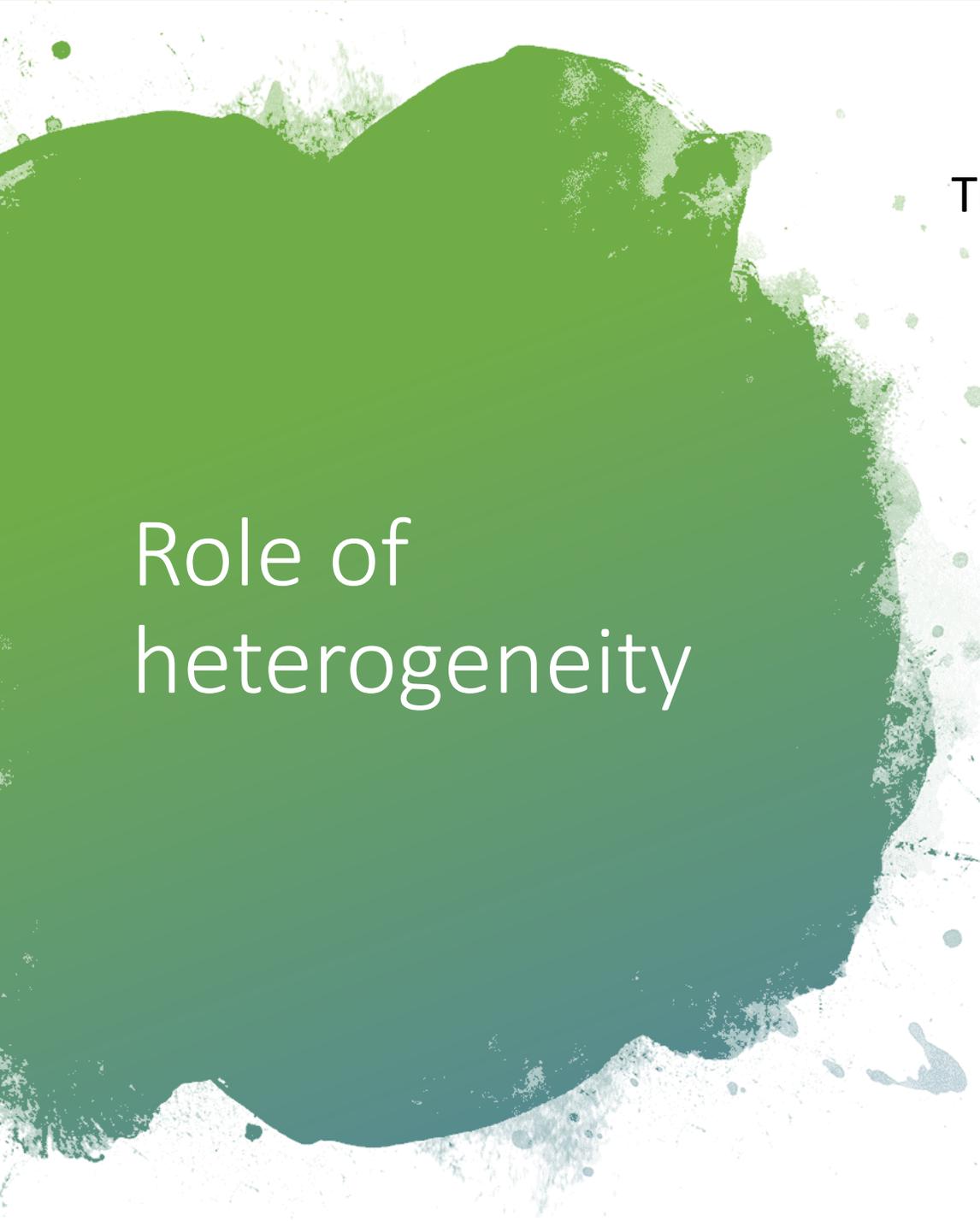
- Physically
- Cognitively
- Emotionally
- Financially
- Socially

How do we measure “recovery”?

