

## Advancing Neuropsychiatric Care: Connecting Brain Injury Treatment to Better Outcomes

Session 1: Introduction and Recognizing Behavioral,  
Emotional, Cognitive Symptoms in Brain Injury

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Matthew Peters, MD  
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Johns Hopkins University School of Medicine

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## Disclosure Summary

**Full Disclosure Policy Affecting CME Activities**

As a provider approved by the Accreditation Council for Continuing Medical Education (ACCME), Johns Hopkins University School of Medicine Office of Continuing Medical Education (OCME) requires attested and signed global disclosure of the existence of all financial interests or relationships with commercial interest from any individual in a position to control the content of a CME activity sponsored by OCME. The following relationships have been reported for this activity:

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Medications discussed are considered off label and not FDA approved for TBI

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## Objectives

- Identify the course components of this seminar series
- Recognize common behavioral, emotional, and cognitive symptoms following brain injury
- Describe the Online Brain Injury Screening and Support System
- Apply above knowledge to a brain injury case presentation

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Webinar Series Schedule

- ▶ **Session 1:** Introduction and Recognizing Behavioral, Emotional, and Cognitive Symptoms in Brain Injury
- ▶ **Session 2:** Pharmacotherapy for Behavioral, Emotional, and Cognitive symptoms in Brain Injury
- ▶ **Session 3:** Psychotherapeutic Approaches, Psychosocial Education, and Family Support for Patients with Brain Injury
- ▶ **Session 4:** Structuring Environments for Safe, Therapeutic Management of Brain Injuries and Seminar Series Recap and Wrap-up

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Roadmap of Today's Session

- ▶ Introductions
- ▶ Phenomenology and Epidemiology
- ▶ Overview of emotional sequelae after brain injury
- ▶ Overview of behavioral sequelae after brain injury
- ▶ Overview of cognitive sequelae after brain injury
- ▶ Q&A #1
- ▶ **BREAK**
- ▶ Online Brain Injury Screening and Support System
- ▶ Example Case discussion
- ▶ Real-time case discussion(s)
- ▶ Wrap-up



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Real-Time Case Discussions

- ▶ Following the break, Drs. Peters & Roy will present an example case discussion relevant to the presentation thus far
- ▶ As a participant, we encourage you to present an interesting case or a case you'd like advice or feedback on
- ▶ For this session, the case discussion will focus on symptom presentation and patient evaluation
- ▶ Important details when presenting:
  - The case must NOT contain identifying information
  - Start with a brief one-liner of the case and the question you'd like answered (e.g., trouble eliciting symptoms, confusing formulation, lack of syndrome in setting of symptoms)
  - Present the most relevant components of the case as they pertain to symptom presentation and patient evaluation – ideally 5 minutes or less
  - And most importantly, we can learn / teach from any case! If you are not sure if you should share, you SHOULD!

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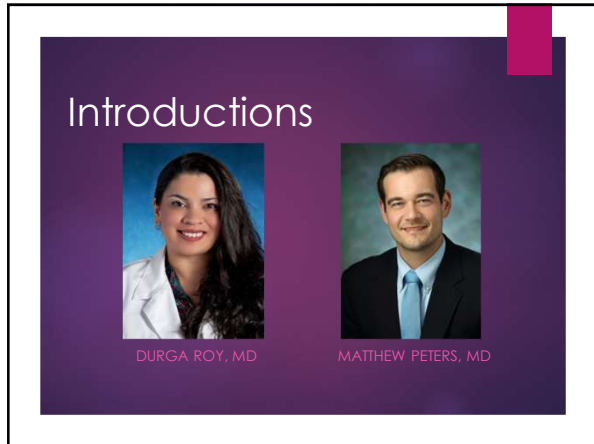
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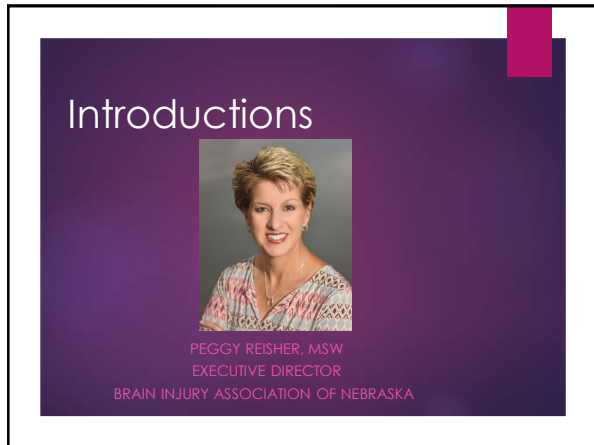
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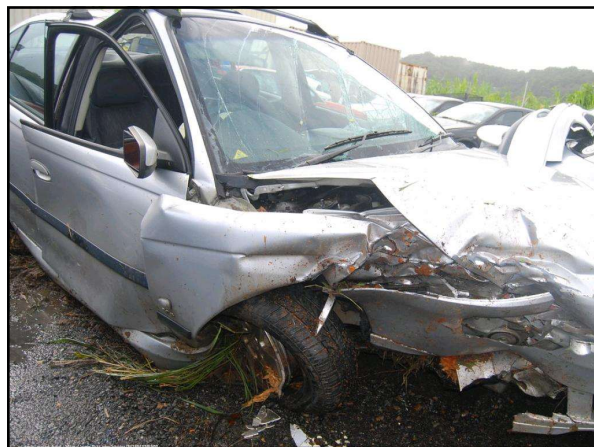
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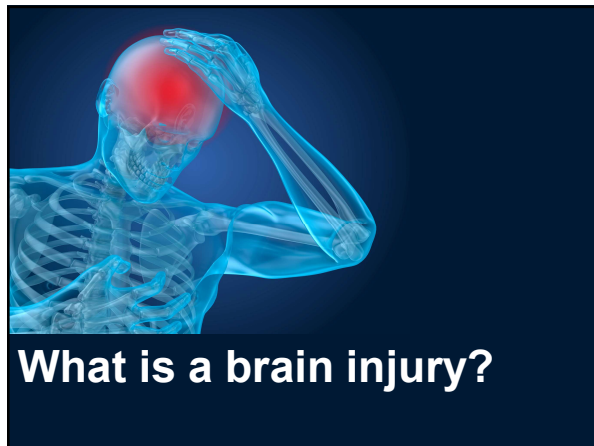
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## What is a brain injury?

