Substance Use Disorders, Risky Substance Use and Brain Injury

John D. Corrigan, PhD

Professor

Department of Physical Medicine and Rehabilitation

Director

Ohio Brain Injury Program

No Conflicts of Interest

I receive funding from:

- National Institute on Disability Independent Living and Rehabilitation Research (NIDILRR)
- Administration on Community Living (ACL) TBI State Partnership Program
- National Institute of Neurological Disorders and Stroke in the National Institutes of Health (NIH)

Objectives

At the conclusion of this presentation, participants will be able to describe:

- …the prevalence of traumatic brain injury (TBI) among persons with substance use disorders (SUD);
- …sources of problems self-regulating behavior for persons with TBI;
- …ways that brain injury affects SUD treatment;
- …new guidance and approaches to treating co-occurring TBI and SUD.

Lifetime Prevalence of TBI in Select Populations

Lifetime History of TBI:	Any TBI	TBI with LOC	Mod/Sev TBI

LOC = loss of consciousness; Mod/Sev = moderate or severe

Lifetime Prevalence of TBI in Select Populations

Lifetime History of TBI:	Any TBI	TBI with LOC	Mod/Sev TBI
General population of adults (*2-state; **3-state average)	33%*	22%**	5%**

LOC = loss of consciousness; Mod/Sev = moderate or severe

Lifetime Prevalence of TBI in Select Populations

Lifetime History of TBI:	Any TBI	TBI with LOC	Mod/Sev TBI
General population of adults (*2-state; **3-state average)	33%*	22%**	5%**
Psychiatric inpatients (Burg et al.)	66%	43%	19%

LOC = loss of consciousness; Mod/Sev = moderate or severe

Lifetime Prevalence of TBI in Select Populations

Lifetime History of TBI:	Any TBI	TBI with LOC	Mod/Sev TBI
General population of adults (*2-state; **3-state average)	33%*	22%**	5%**
Psychiatric inpatients (Burg et al.)	66%	43%	19%
Prisoners (*Shiroma et al; **Bogner & Corrigan)	60%*	50%*	14%**

LOC = loss of consciousness; Mod/Sev = moderate or severe

Lifetime Prevalence of TBI in Select Populations

Lifetime History of TBI:	Any TBI	TBI with LOC	Mod/Sev TBI
General population of adults (*2-state; **3-state average)	33%*	22%**	5%**
Psychiatric inpatients (Burg et al.)	66%	43%	19%
Prisoners (*Shiroma et al; **Bogner & Corrigan)	60%*	50%*	14%**
Homeless (*Stubbs et al.; **Bremner et al., Solliday-McRoy et al.)	53%*	47%**	25%*

LOC = loss of consciousness; Mod/Sev = moderate or severe

Lifetime Prevalence of TBI in Select Populations

Lifetime History of TBI:	Any TBI	TBI with LOC	Mod/Sev TBI
General population of adults (*2-state; **3-state average)	33%*	22%**	5%**
Psychiatric inpatients (Burg et al.)	66%	43%	19%
Prisoners (*Shiroma et al; **Bogner & Corrigan)	60%*	50%*	14%**
Homeless (*Stubbs et al.; **Bremner et al., Solliday-McRoy et al.)	53%*	47%**	25%*
SUD treatment (*Corrigan & Bogner; **Felde et al.)	65%*	40%**	17%*

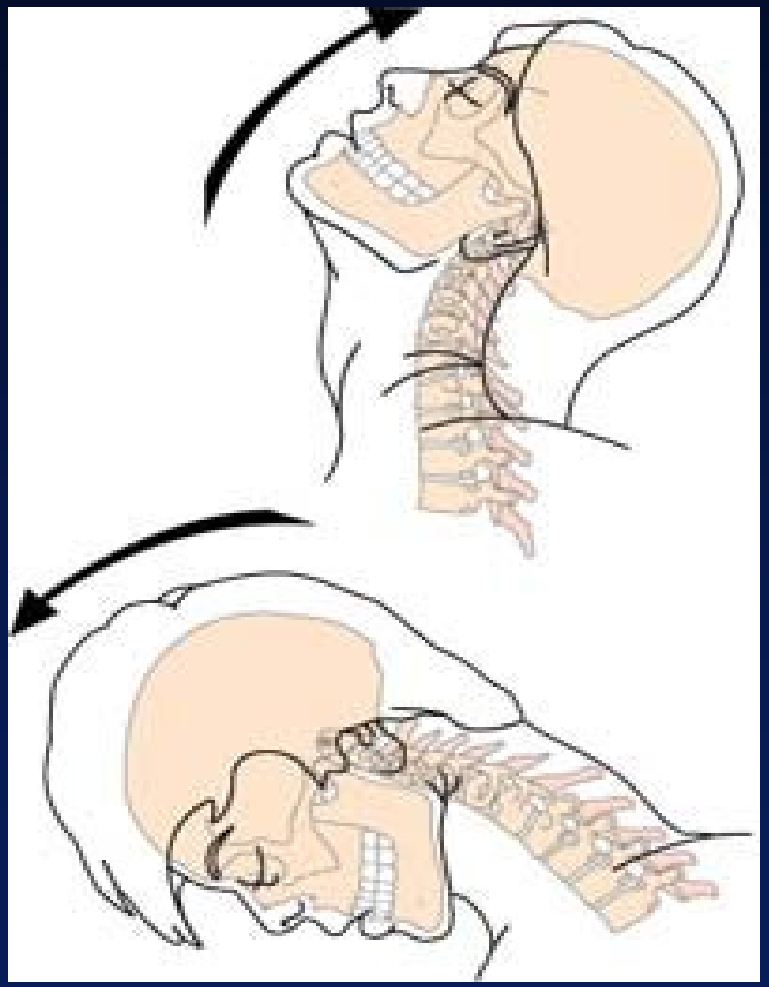
LOC = loss of consciousness; Mod/Sev = moderate or severe

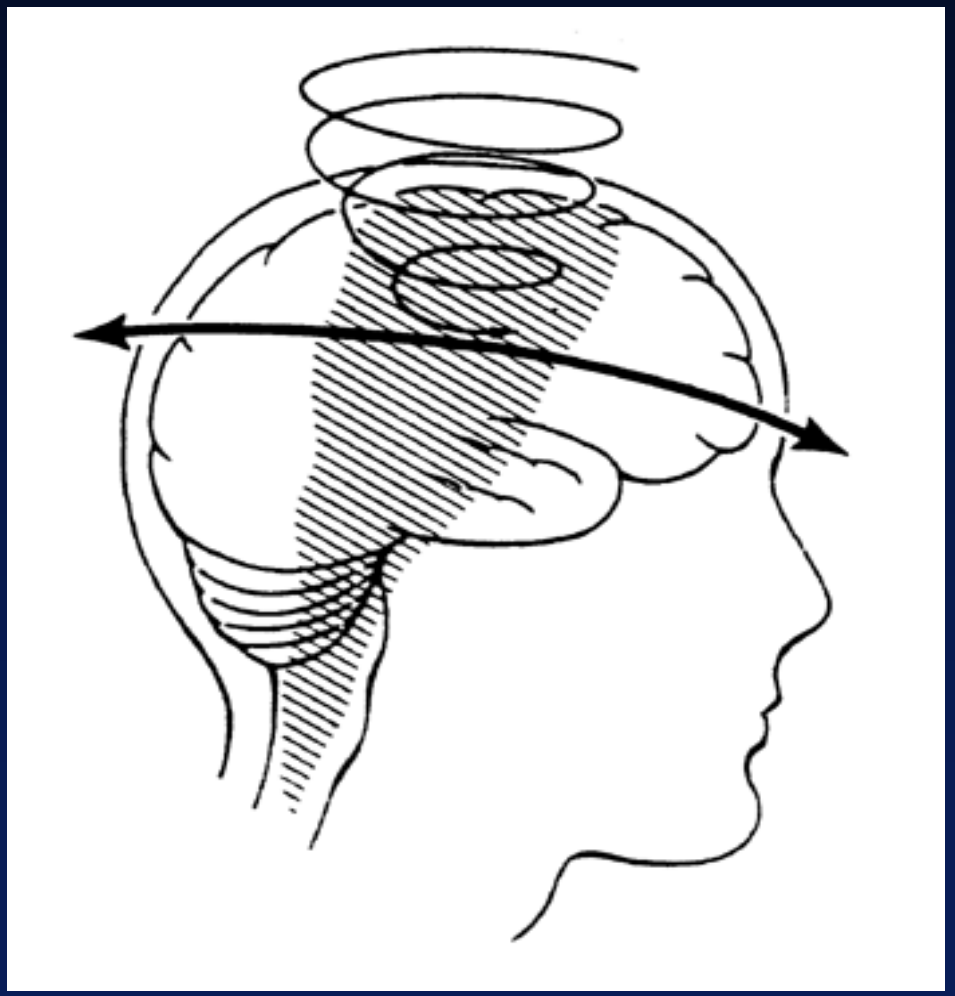
Why is TBI so common among these vulnerable populations?

The "Fingerprint" of TBI

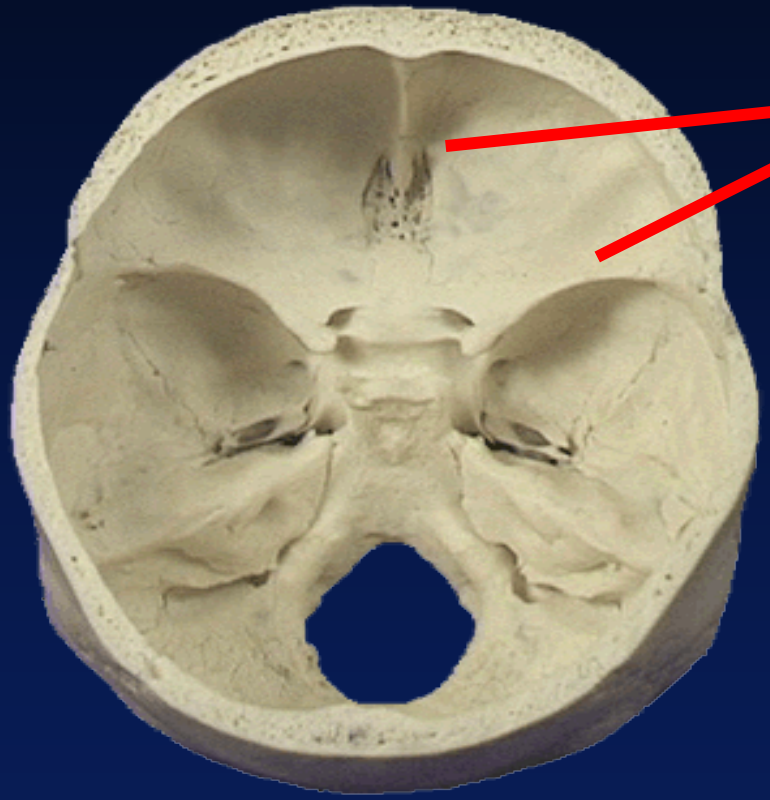
Frontal areas of the brain, including the frontal lobes, are the most likely to be injured as a result of TBI, regardless the point of impact to the head