- Subjectively
- Objectively
 - Neuroimaging
 - Neuropsych testing
 - Questionnaires

Why is there variability and disagreement?

- There is some percentage of people who continue to report and/or exhibit some type of symptoms following the mTBI that were not present prior to the mTBI – but what percentage? What number?
- We may not be able to objectively or adequately measure these symptoms
- There is an incongruence between complaints and objective findings (dated tests, sensitivity of tests, testing environment, other factors)
- Variability and inconsistency exists in the literature based on patient sample (civilian, military, athletes, clean, clinical, forensic)

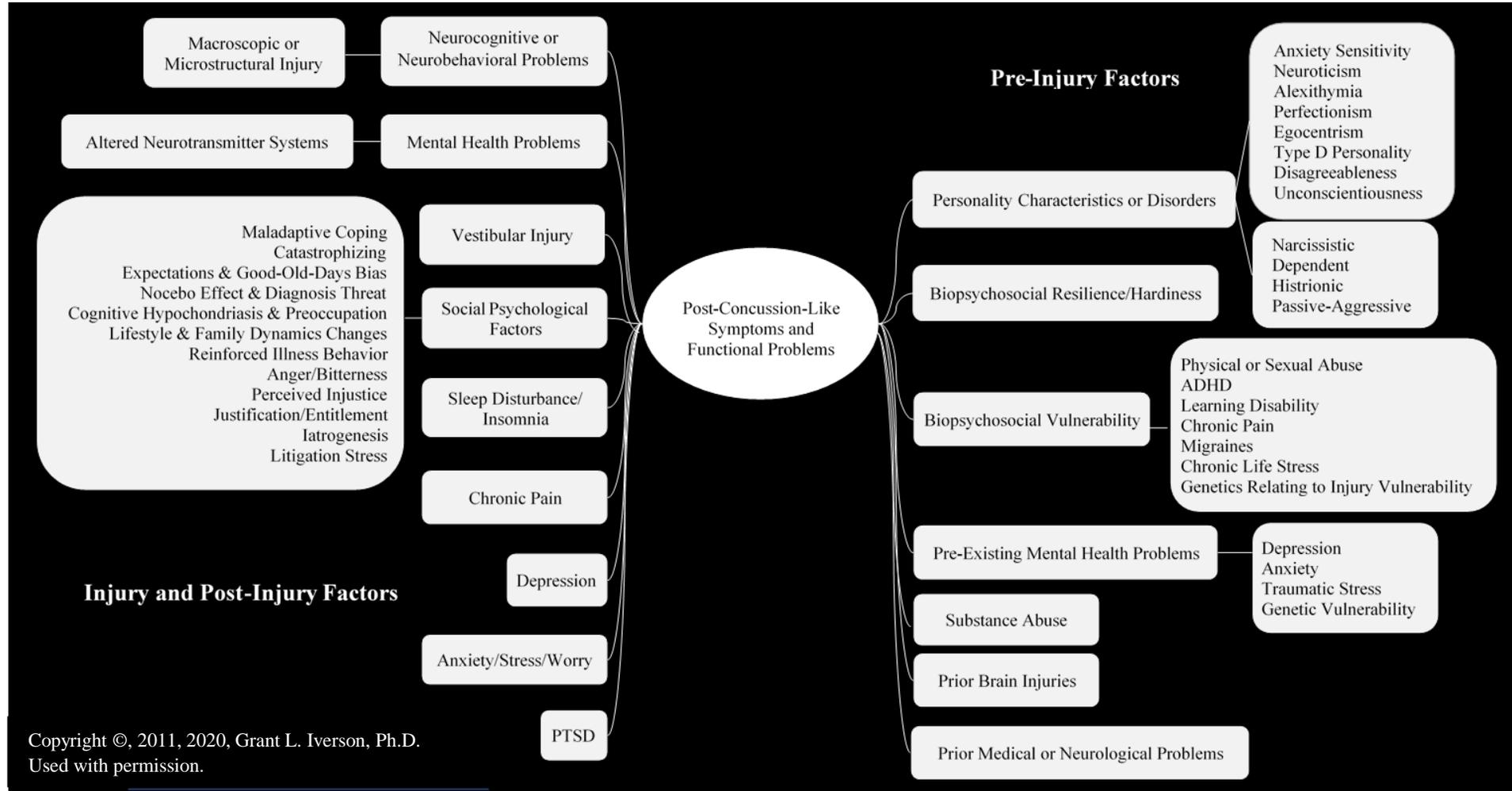


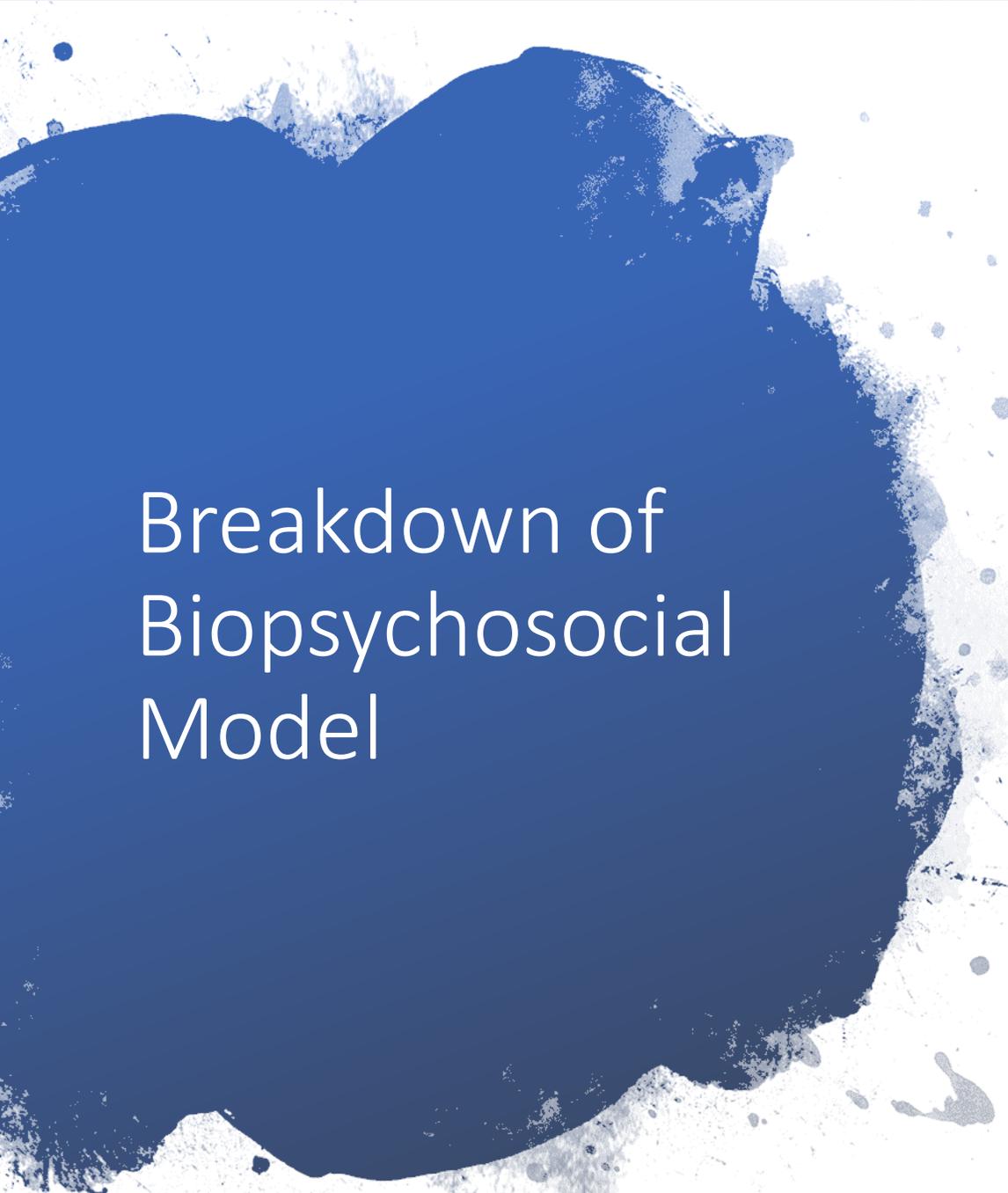
Role of heterogeneity

There is a lot of heterogeneity at all levels

- Injury
- Pre-injury factors
- Post-injury factors
- Attributions
- Psychological factors
- Variability as a function of neurologic and psychologic disorders
- Medical treatment/diagnoses
- Litigation factors
- Complexities of the current world