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### Acquired Brain Injury

- ▶ Any type of brain injury that transpires post-birth
- ▶ **Not** resulting from
  - congenital disorders
  - degenerative diseases
  - brain trauma at birth
- ▶ Leads to changes in the normal neuronal tissue activity
- ▶ Leads to changes in brain structure

Goldman et al. 2022

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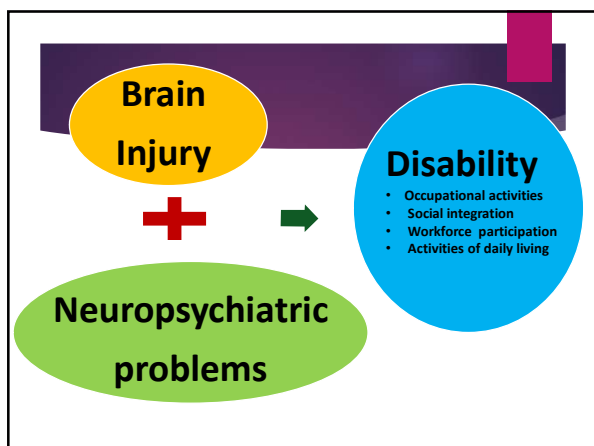
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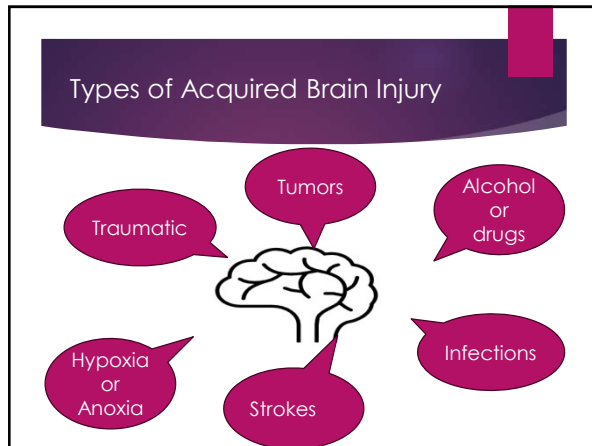
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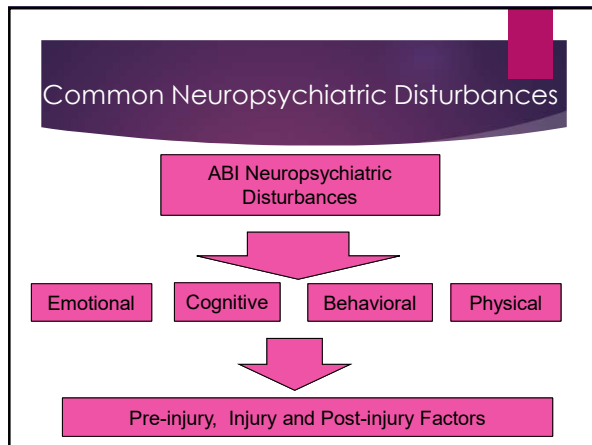
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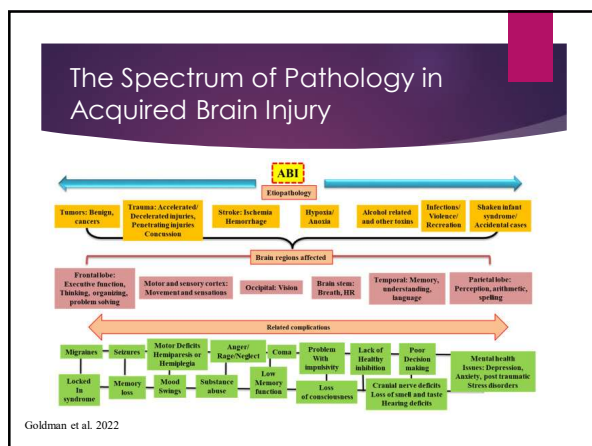
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### Vulnerable Brain Regions