The brain is set into motion along multiple axial planes

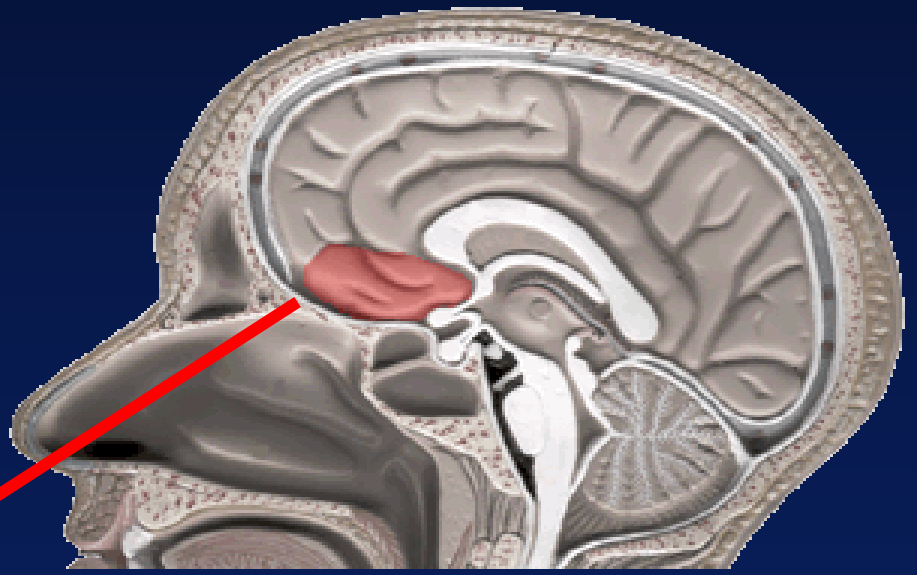




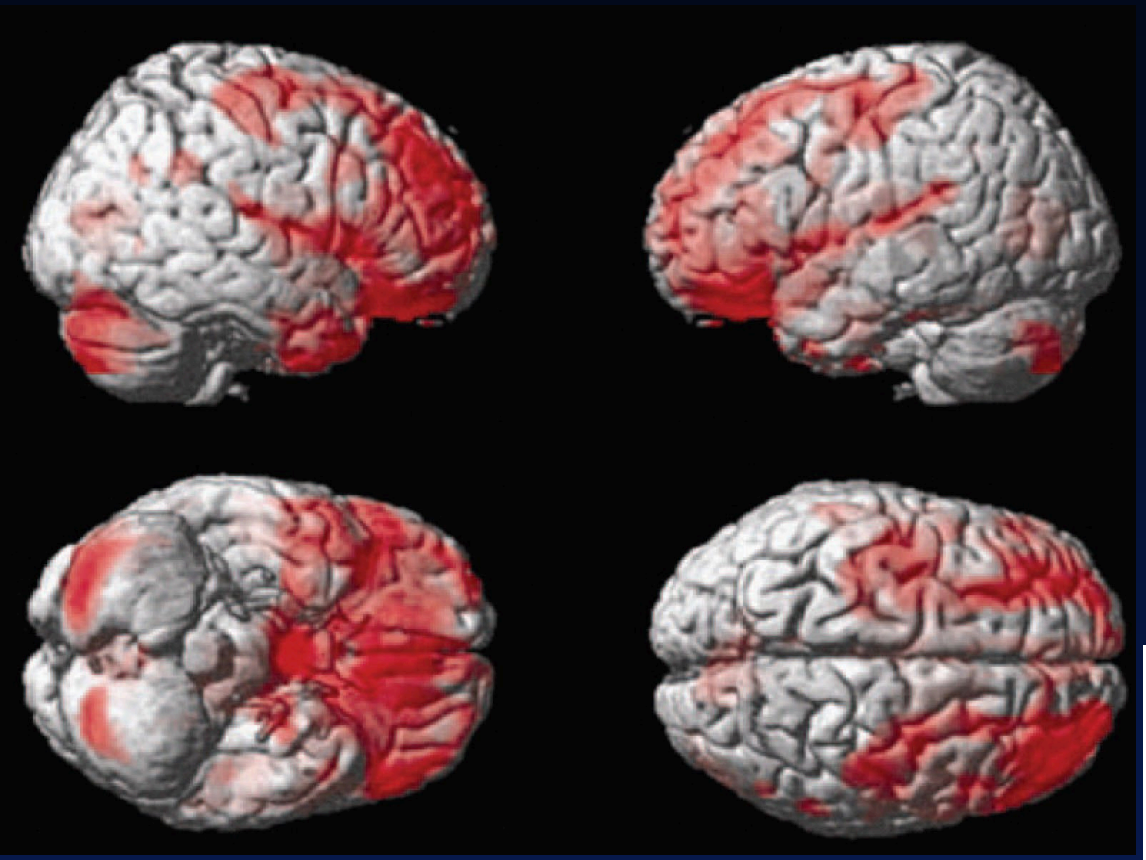
Interior Skull Surface



Bony ridges

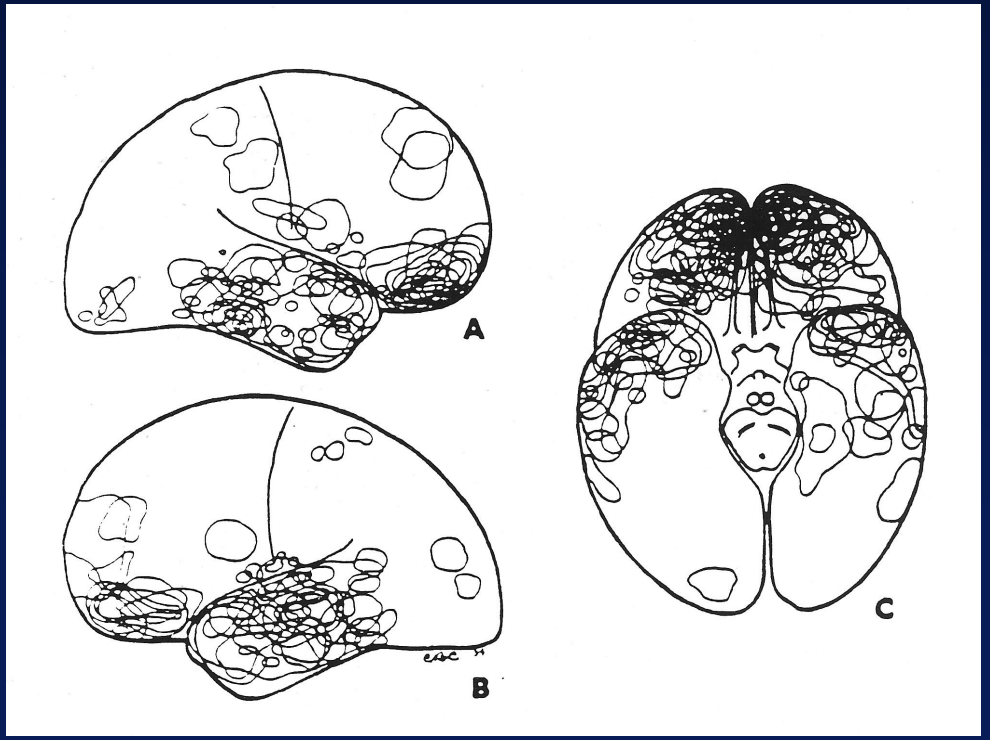


Injury from contact with skull



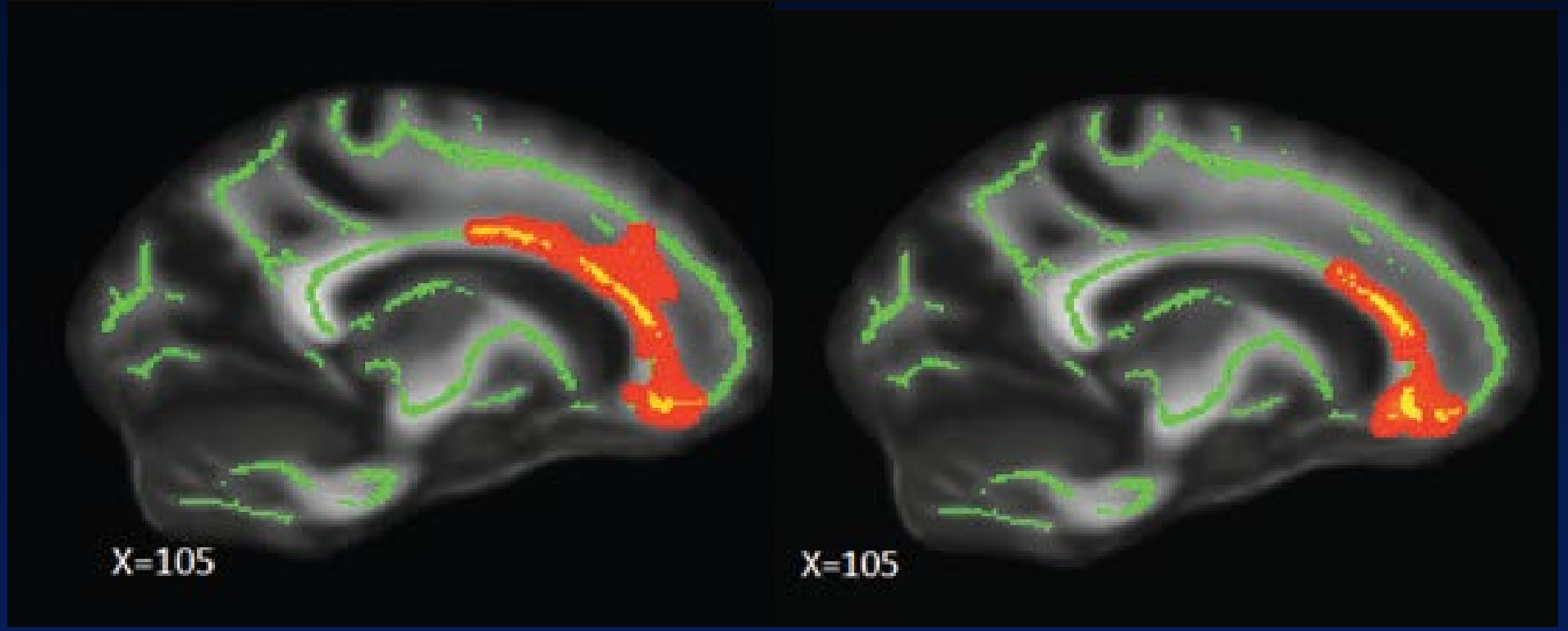
Loss of gray matter one year post-injury (Bigler, 2007)

Areas of contusion in (Courville, 1950)



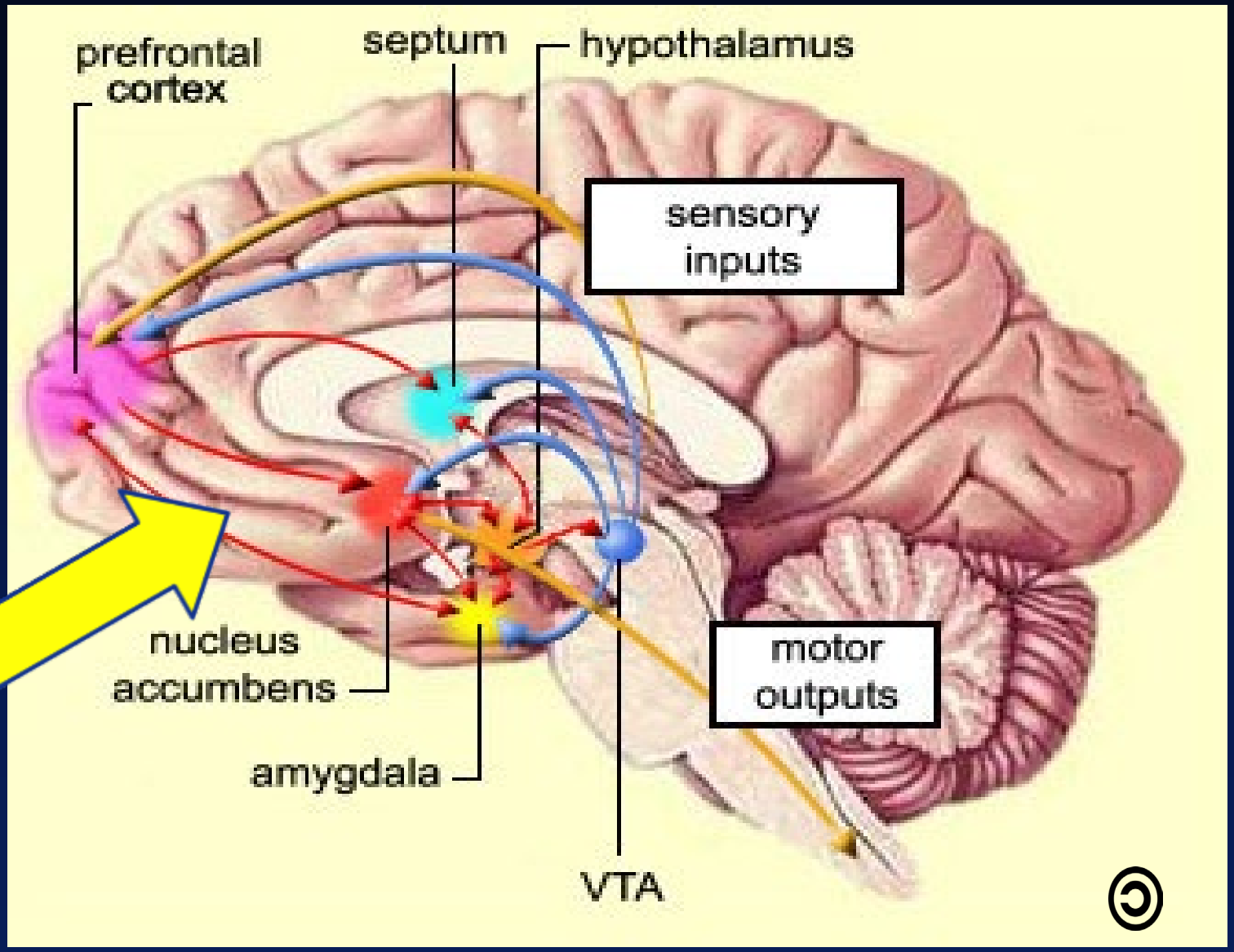
Diffusion Tensor Imaging

(Mustafi et al., 2018)