- Environmental factors

Biopsychosocial Model





Breakdown of Biopsychosocial Model

- There is an interaction between Pre-Injury Factors, the Injury and Post-Injury factors
- How many possible scenarios are there?
- This helps explain why there is so much heterogeneity seen in these injuries

How can we use this model to better inform both evaluation and treatment of our mTBI patients?

How can we use this model to help manage mTBI?

Neuropsychological Evaluations:

- Are we examining all aspects of this model?
- Do we have tools to measure or understand these variables?
- Are our conclusions consistent with this model?
- Do we make treatment recommendations in keeping with this model?

Treatment:

- Do we have treatments that consider these factors?
- How can we inform our treatment or provide this information to other treating providers?
- How can we explain these models and associated recommendations to our patients?

Pre-Injury Factors

- Personality Characteristics/Disorders
- **Biopsychosocial** Resilience/Hardiness
- **Biopsychosocial** Vulnerability
- Pre-existing mental health
- Substance Abuse
- Prior Brain Injuries
- Prior medical/neurological problems

How do we assess/measure Pre-Injury Factors?

- Clinical interview (with patient and collaterals)
- Record review (limited in clinical evaluation)
- Psychological measures
 - MMPI, PAI – limited
 - Other personality measures – NEO-PI?
 - Other questionnaires?

Are these measured the same way as Post-Injury factors? They are almost always only measured post-injury.

Actual Injury

- Huge spectrum within mTBI of unknown full relevance
- Should meet some criteria for mTBI, but this varies and there are many reasons why this is hard to meet
- Very hard to measure severity of injury within mTBI (subjective experience, length of time until evaluated, immediate vs delayed symptoms, amount of force; Powell 2008)
- The interaction with pre-injury and post-injury factors begins immediately

Post-Injury Factors

Physical injuries/Symptoms

- Vestibular injury (also linked to increased cognitive deficits)
- Sleep disturbance/insomnia
- Chronic pain
- Severity of other injuries