**Dorsolateral prefrontal cortex**

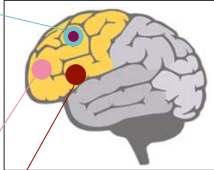
- Difficulties in switching parameters and planning
- Slowness in performance
- Low frustration tolerance

**Orbitofrontal prefrontal cortex**

- Disinhibition
- Impulsivity

**Ventromedial prefrontal cortex**

- Apathy



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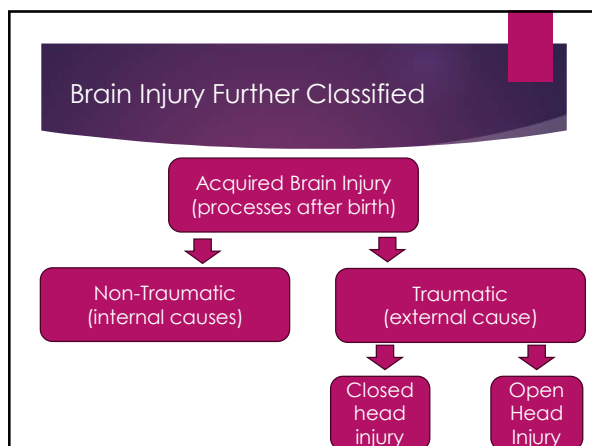
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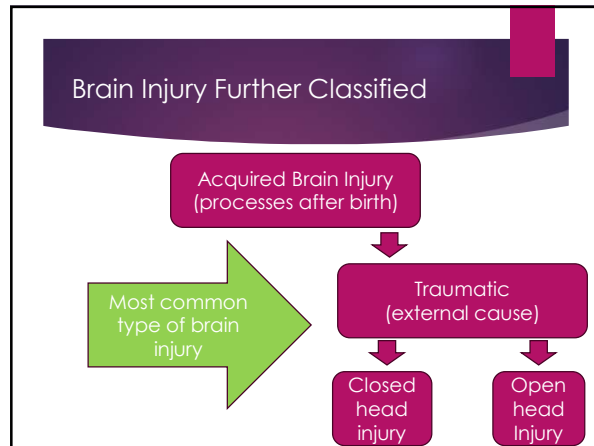
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### Traumatic Brain Injury Definition

► Traumatically induced physiological disruption of brain function

- loss of consciousness
- loss of memory
- alteration in mental state
- +/- focal neurological deficits or head imaging findings

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### TBI as a Public Health Problem

- 3.6 million TBIs in the US annually
- 3.2 to 5.3 million with TBI-related disability
- \$60-221 billion in annual direct and indirect medical costs
- 43% with functional or neuropsychiatric sequelae

Taylor et al 2017, Albrecht 2019, Faul 2010

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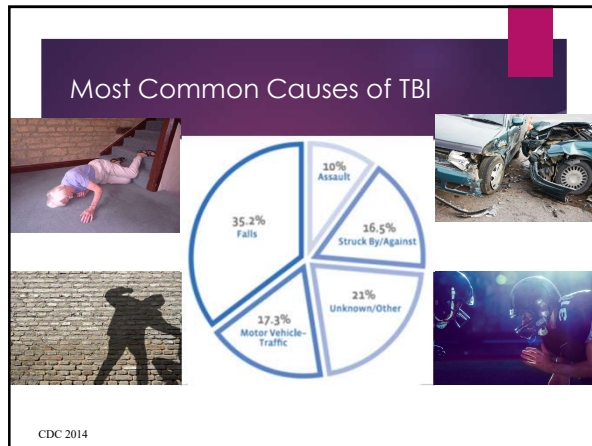
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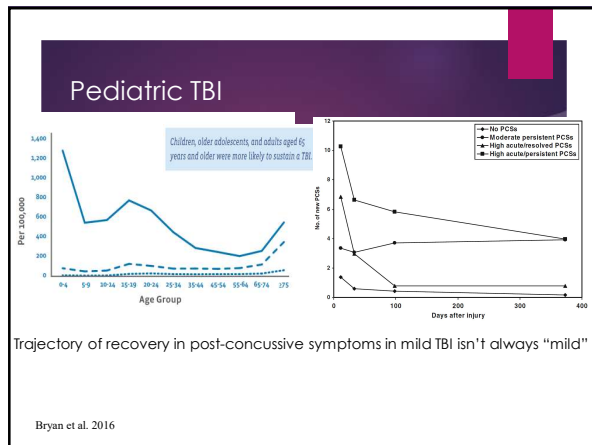
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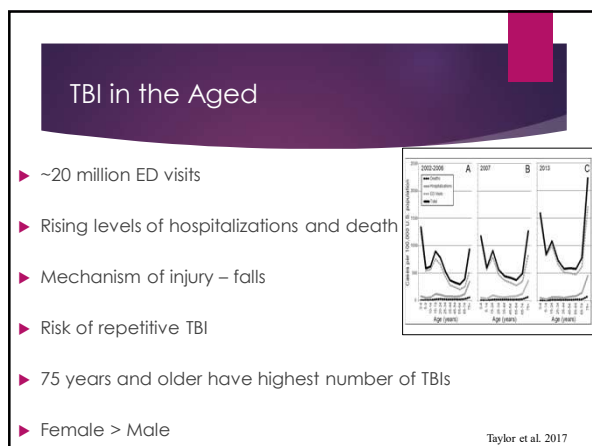
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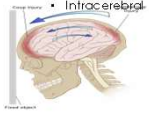
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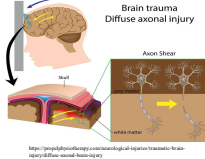