Axial Diffusivity

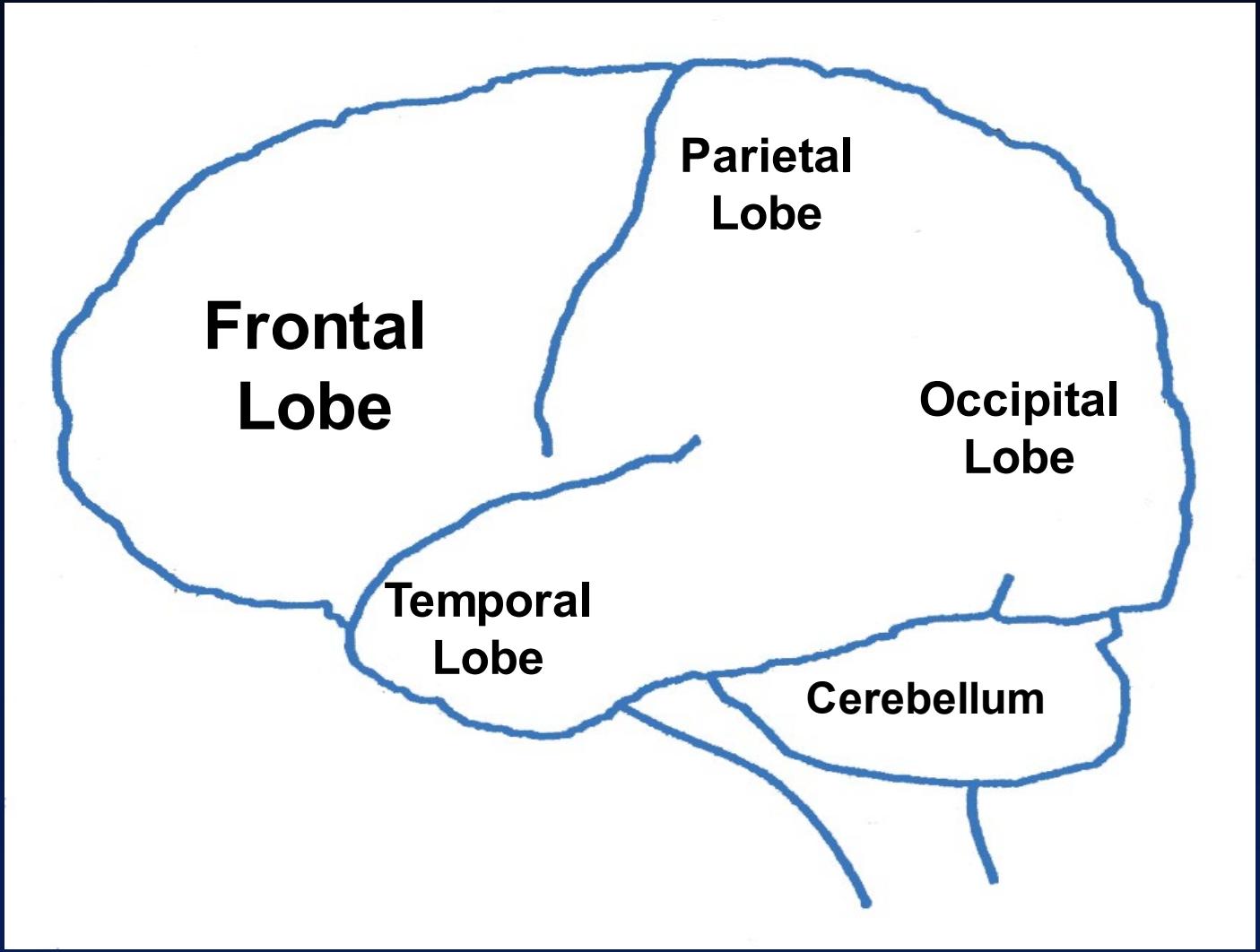
Mean Diffusivity


prefrontal cortex
septum
hypothalamus
sensory inputs
motor outputs
nucleus accumbens
amygdala
VTA

Simplified Brain Behavior Relationships

Frontal Lobes

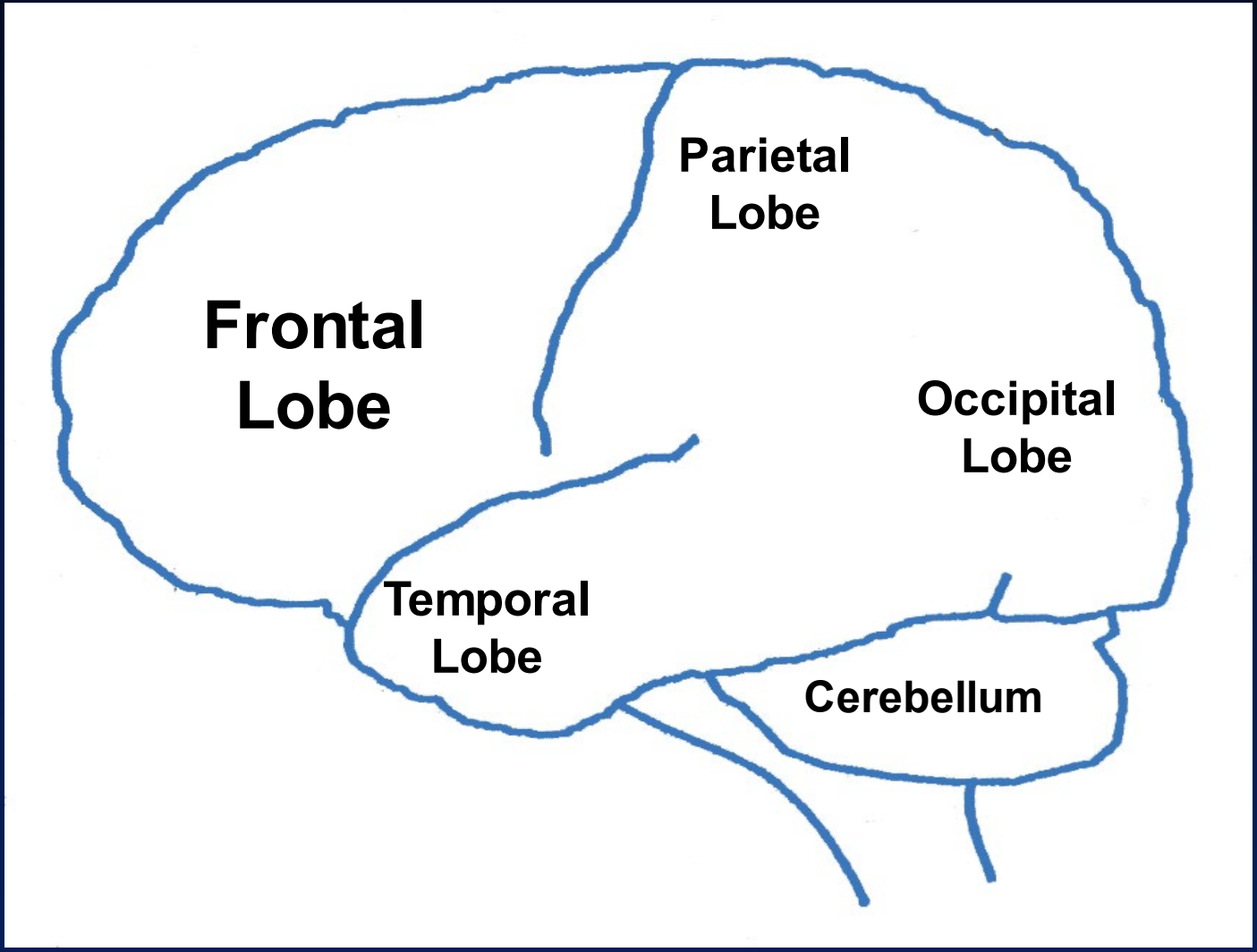
- Initiation
- Problem solving
- Judgment
- Inhibition of impulse
- Planning/anticipation
- Self-monitoring
- Motor planning
- Personality/emotions
- Awareness of self
- Organization
- Concentration
- Mental flexibility
- Speaking



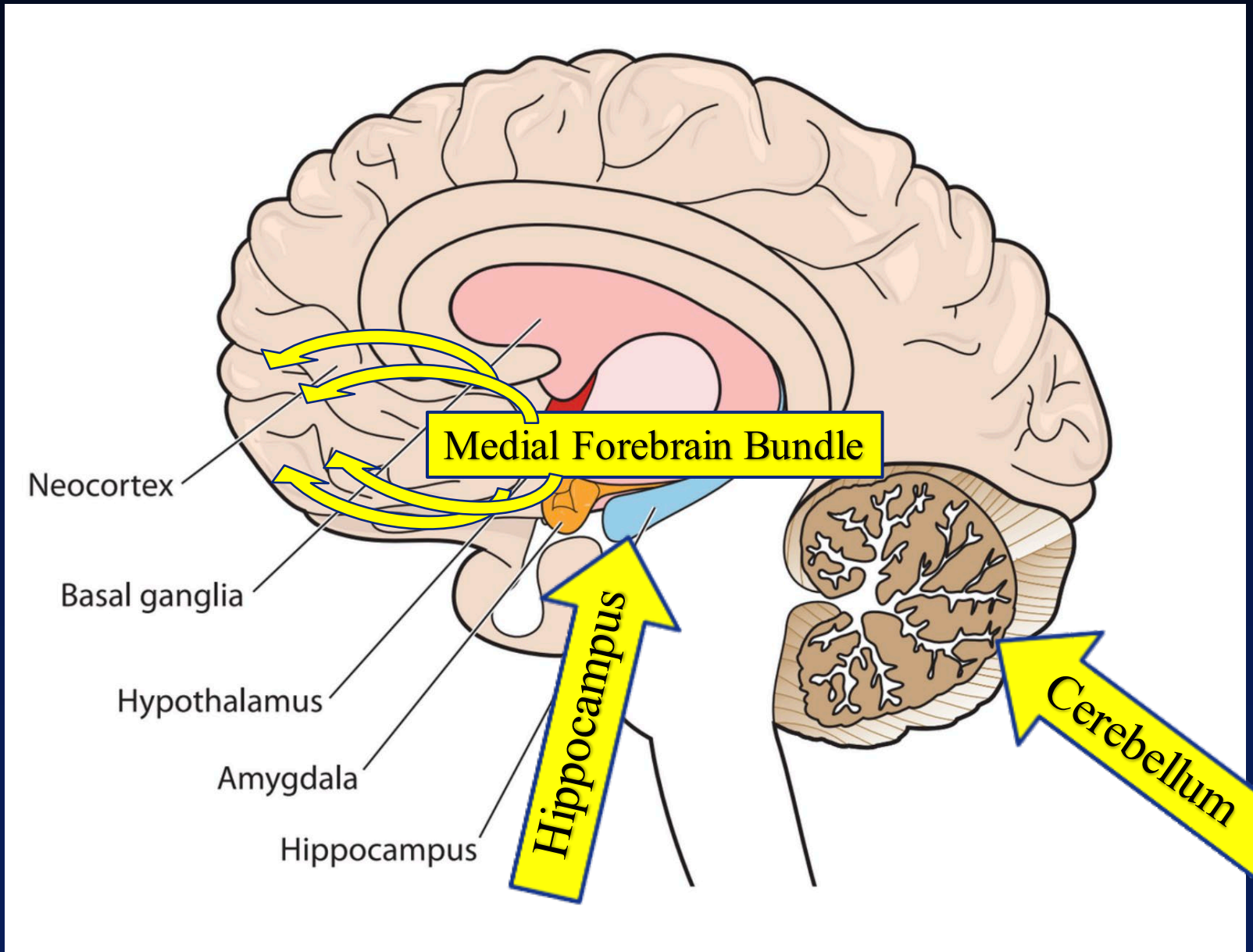
Simplified Brain Behavior Relationships

Frontal Lobes

- Initiation
- Problem solving
- Judgment
- Inhibition of impulse
- Planning/anticipation
- Self-monitoring
- Motor planning
- Personality/emotions
- Awareness of self
- Organization
- Concentration
- Mental flexibility
- Speaking