Psychological Injuries/Symptoms

- Depression
- Anxiety/Stress/Worry
- PTSD

Depression

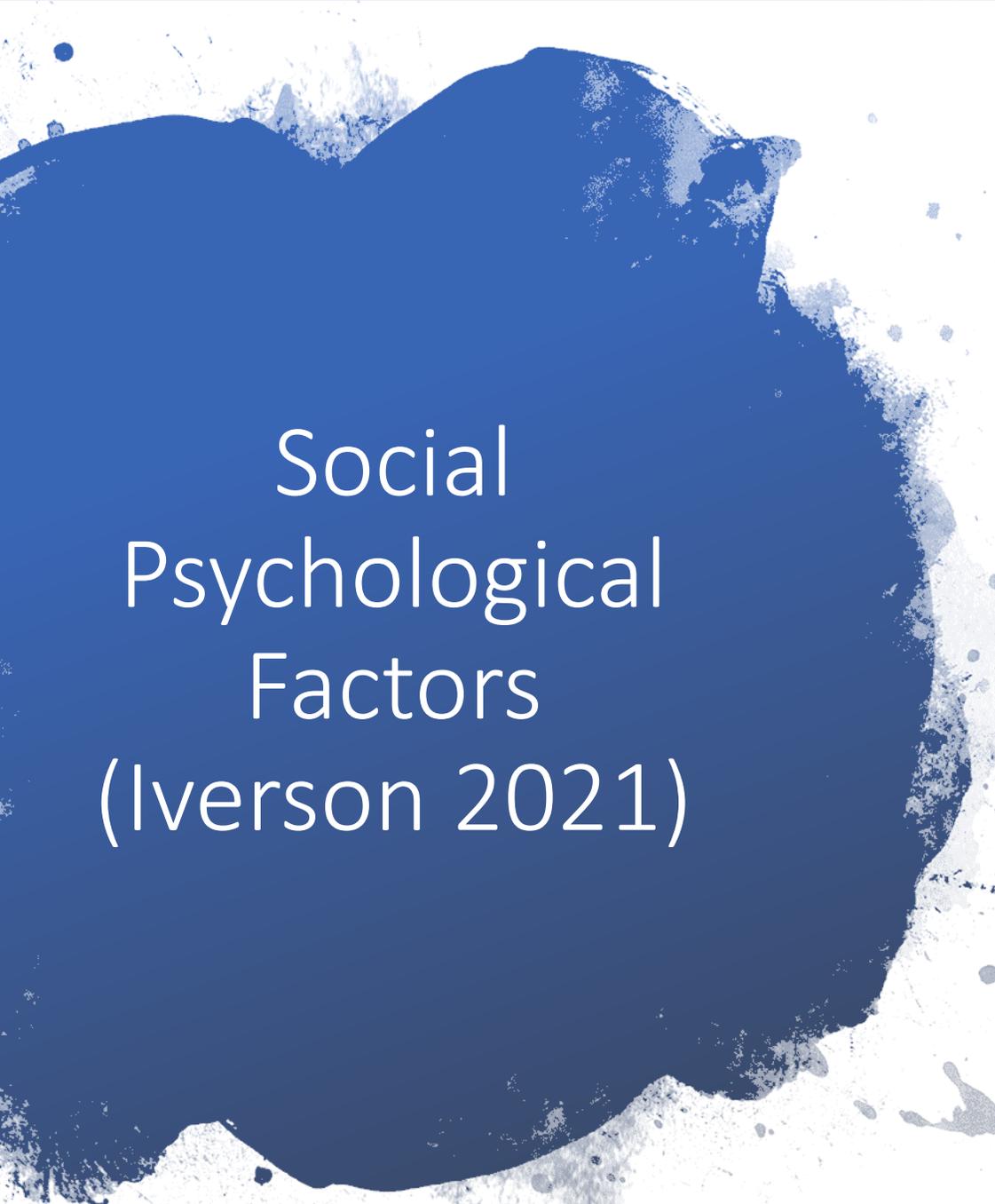
- Most common psychiatric disorder after TBI (rates between 17-23% post-injury – some studies as high as 40-50%)
- Multi-faceted causes
 - Physiological/neurological
 - Related to event and changes/adjustment following
 - Related to secondary events (such as financial stressors, relationship issues)
 - Often an interaction of all
- Are treatments same regardless of the cause?
- Pre-existing depression increases risk for post-TBI depression

Anxiety

- Also very common and frequently together with depression (ranges from 19-50% post-injury)
- Highly co-morbid with depression
- Can be generalized anxiety, phobias, panic disorders, OCD, somatically related, acute stress disorder or PTSD
- Also more common when there is a pre-existing history prior to the injury

PTSD

- Co-existing with mTBI is very common
- In a military sample having a mTBI more than doubled the risk of having PTSD
- Both can cause physical, cognitive and emotional symptoms that can interact and lead to negative interaction loop
- Treatment ... is treatment the same when PTSD co-exists with mTBI?