## Focal versus Diffuse Injury

- Focal
  - Cerebral Contusion
  - Hematoma
    - Subdural
    - Epidural
    - Intracerebral



- Diffuse
  - Diffuse Axonal Shearing



<https://www.acquiredbraininjury-education.scot.nhs.uk/wp-content/uploads/contracoup.png>

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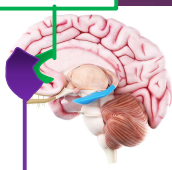
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**ROSTRAL ANTERIOR CINGULATE CORTEX**  
 ↓ Gray Matter Volume



**PREFRONTAL CORTEX**  
 ↓ Gray Matter Volume

↓ White matter tract integrity:
 

- cingulum
- internal capsule
- longitudinal fasciculi
- anterior/posterior corona radiata

Medeiros et al. 2022

**Journal of Neurotrauma**  
 REVIEW  
 Neuroimaging Correlates of Depression after Traumatic Brain Injury: A Systematic Review  
 Santos C, Medeiros C, Costa T, et al. (2022) Neuroimaging Correlates of Depression after Traumatic Brain Injury: A Systematic Review. *Journal of Neurotrauma*. doi:10.1089/neuro.2022.10000

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## Recognizing Neuropsychiatric Symptoms in Brain Injury



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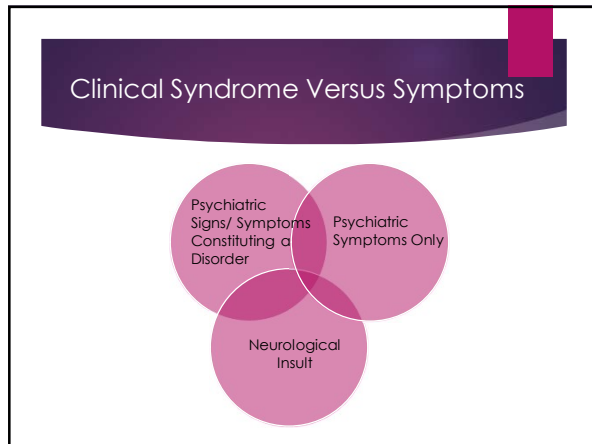
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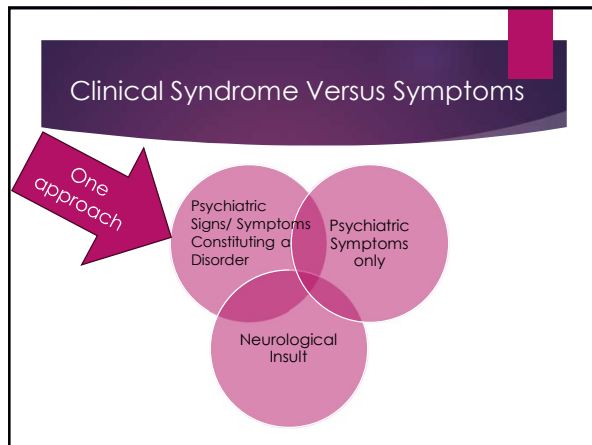
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### Prevalence of Psychiatric Syndromes After TBI

Psychiatric Syndromes	Prevalence in Gen. Pop	Prevalence after TBI
Major Depression	10%	35%
Mania	1-2%	1-9 %
Schizophrenia	1 %	1-7 %
Anxiety disorders	18 %	25 %
Substance Abuse	4 %	25 %
New Behavior Problems		25 %