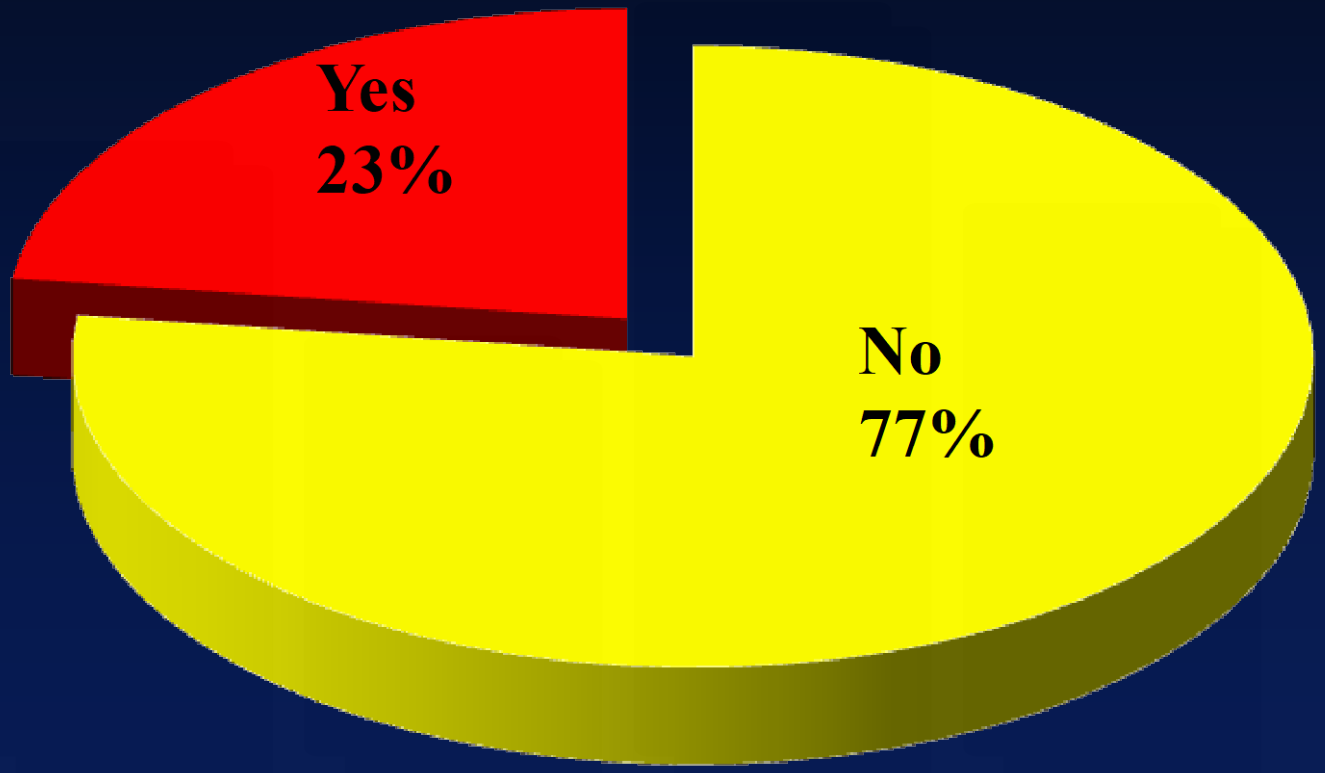


Anoxic/Hypoxic Brain Damage



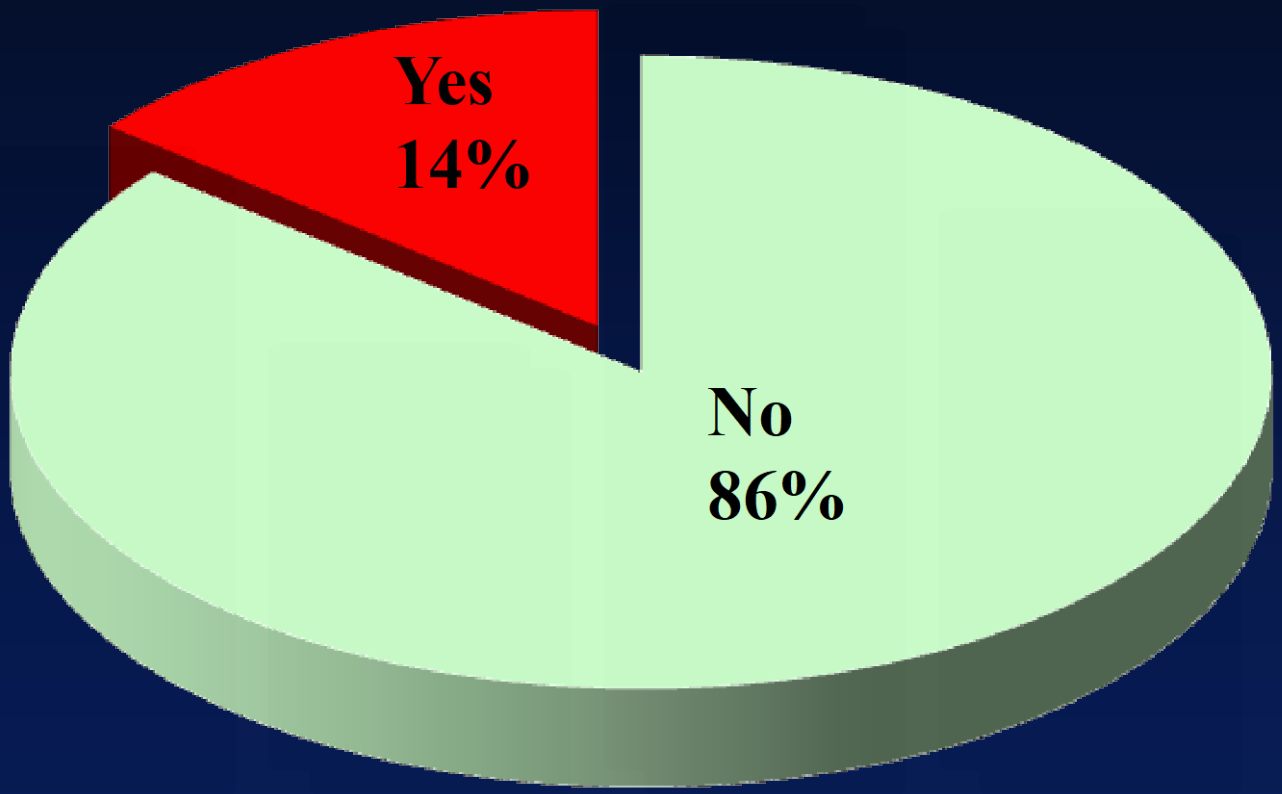
At-risk substance use after rehabilitation for TBI

Pre-Injury Risky Alcohol Use Among US Adult Civilians in Rehab for TBI



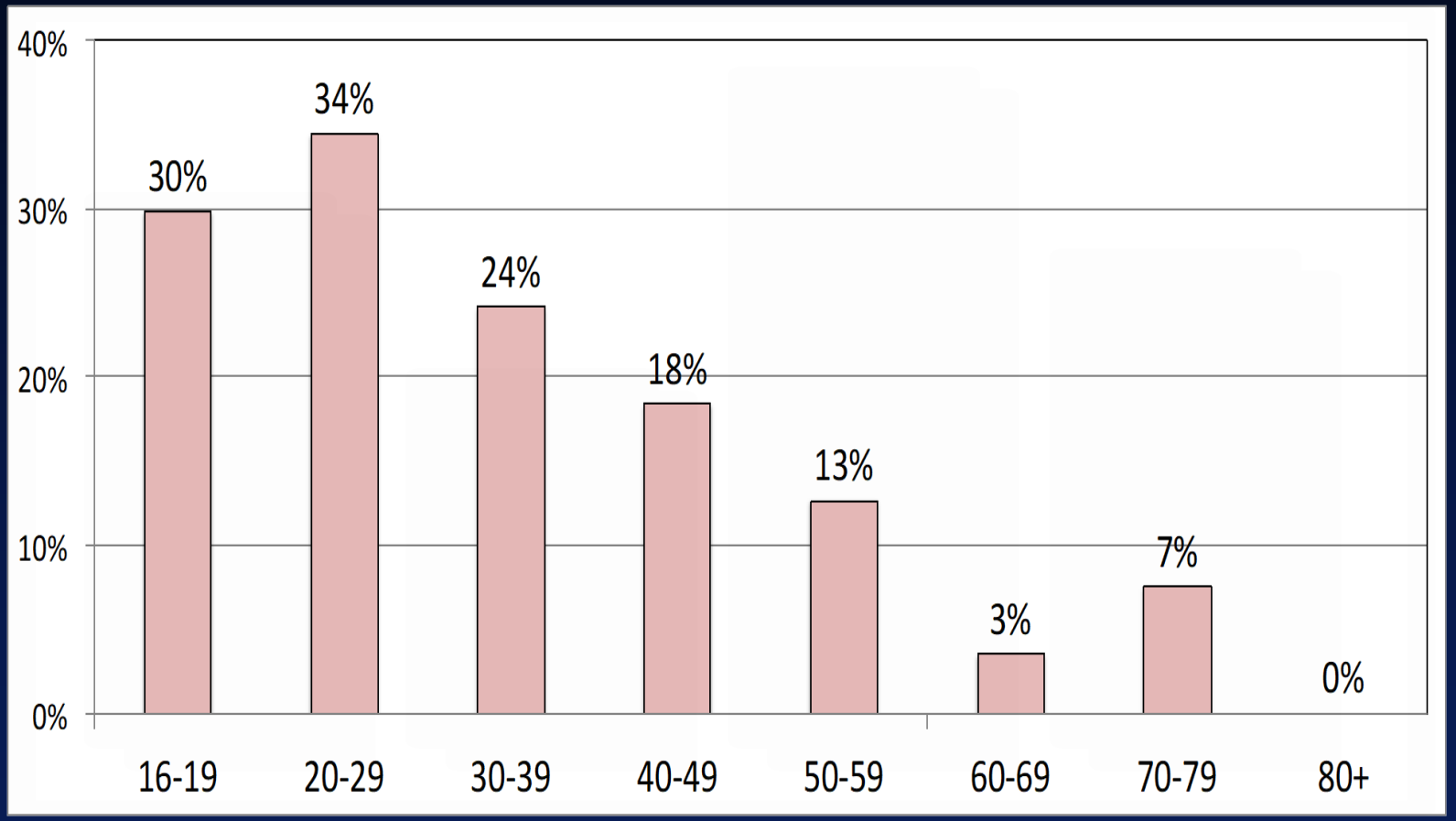
Drinking in excess of age and gender guidelines for healthy use at the period in their life when the injury occurred.