Social Psychological Factors (Iverson 2021)

- Maladaptive Coping
- Catastrophizing
- Expectations & Good-Old-Days Bias
- Nocebo Effect & Diagnosis Threat
- Cognitive Hypochondriasis & Preoccupation
- Lifestyle & Family Dynamics Changes
- Reinforced Illness Behavior
- Anger/Bitterness
- Perceived Injustice
- Justification/Entitlement
- Iatrogenesis
- Litigation Stress

How do we measure these?

- Maladaptive Coping – *Brief COPE/Self-Efficacy* (see Noland et al, 2021; Lum et al, 2021)
- Catastrophizing – *Pain Catastrophizing Scale* (Sullivan 1995);
- Expectations & Good-Old-Days Bias -
- Nocebo Effect & Diagnosis Threat -
- Cognitive Hypochondriasis & Preoccupation - *The Modified Somatic Perception Questionnaire (MSPQ)*; *Health Anxiety Inventory (HAI)*
- Lifestyle & Family Dynamics Changes
- Reinforced Illness Behavior - *The Modified Somatic Perception Questionnaire (MSPQ)*
- Anger/Bitterness
- Perceived Injustice – *Injustice Experience Questionnaire* (Sullivan, 2008)
- Justification/Entitlement
- Iatrogenesis
- Litigation Stress or ANY STRESS?

What could be added to the Model?

- **Self-Efficacy** - Perhaps another term related to “maladaptive coping”. Studies have shown that how one copes with stress can impact psychological stress and in our mTBI sample higher self-efficacy was associated with better scores on select cognitive measures (Noland et al, 2021). In addition, avoidant coping style was associated with worse executive functioning in our mTBI sample in another study (Lum et al, 2021).
- Hope – Found to be associated with positive outcomes in PD patients?
- Role of somatization/potential somatoform disorder?
- Cognitive Variables?

Cognition and Iverson's Model

Where are the cognitive factors? Could there also be pre- and post-injury cognitive factors?

- Premorbid cognitive abilities
- Cognitive reserve
- Cognitive sensitivity/awareness
- Cognitive threshold
- Daily cognitive demands

The Neuropsychological Evaluation

- This biopsychosocial model was created by a neuropsychologist to help us understand what symptoms are contributing to persistent symptoms
- How does it relate to our evaluations?
- What should we be evaluating?
- Traditionally our evaluations focus on cognition and that is what we do best
- Most of us do a typical NP evaluation when we get an mTBI referral

Neuropsychological Evaluation of mTBI

- What do our traditional measures tell us?
 - Strengths and weakness across a number of cognitive domains
- Meta-analyses results
 - What are the findings? Many show very small effect sizes ... some studies show attention, processing speed, visual working memory, new learning, verbal fluency or executive dysfunction
- Normal variability
 - We know a lot of individual variability is relatively common (although look at the numbers)
 - Is normal variability consistent across a certain domain?

(More) NP Evaluation of mTBI

Sensitivity

- How does normal variability impact sensitivity? If it can be normal to have 2-3 standard deviations of normal variability, how do we find abnormalities? Are we adequately measuring their complaints? (multitasking, divided attention)
- In a high functioning individual, are we capturing the challenges of their difficulties?

Ecological validity

- Generally not great. If we test someone in a quiet, distraction-free environment, how does that compare to the real world? If we ask them to focus and learn something when we ask them to, how does that compare to the real world? If we structure and plan the day for them, how does that compare to the real world?

Up-to-date versus Out-of-date

- Is the world the same as it was 10, 20, 30 years ago when these measures were created? Are multitasking demands the same? Do we have tests that measure multi-tasking and divided attention?

(More) NP Evaluation of mTBI

Are we measuring the most relevant psychological aspects?

- BDI and BAI – many physical symptoms
- PAI and MMPI – many physical/somatic symptoms

Are we measuring the constructs that Iverson identifies as important?