Deb et al. 1998; Kessler et al. 2004

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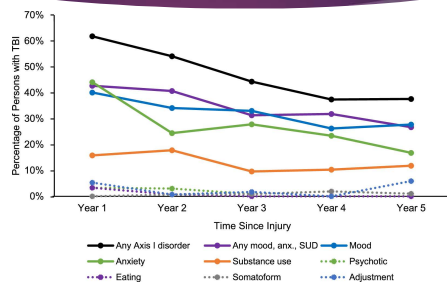
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## Syndrome-Focused Approach

Syndromes	Prevalence	Core Features
Cognitive Impairment	5%-60%	<ul style="list-style-type: none"> <li>Poor Memory</li> <li>Poor attention/processing speed</li> <li>Executive dysfunction</li> </ul>
Major Depressive Disorder	13-53%	<ul style="list-style-type: none"> <li>Low mood</li> <li>Irritability</li> <li>Suicidal ideation</li> </ul>
Bipolar Mania	1-9%	<ul style="list-style-type: none"> <li>Euphoric mood</li> <li>Irritability</li> <li>Impulsivity</li> </ul>
Anxiety Disorders	11-70%	<ul style="list-style-type: none"> <li>Persistent worry</li> <li>Autonomic arousal</li> </ul>
Apathy	10%	<ul style="list-style-type: none"> <li>Lack of motivation or drive, loss of initiative</li> <li>Euthymic mood</li> </ul>

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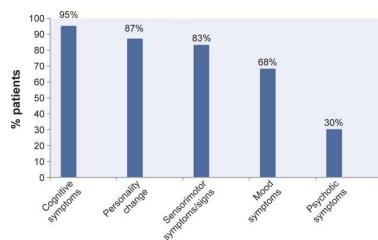
## Psychiatric Disorders after TBI



Howlett et al. 2022

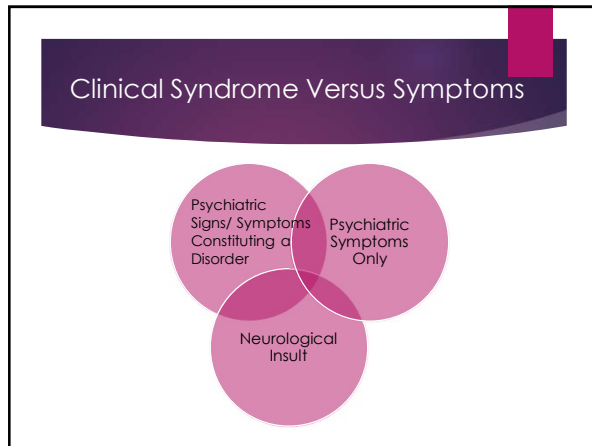
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## Psychiatric Symptoms Linked to Psychiatric Disorders in TBI



Lauterbach et al. 2015

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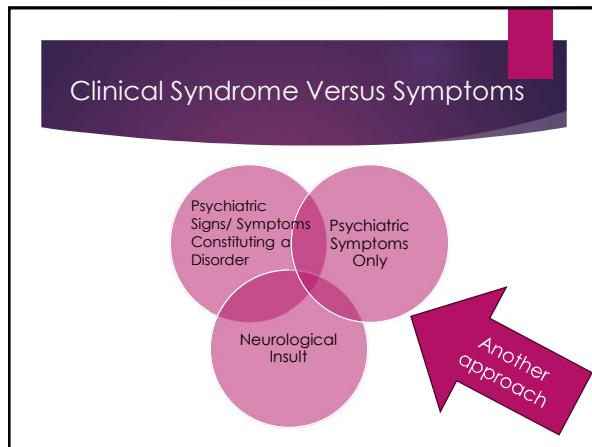
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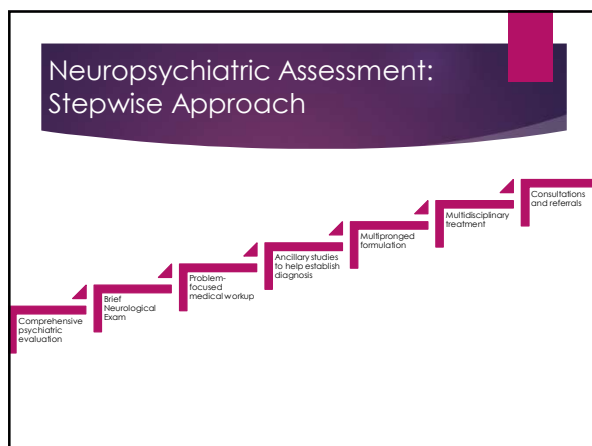
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A Symptom-Focused Approach:  
A Phenomena of Dyscontrol

Behavioral		
Aggression		
Agitation		
Disinhibition		

Arciniegas 2015

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A Symptom-Focused Approach:  
A Phenomena of Dyscontrol

Behavioral	Emotional	
Aggression	Affective lability	
Agitation	Pathological laughter and crying	
Disinhibition	Irritability	