Risky Alcohol Use Among US Adult Civilians Alive 5 Years after Rehab for TBI



Drinking in excess of age and gender guidelines for healthy use when interviewed 5 years after injury.

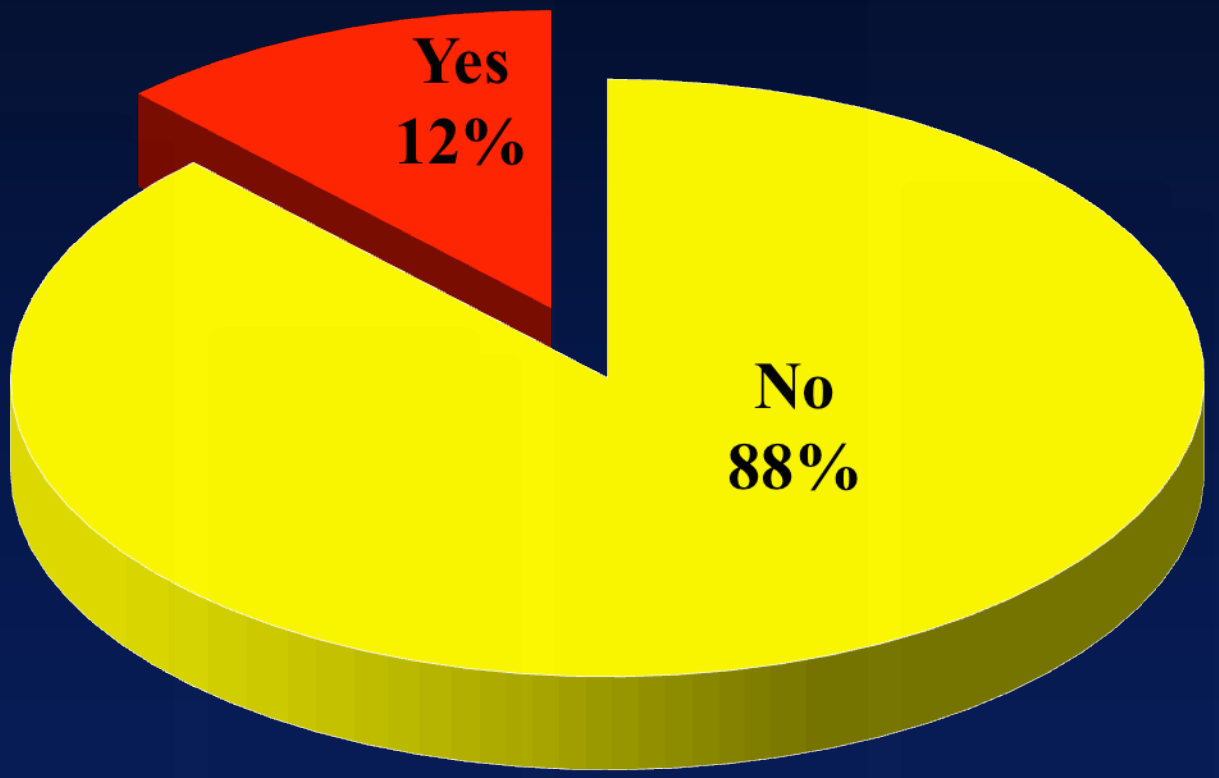
14.2% risky alcohol use in the 5 years since injury



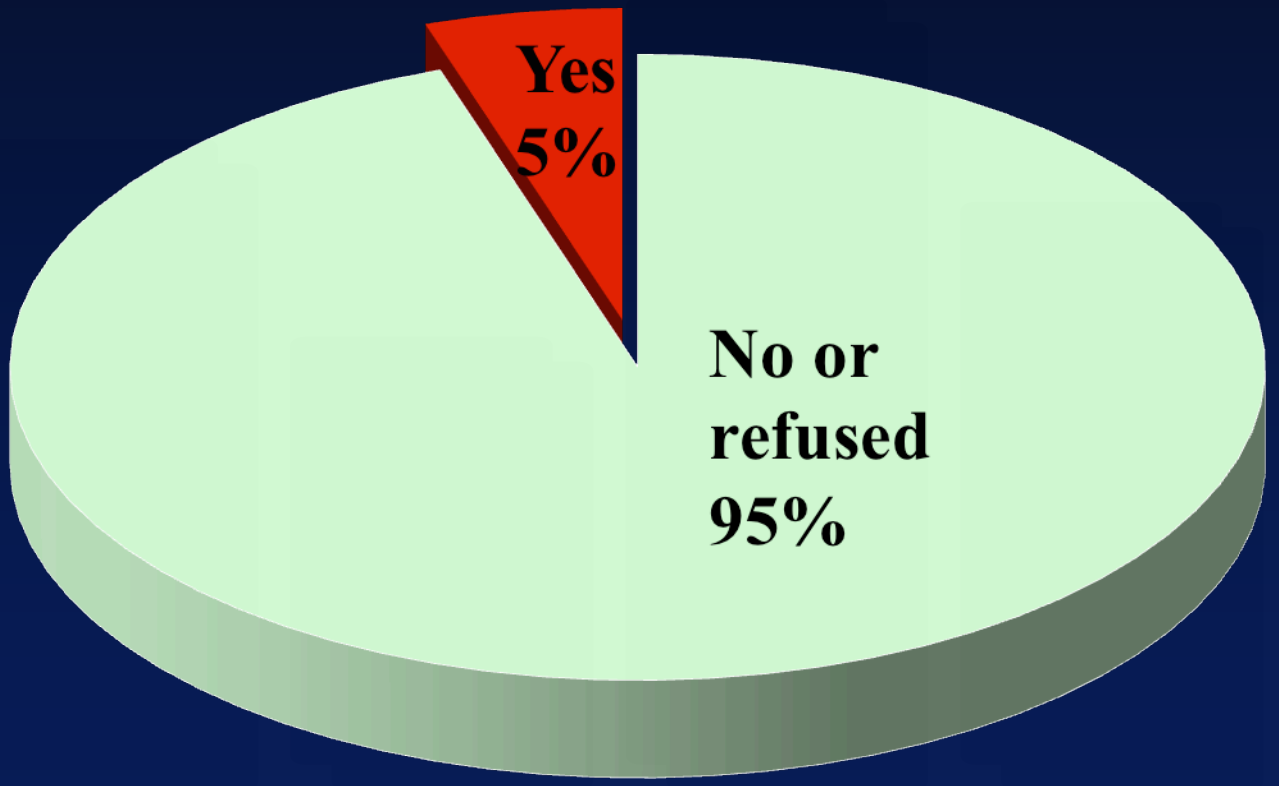
Of the average annual 13,700 admissions to U.S. IRF's* with a primary diagnosis of TBI, an estimated annual average of more than 1,945 have misused alcohol in the 5 years after injury.

*October 1, 2001 and December 31, 2007

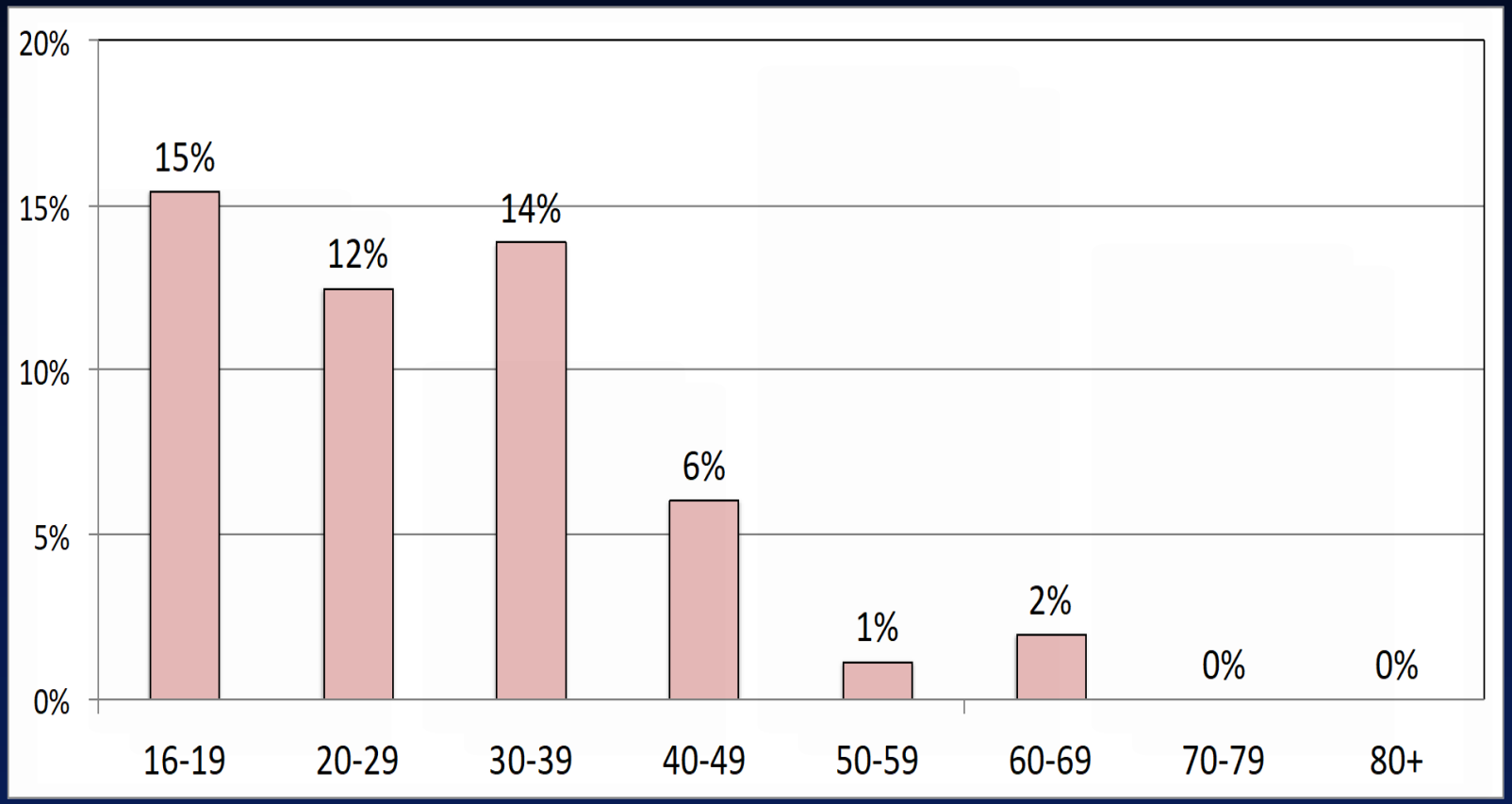
Illicit Drug Use in the Year before Injury Among US Adult Civilians in Rehab for TBI



Illicit Drug Use Among US Adult Civilians Alive 5 Years after Rehab for TBI



5.1% have used an illegal drug in the 5 years since injury



Of the average annual 13,700 admissions to U.S. IRF's* with a primary diagnosis of TBI, an estimated annual average of 700 have used illegal drugs in the 5 years after injury.