How helpful is our “Diagnosis”

- Depression
- Anxiety
- PTSD
- Somatoform
- Neurocognitive Disorder

Are these diagnoses informing treatment or education the provider or the patient?

How are we communicating our results?

- “It is imperative that information is presented in a way that is informative, yet easily understandable. Further, reports must be both comprehensive and concise.”
- “If tests results are not communicated effectively, the use of the entire assessment process may be called into question.”

Role of the neuropsychologist

- “Neuropsychologists specialize in the assessment and treatment of neurobehavioral disorders encountered across the lifespan. As treatment providers, neuropsychologists offer invaluable expertise in developing compensatory strategies and identifying resources to help patients cope with disruptions in their daily functioning.”
- “Neuropsychological treatments and interventions are ideally created with appreciation of individuals’ unique characteristics and needs.”

What treatments are available to us?

- Education
- Psychotherapy – CBT and others
- Cognitive Remediation therapy
- Medical/Pharmacological
- Alternative/Complementary
- VERY alternative

Why is the population so difficult to treat?

- Problems with diagnosis
- Heterogeneous symptoms presentation
- Heterogeneous recovery pattern
- Lack of objective measures of contributing factors and comorbidities
- Interaction of pre-existing and post-injury characteristics
- Coalescing of multiple symptoms
- Requires multi-disciplinary effort

Differentiating treatments for mTBI from moderate to severe TBI

- As a whole these populations are very different
- Approaches for those with more severe impairment often focus on self-awareness (denial/anosognosia), severe cognitive difficulties and emotional dysregulation
- Many excellent models of this including holistic neurorehabilitation (i.e. Prigatono, Pepping, Klouff, Wilson)
- We can learn from some of these models, but mTBI patients are often very different
- Risk of iatrogenic effects increase if we lump all TBI's together in treatment

Health Education about mTBI

- Many studies have found this to decrease PCS symptoms over time
- Education about the nature of the injury and projected positive outcome was beneficial for overall recovery (Mittenberg, 1996, 2001; Ponsford 2002)
- What type of education/information works best?
 - Balance between being too dismissive, managing expectations, and providing compassion and understanding
 - Mittenberg et al created a manual that included information on the symptoms and prognosis, as well as a CBT self-help strategy

Issues with General Health Education

- When is it presented (ER, acute, after some time period)?
- How is it presented (verbally, written, phone)?
- By whom is it presented?
- Is there a “one-size fits all” that works?
- What should be included – typically knowledge about mTBI, symptom management, prognosis and recommendations

Iatrogenic Effects? Some studies show that education interventions increased PCS symptoms over time (i.e. Yang et al, 2018). Questioned whether the coping strategies actual “implicitly or explicitly primed patients to attend to PCS”

Psychotherapy

- Cognitive Behavioral Therapy (CBT) is most commonly used form of therapy in this group
 - May need adaptations
 - Helpful to have practitioners who understand the issues
 - Could be used to introduce/explain some of the Iverson model factors
 - Explanation of the coalescing of physical, cognitive, and emotional factors
 - Deemed most successful approach, but not always
 - Couples/family therapy
 - There is a risk for iatrogenic effects

Select Reviews of Psychological Intervention in TBI/PCS Patients

Cognitive Behavioral Therapy (41.9%) and Psychoeducation (25.8%) were most common and included telephone-based, computer-based and web-based programs, as well as mobile applications, videogames, and virtual reality. “Neuropsychological interventions were scarce.” - only 4.8% of papers reviewed. (Gomez-de-Regil et al, 2019)

CBT was not effective in reducing the severity of PCS, but helped improve depression, anxiety, and social integration (Chen et al, 2020)

Cognitive Rehabilitation/Remediation

- Typically done by speech language pathologists (SLP) or occupational therapists (OT)
- Again – very important for this to be someone who understands the differences between mTBI and more severe injuries
- Although usually not a psychologist, it is important for the individual to have an understanding about the interactions between the physical, cognitive and psychological symptoms
- Essential to have this type of person on your “team”