Arciniegas 2015

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A Symptom-Focused Approach:  
A Phenomena of Dyscontrol

Behavioral	Emotional	Cognitive
Aggression	Affective lability	Slower processing speed
Agitation	Pathological laughter and crying	Poor verbal learning
Disinhibition	Irritability	Impaired executive function

Arciniegas 2015

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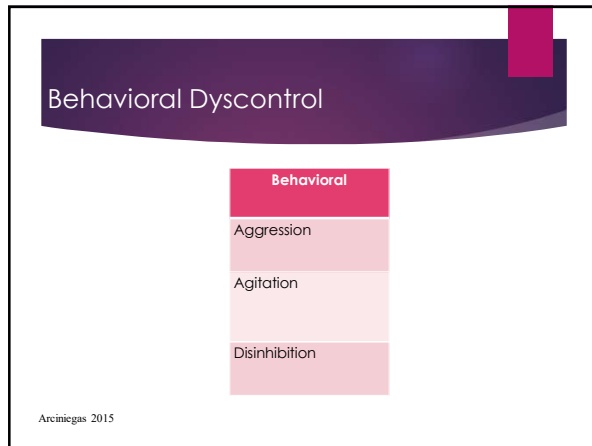
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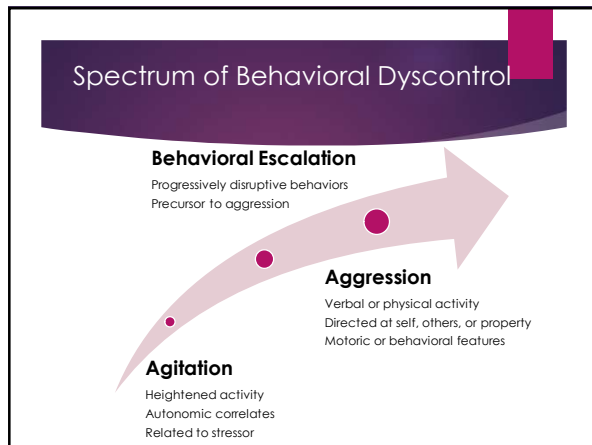
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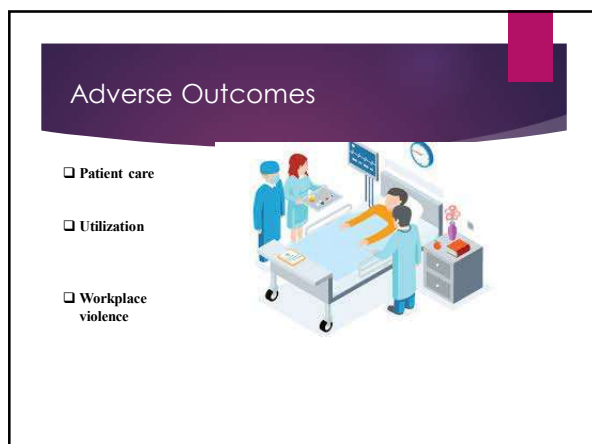
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### Behavioral Dyscontrol: Definitions

Behavioral Dyscontrol	Definition
Aggression	Impulsive acts in response to internal or external stimuli
Agitation	Verbal outbursts/physical violence to objects other people
Disinhibition	Heightened verbal/motor activity that is not goal directed
	Socially/ contextually inappropriate nonaggressive acts

Arciniegas et al. 2015, Poeck 1969, Beresford et al. 2005

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### Behavioral Dyscontrol: Characteristics

Behavioral Dyscontrol	Characteristics
Aggression	Purposeful, reactive, explosive, nonreflective, periodic
Agitation	Non-purposeful, restless, lack of goal direction
Disinhibition	Nonreflective to social and cultural behavioral norms May be hypersexual

Arciniegas et al. 2015, Yudofsky et al. 1986, Fava et al. 1997

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### Behavioral Dyscontrol: Correlates

Behavioral Dyscontrol	Correlates
Aggression	<ul style="list-style-type: none"> <li>Associated with pre-injury personality disorders</li> <li>Common in mood disorders (psychotic mania)</li> <li>Common in 30-80% severe TBI</li> <li>Various aggression scales used in clinical practice</li> </ul>
Agitation	<ul style="list-style-type: none"> <li>Commonly seen in post-traumatic delirium</li> <li>More likely in those cognitively impaired</li> <li>Worsened by restraints</li> </ul>
Disinhibition	<ul style="list-style-type: none"> <li>12%-32% of those with moderate to severe TBI</li> <li>Impaired social cognition and comportment</li> <li>NPI scale can capture symptoms</li> </ul>