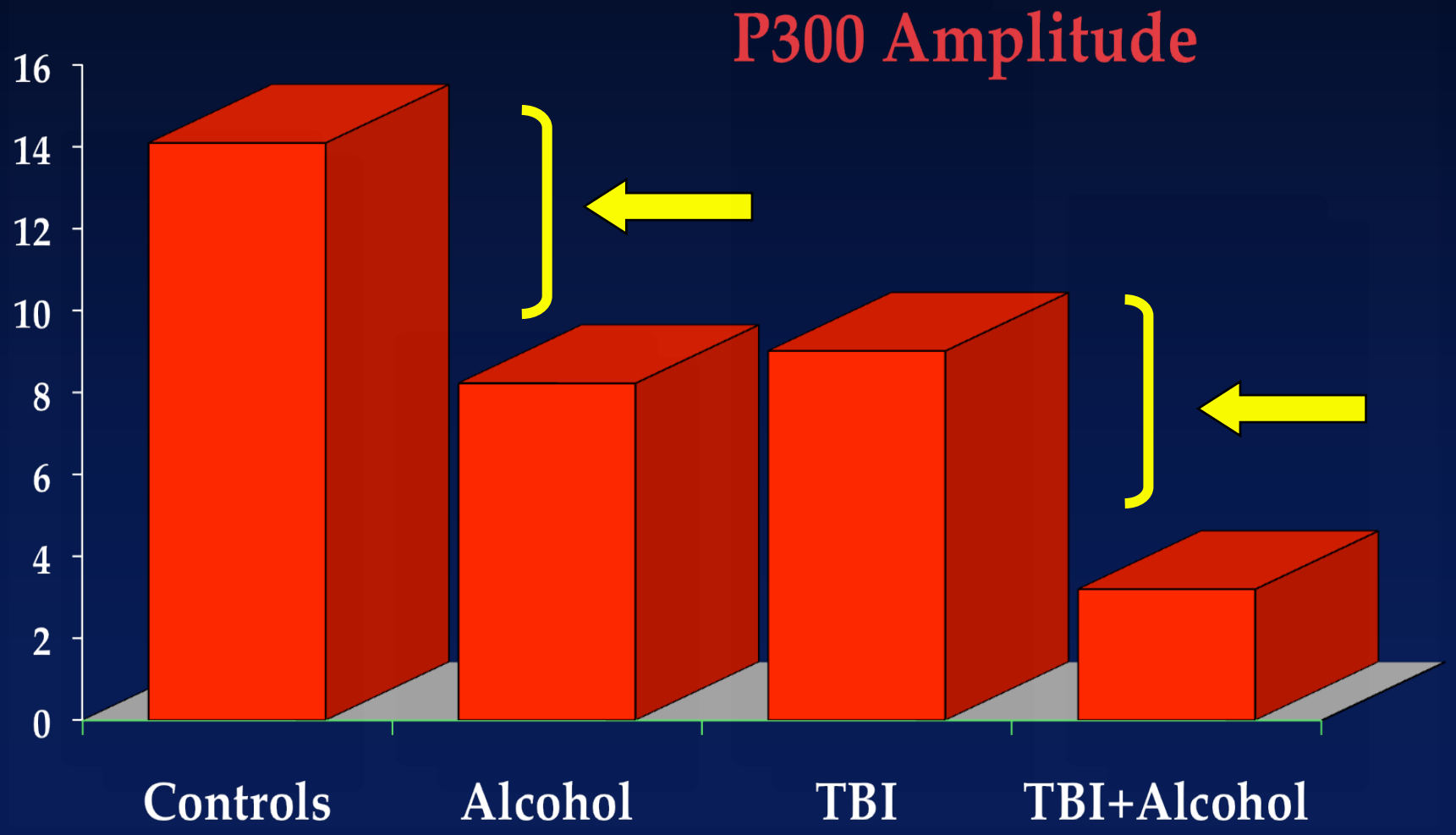
*October 1, 2001 and December 31, 2007

Negative Effects After Rehabilitation

- Is associated with unemployment, criminal activity, depression, seizure, suicide, and other causes of premature mortality (see Corrigan, Adams & Dams-O'Connor, 2021)
- Interactive effect for indicators of brain function and structure (e.g., Dikmen et al., 1993; Bigler et al., 1996; Baguley et al., 1997; Barker et al., 1999)

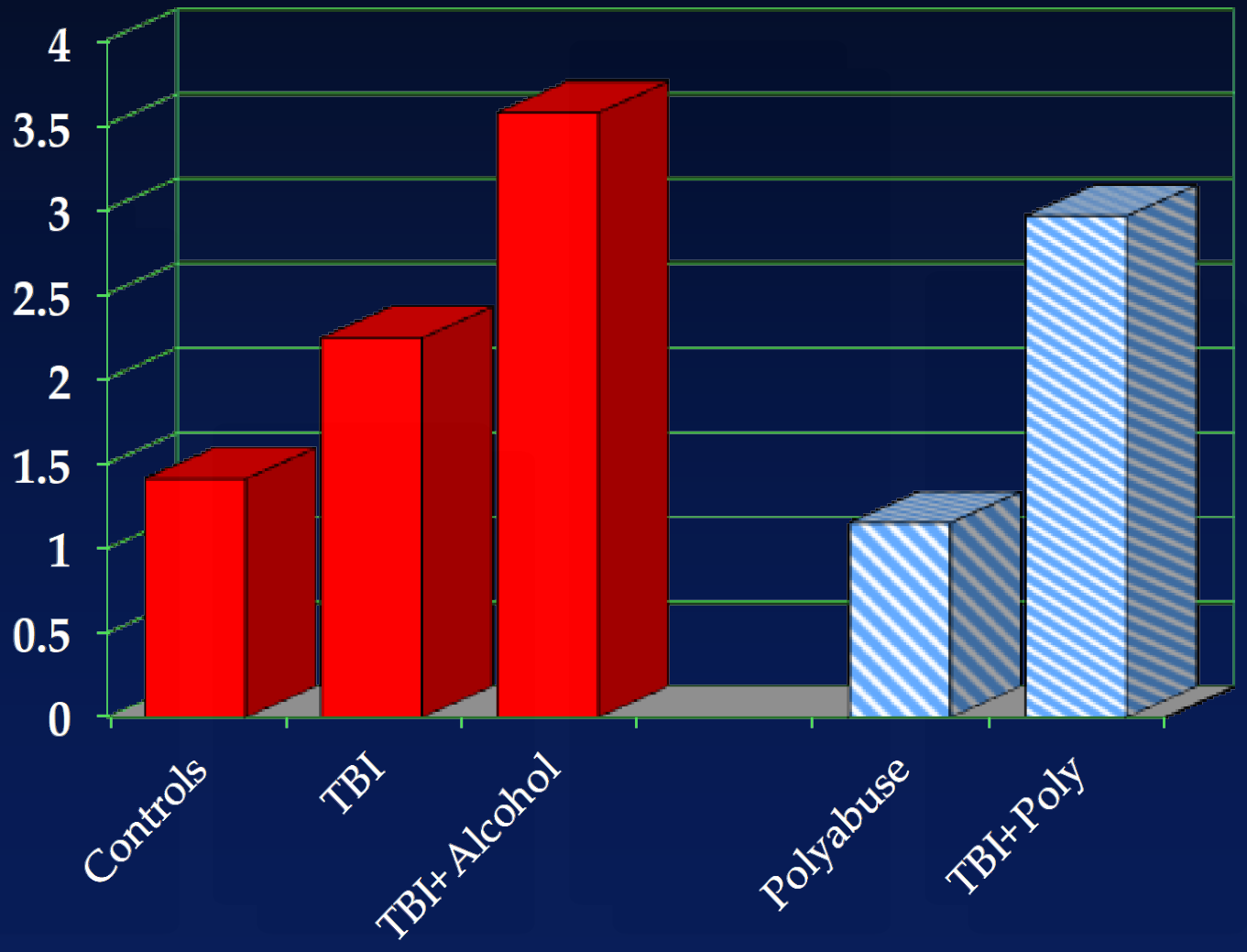
Event Related Evoked Potentials

[from Baguley, et al., 1997]



Ventricle to Brain Ratio

[from Bigler, et al., 1996 and Barker, et al., 1999]



Cannabis Use and TBI

- Cannabis use and TBI rarely studied—13 studies in last 12 years, only 9 empirical (Corrigan, Adams & Dams-O'Connor, 2021)
- Population surveys from Ontario Canada (before legalization): TBI more than doubled association with cannabis use, in both adolescents and adults (Ilie et al., 2015, 2019)
- Birth cohort from UK: prior TBI a risk factor for cannabis use at age 17 relative to controls without injuries, but not more so than orthopedic injury controls (Kennedy, Cohen & Munafo, 2017)
- Similar finding from large survey of university students—once prior delinquency and risk-taking accounted for, prior TBI was not a risk factor for cannabis use (Kort-Butler, 2017)

Reasons for Cannabis Use after TBI

Hawley et al., 2018

- Acute rehabilitation patients many years after injury
- 45% using cannabis (legal for recreational use in state)
- Reasons for use: recreational (72%), stress/anxiety reduction (62%), improving sleep (55%).

Lawrence et al., 2020

- Prospective cohort in a concussion clinic
- 14% used cannabis sometime during the first 4 weeks post-injury
- No association with either more or faster recovery
- Among those not recovered after 1 month, cannabis use was associated with lower number and severity of symptoms

Opioids and Brain Injury

A Perfect Storm of Cascading Vulnerabilities

Persons with brain injury have:

Greater exposure to prescription opioids

Adams, Corrigan, and Dams-O'Connor, Journal of Neurotrauma, 2020

Headaches are a common painful condition following TBI

- One of the most common physical complaints following TBI
- Most common symptom following deployment-related mild TBI
  - Commonly comorbid with other postconcussive symptoms (PTSD, depression, pain)
  - Migraine-like features common
- Among adults with moderate/severe TBI, 33% reported new or worse headaches at both 1-year and 5-years post-injury

- **While opioids are not indicated for headaches, likelihood of opioid receipt may increase especially when pain is chronic**

Stacey et al, 2017; Aldag et al 2017; Holtkamp et al. 2016; Zasler and Etheredge, 2020

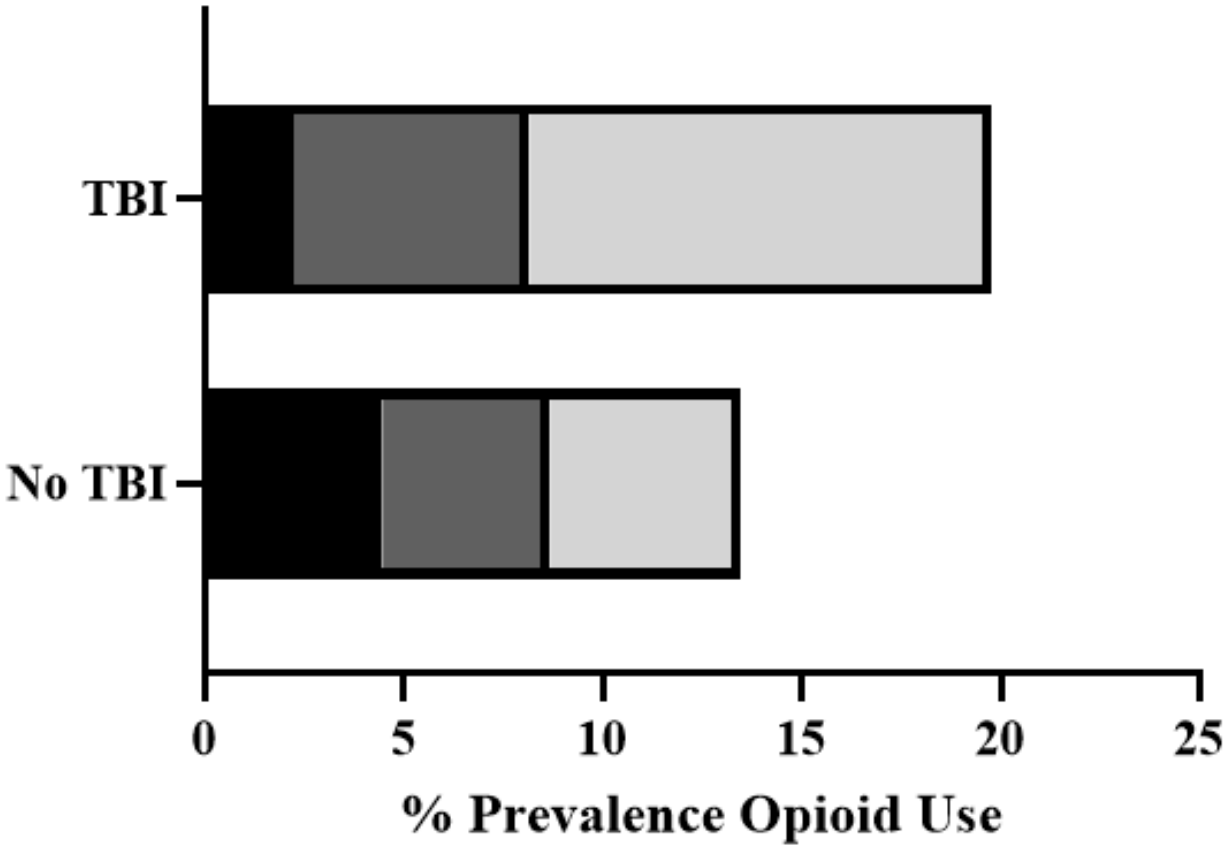
Acute and chronic pain are common following TBI