Cognitive Remediation in mTBI

- Often times people are more willing to see an SLP or OT rather than a psychologist or therapist
- Can work in real time and look at factors impacting performance in the moment, rather than just completing a test
- Develop an ongoing relationship and more indepth insight
- Can practice strategies in more real-world settings
- Can speak to persistence, dedication and motivation

Support for Cognitive Remediation

Cicerone et al (2019) reviewed literature 2009-2014

- Did not separate out mTBI from more severe TBI or stroke

Found benefits for attention deficits, mild memory deficits, social-communication deficits, and metacognitive strategy training for executive functioning.

Allen (2019) – Comprehensive book chapter in Neurosensory Disorders in mTBI edited by Michael Hoffer and Carey Balaban

Cognitive Remediation

Restorative:

- Stimulate neural networks – based on well-known principles of neuroplasticity

Compensatory:

- Provide strategies or alternative work-arounds

Metacognition:

- Identifying, assessing, and self-calibrating one's own cognition and behavior

All provide:

- Tailored functional recovery strategies based on deficits as well as real-life situations
- Patient-centric care – consideration of patient's own cognitive complaints

For treatment - Understanding comorbid disorders/pre-injury and post-injury symptoms

- Understand primary cause versus causes that are intensifying, overlapping, or imitating cognitive impairments
- Are there certain symptoms/comorbidities that should be treated first, or that could fully “cure” an individual’s cognitive difficulties?
- Account for an individual’s environment/context/situation
- Account for an individual’s ability to engage and respond in treatment
- This is often why “multidisciplinary treatment” can be more successful (i.e. Janak et al, 2017)

The Good, the Bad and the Ugly

- mTBI and PCS are complex and heterogenous
- There are many types of symptoms and many potential contributing factors
- There are difficulties in all level of care ... diagnosis, evaluation, and treatment
- There are things that we can do that can make it better, but also could make it worse
- There is a lot of conflicting and non-definitive research out there
- These patients will keep us all busy for a long time!!!

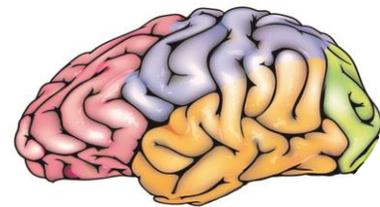
Neuropsychology is critical

- We are uniquely qualified with the background in “neuro” and “psychology”
- We are trained in the unique interaction of these two things
- Both are equally important in the management of mTBI
- We have more time and more tools than any other professional to evaluate these patients
- These patients are suffering
- We can do better in improving our evaluations, increasing our understanding, finding better measurement tools, and especially in providing successful treatment options

Conclusions

- We need to evaluate and treat the symptoms
- The diagnosis is relevant and important to some degree, but is not required and necessarily the most important thing
- There are MANY factors involved in every individual's unique presentation
- A biopsychosocial model is helpful
- As neuropsychologists we are uniquely qualified to understand both the NEURO and the PSYCHOLOGICAL

mTBI is like pie You may get a neat slice



You may see things that are very familiar ...



You may get layers, something that is “out of the box” or a soupy mix of stuff ...



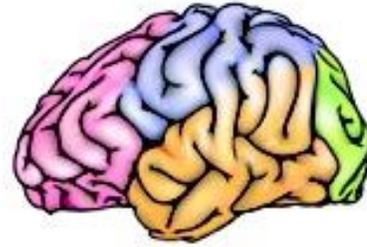
And sometimes it is an ooey, gooey mess and you just have to dig in and try your best.



Final Quote

“If the brain were so simple that we could understand it, we would be so simple that we could not.”

-- Lyall Watson



**NEUROPSYCHOLOGY
AND COGNITIVE HEALTH**

Please feel free to contact me if you have any additional questions.

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