Arciniegas et al. 2015, Flanagan et al. 2009, Lauterbach et al. 2015

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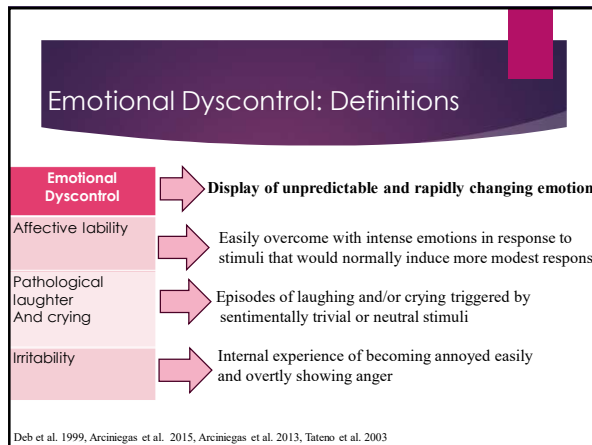
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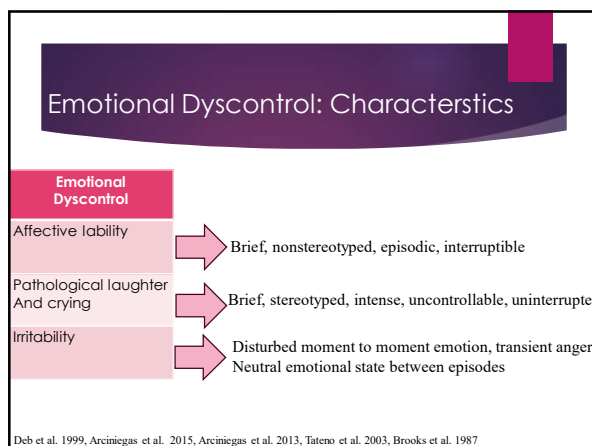
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### Emotional Dyscontrol: Correlates

Emotional Dyscontrol	Correlates
Affective lability	<ul style="list-style-type: none"> <li>Prevalence of 28% in the three months after injury</li> <li>Can occur amidst depressive and manic episodes</li> <li>CNS-LS or the NPI-C can capture symptoms</li> </ul>
Pathological laughter and crying	<ul style="list-style-type: none"> <li>Highly comorbid in mood disorders</li> <li>Rates of 5-11% within a year of injury</li> <li>Associated with damage to frontal cortices, internal capsule, and/or pontocerebellar structures</li> </ul>
Irritability	<ul style="list-style-type: none"> <li>Highly comorbid in those with pre-existing psychiatric illness</li> <li>Rates of 12 % at 12 months after injury</li> <li>Common in severe TBI and post-concussive syndrome</li> </ul>

Walker et. al 2010, Wortzel et al. 2008  
Arciniegas et al. 2015, Roy et al. 2015

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### Cognitive Dyscontrol

Cognitive
Slower processing speed
Poor verbal learning
Impaired executive function

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### Cognitive Dyscontrol: Definitions

Cognitive Dyscontrol	Definition
Slower processing speed	Decreased rate in acquiring, processing and responding to new information
Poor verbal learning	Inability to acquire, retain and utilize information through language
Impaired executive function	Impairment in goal-directed behavior involved in organizing thoughts and purposeful tasks

Deb et al. 1999, Arciniegas et al. 2015, Arciniegas et al. 2013, Tatenio et al. 2003

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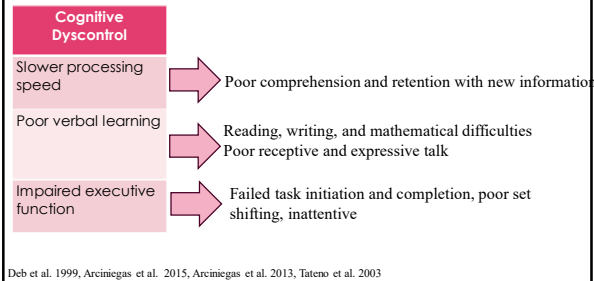
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## Cognitive Dyscontrol: Characteristics



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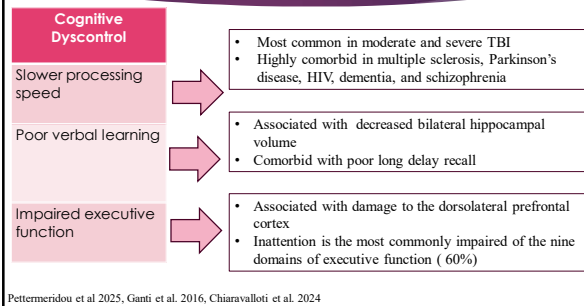
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## Cognitive Dyscontrol: Correlates



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## Summary

- ▶ Presentation doesn't always fit the DSM "psychiatric disorders"
- ▶ Unique phenomena of symptoms that is nuanced
- ▶ Behavioral, emotional and cognitive phenotypes have subtypes
- ▶ As clinicians, we need to be precise in our identification
- ▶ We still have long way to go in understanding TBI

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## Real-Time Case Discussions

- ▶ Following the break, Drs. Peters & Roy will present an example case discussion relevant to the presentation thus far
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## OBISSS

Online Brain Injury Screening and Support System


- Helps identify lifetime history of brain injury
- Offers tip sheets to help manage symptoms
- Self-administered
- Free for all to use
- **Note:** This screening tool is not a medical evaluation and does not provide a diagnosis.