- Pain was most common medical condition among adults receiving rehabilitation for TBI (TBI Models Systems)
- Prevalence of chronic pain following TBI estimated to be over 50%
- Chronic pain following TBI is associated with functional disability and mood disorders

- **Acute and chronic pain have been drivers of prescription opioid receipt in the US**

Nampiaparampil 2008; Dams-O'Connor et al 2018; Adams, Corrigan, Dams-O'Connor 2019; Hong et al, 2019

More pain, more opioid use among older adults with TBI



Nearly 90% of opioid users with TBI reported moderate-to-severe levels of pain in the last two years

Kumar et al., 2021

Moderate to severe TBI associated with increased opioid receipt

TBI Practice Based Evidence Study

- Over 70% of patients with moderate-severe TBI were given opioids at any time during their inpatient stay
- 45% were prescribed opioids during the last 2 days of their inpatient stay

TBI Chronic Pain Collaborative Study

- Overall, 56% of 1805 participants have been prescribed opioids since inpatient rehabilitation
- Only 50% used the medication that was prescribed; 7% with pain report over-use
- Most have found it “helpful” or “very helpful” for their pain

Hammond et al, 2015; Hoffman, IBIA presentation, 2021

The Perfect Storm – Cascading Vulnerabilities

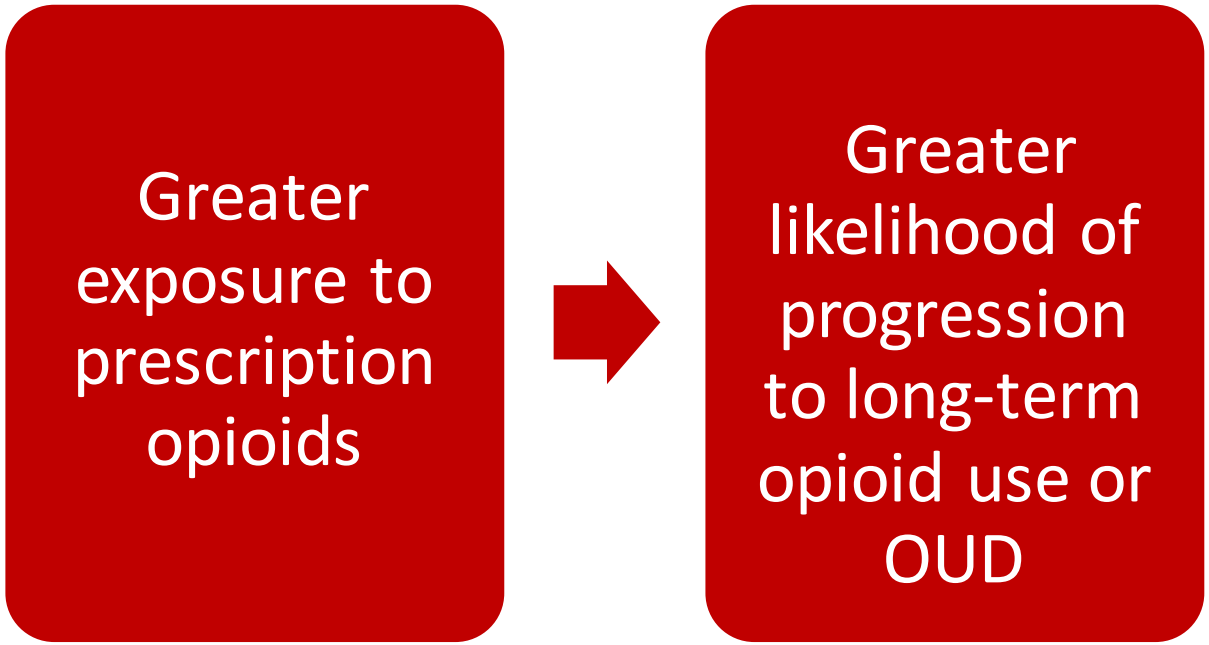
Persons with brain injury have:

Greater exposure to prescription opioids

Adams, Corrigan, and Dams-O'Connor, Journal of Neurotrauma, 2020

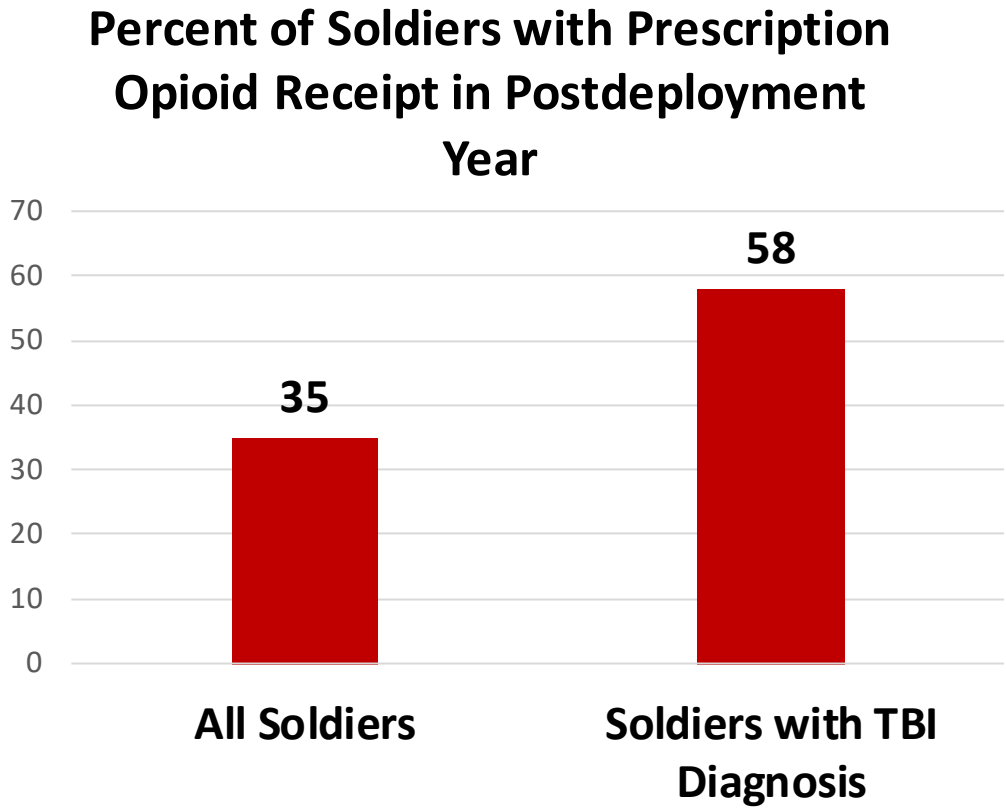
The Perfect Storm – Cascading Vulnerabilities

Persons with brain injury have:



Adams, Corrigan, and Dams-O'Connor, Journal of Neurotrauma, 2020

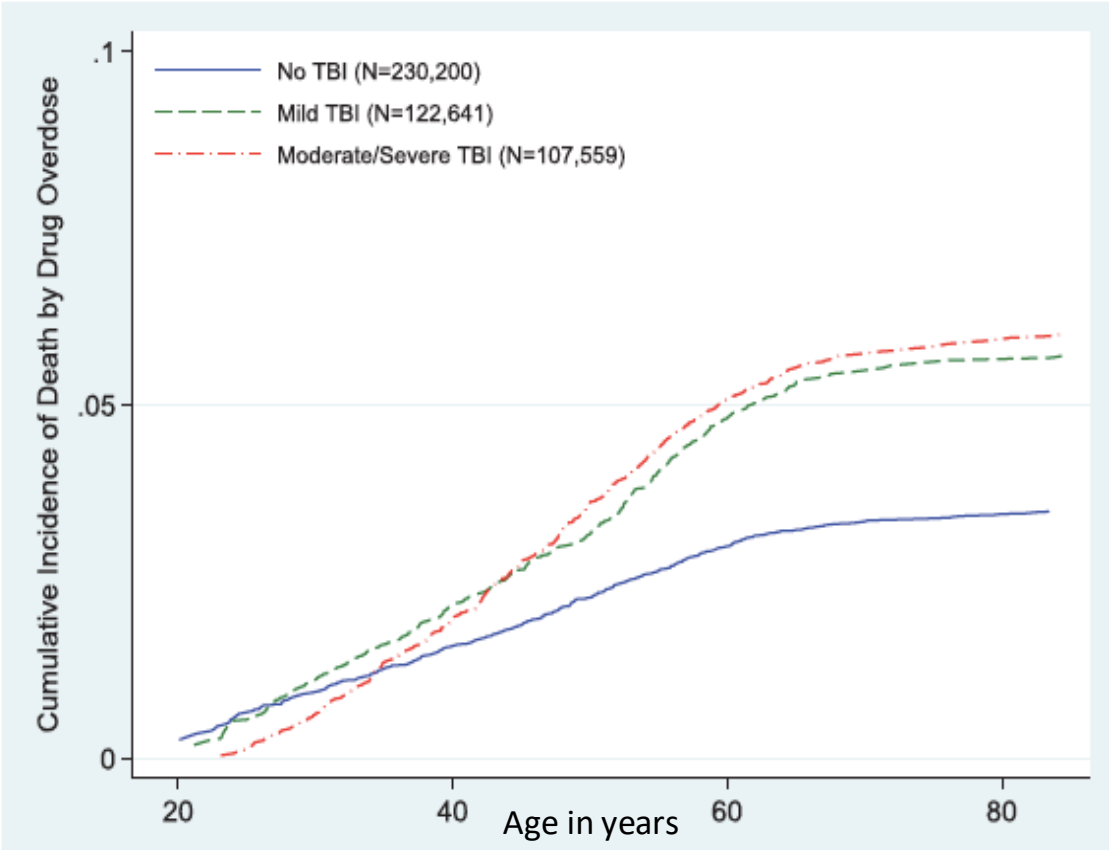
Combat Veterans more likely to be prescribed opioids and use opioids long-term



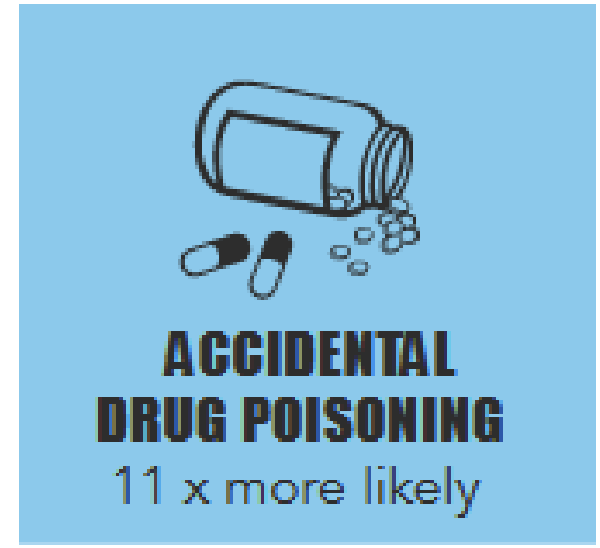
- Among Afghanistan/Iraq Veterans using the Veterans Health Administration with a TBI diagnosis
  - 21% filled an opioid prescription and 25% of this group used opioids long-term
- Increased risk for concurrent benzodiazepine and opioid use due to mental health comorbidities
  - Can increase overdose risk