**Access OBISSS Now:**

**OBISSS Link:** [nashia.org/obiss](https://nashia.org/obiss)

**State:** Nebraska

**Password:** 402



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SECTION 1: In recent weeks, how much have you been bothered by the following problems?					
	This is not a problem for me.	I have this problem but it does not bother me.	This problem bothers me sometimes.	This problem bothers me often.	This problem bothers me all the time.
I lose and misplace important things, like my homework or cellphone.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I forget what people tell me.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
I forget what I have just read.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
I lose track of time.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
I forget what I just did yesterday.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
I forget things I just learned.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
I forget to go to practice or to be on time to meetings.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I forget to turn off my gadgets and electronic devices, like my cell phone or game console.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Section 2: In recent weeks, how much have you been bothered by the following problems?					
	This is not a problem for me.	I have this problem but it does not bother me.	This problem bothers me sometimes.	This problem bothers me often.	This problem bothers me all the time.
I have trouble following what my parents or teachers are saying.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When someone gives me directions, I can't remember all the steps.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
People talk too quickly or expect me to understand too fast.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

Section 3: In recent weeks, how much have you been bothered by the following problems?					
	This is not a problem for me.	I have this problem but it does not bother me.	This problem bothers me sometimes.	This problem bothers me often.	This problem bothers me all the time.
I cannot pay attention or concentrate.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I am easily distracted.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
I cannot pay attention in noisy places.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
It's hard for me to know what people are talking about.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
It's hard for me to focus on my homework or chores.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Section 4: In recent weeks, how much have you been bothered by the following problems?					
	This is not a problem for me.	I have this problem but it does not bother me.	This problem bothers me sometimes.	This problem bothers me often.	This problem bothers me all the time.
I say things I don't mean to say.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I do things I don't mean to do.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I don't follow directions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Other people say I talk too fast.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
When other people are talking.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

Section 5: In recent weeks, how much have you been bothered by the following problems?					
	This is not a problem for me.	I have this problem but it does not bother me.	This problem bothers me sometimes.	This problem bothers me often.	This problem bothers me all the time.
Parts of my body hurt often.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do not get a good night's sleep.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I feel tired.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bright lights bother my eyes.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
I sometimes have trouble seeing (fuzzy vision).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I have trouble telling how close or far something is to me (I run into furniture or trip on the stairs).	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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**Section 6: In recent weeks, how much have you been bothered by the following problems?**

	This is not a problem for me.	I have this problem but it does not bother me.	This problem bothers me sometimes.	This problem bothers me often.	This problem bothers me all the time.
It's hard to understand what people tell me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
It's hard to understand what I've read.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I cannot find the right word when I am talking.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Other people don't understand what I am saying.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
It's hard for me to write down my thoughts.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

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**Section 7: In recent weeks, how much have you been bothered by the following problems?**

	This is not a problem for me.	I have this problem but it does not bother me.	This problem bothers me sometimes.	This problem bothers me often.	This problem bothers me all the time.
It's hard for me to get to class or to other activities on time.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
It's hard to start important tasks first.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
It's hard to start activities or tasks in general.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It's hard for me to switch between tasks.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
It's hard for me to finish the tasks I start.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I make mistakes when I complete a task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I often turn in my homework late or forget I have homework.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

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**Section 8: In recent weeks, how much have you been bothered by the following problems?**

	This is not a problem for me.	I have this problem but it does not bother me.	This problem bothers me sometimes.	This problem bothers me often.	This problem bothers me all the time.
If I have a new problem, I don't know how to solve it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
When I make a decision, I don't change my mind.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
I like to finish tasks the way I first learned how to do them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
I don't understand why people do things differently than me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

**Section 9: In recent weeks, how much have you been bothered by the following problems?**

	This is not a problem for me.	I have this problem but it does not bother me.	This problem bothers me sometimes.	This problem bothers me often.	This problem bothers me all the time.
I feel worried or anxious.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
I feel bothered or annoyed.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I cry for no reason.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel sad a lot or don't care about my favorite things.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think about a bad thing that happened to me.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have big emotions (mad, sad, scared) when something small happens.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Maybe Sally's multiple injuries have impacted her ability

- She misses scheduled meetings with her counselor and required group meetings.

**MEMORY**

- Doesn't complete her required homework.

**ORGANIZATION**

- During 1 on 1 meetings, she seems to zone out and does not respond immediately to questions.

**DELAYED  
PROCESSING**

- Has a difficult time following basic instructions

**MENTAL  
TRACKING**

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