Adams et al., 2018; Hudson et al, 2019; Carlson et al 2018

TBI associated with increased overdose deaths



TBI Model Systems

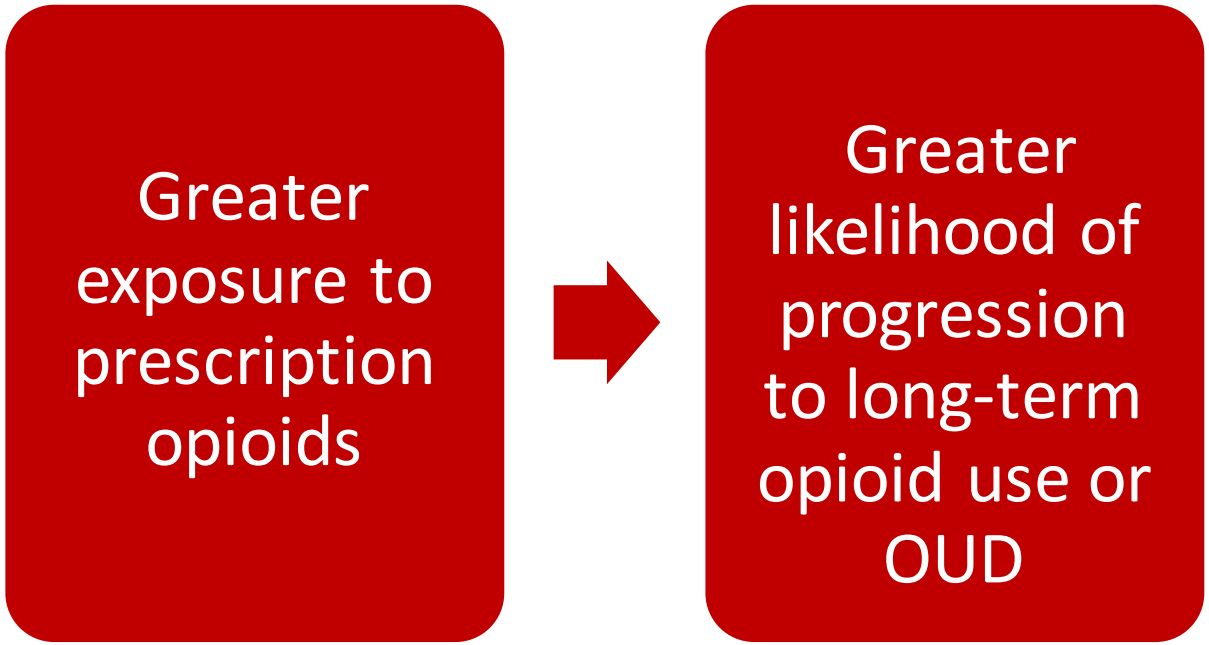


90% of accidental overdose deaths were drug related (predominantly opioids)

Byers et al., 2019; Harrison-Felix et al. 2015, 2016; CDC/NIDILRR Fact Sheet

The Perfect Storm – Cascading Vulnerabilities

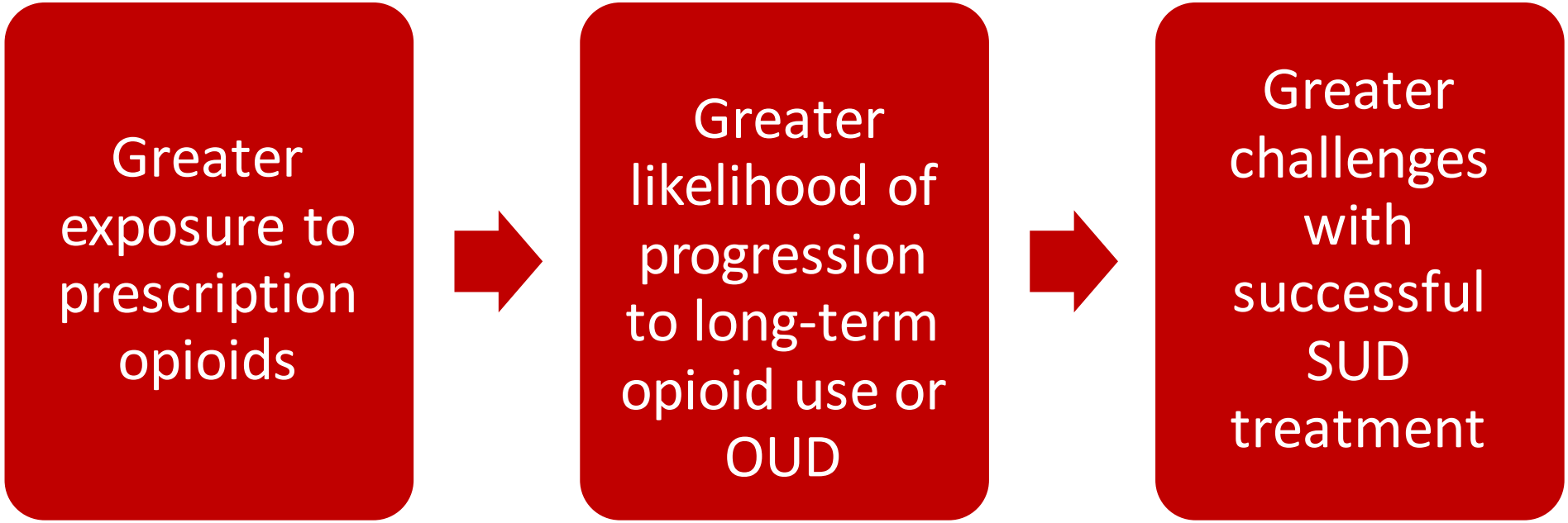
Persons with brain injury have:



Adams, Corrigan, and Dams-O'Connor, Journal of Neurotrauma, 2020

The Perfect Storm – Cascading Vulnerabilities

Persons with brain injury have:



Adams, Corrigan, and Dams-O'Connor, Journal of Neurotrauma, 2020

Two Consistent Clinical Observations from SUD Treatment

- Compared to others in SUD treatment there is an even *greater* disconnect between TBI clients' intentions and their behavior.

- Clients with TBI are more likely to prematurely discontinue treatment, often after being characterized as non-compliant.

People with TBI face additional challenges seeking substance use disorder treatment

- It's easy to see behavior as intentionally disruptive, particularly when there are no visible signs of disability:
  - –Frontal lobe damage affects regulation of thoughts, feelings & behavior–promoting disinhibition.
  - –Social "rules" may not be observed and interpersonal cues not perceived, creating consternation for fellow clients and staff.

People with TBI face additional challenges …(cont'd)

- Cognitive impairments may affect a person's communication or learning style, making participation in didactic training and group interventions more difficult.
- Misinterpretation of neurological problems as resistance to treatment undermines treatment relationships.

Neurologic-Informed Care

- American Society of Addiction Medicine (ASAM) Fourth Edition of *The ASAM Criteria:* cognitive impairment should not be a barrier to SUD treatment.
- Includes subtle cognitive weaknesses that may be misinterpreted by clinicians.
- ASAM criteria describe "neurologic-informed care"—training clinical staff to refine the ways in which services are provided to clients with co-occurring cognitive impairment and SUD.
- Neurologic-informed care is not a specific SUD treatment modality; it is knowledge and skills that are applied to whatever treatment modalities a clinician employs.

New Tools for SUD Treatment

Traumatic Brain Injury and Substance Use Disorders: Making the Connections Toolkit by Carolyn Lemsky and funded by The Mid-America Addiction Technology Transfer Center, the Mountain Plains Addiction Technology Transfer Center and the National Association of State Head Injury Administrators (NASHIA)
https://www.nashia.org/resources-list/olia67paxy7sg1u4fr3tzqpezuvdto-knjxh-5j6np

Substance Use and Brain Injury (SUBI) Client Workbook 2nd edition by Carolyn Lemsky and funded by NASHIA and several state brain injury programs, including Ohio
https://www.nashia.org/resources-list/olia67paxy7sg1u4fr3tzqpezuvdto-knjxh-5j6np

SAMHSA/NASHIA Toolkit

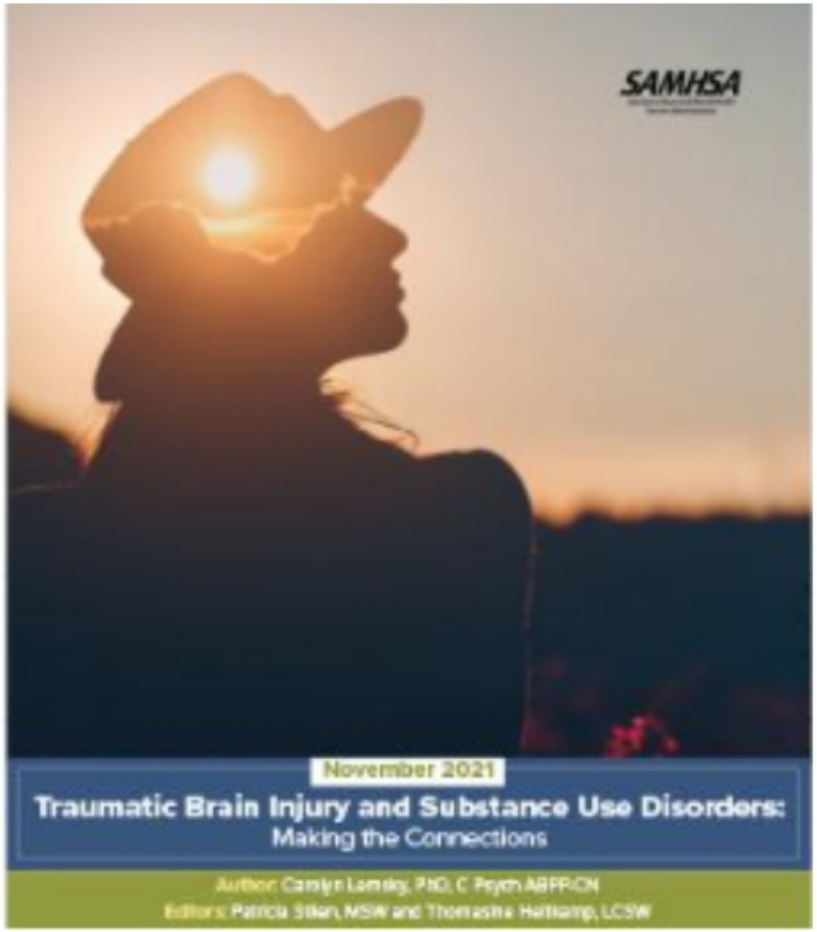
Ohio Brain Injury Program

Purpose: A resource for "…behavioral health treatment providers, healthcare providers, educators, and … administrators to gain a deeper understanding of the impact of SUD on persons who have survived a TBI."

4 Sections

- Section 1: understanding the behavioral implications of a brain injury
- Section 2: evidence-based tools for use in screening for brain injury and hands-on guidance on their use
- Section 3: neurocognitive problems, with suggested techniques for supporting clients with a brain injury (uses case vignettes to promote skill development)
- Section 4: a single vignette demonstrating suggestions from preceding sections, including guidance on how to use environmental supports to address cognitive difficulties

Ohio Brain Injury Program



Traumatic Brain Injury and Substance Use Disorders: Making the Connections

Collaborating TTC: Mountain Plains ATTC
Publication Date: October 27, 2021

Traumatic Brain Injury and Substance Use Disorders: Making the Connections merges the content on traumatic brain injury (TBI) and substance use disorders (SUD) to expand capacity to address both issues in treatment. The author, Dr. Carolyn Lemsky, is a board-certified neuropsychologist with over 25 years of experience working in rehabilitation settings in the U.S. and Canada. The toolkit provides valuable and practical information for advancing behavioral health providers' capacity when serving persons who have brain injuries.

www.nashia.org/resources-list/sudtoolkit

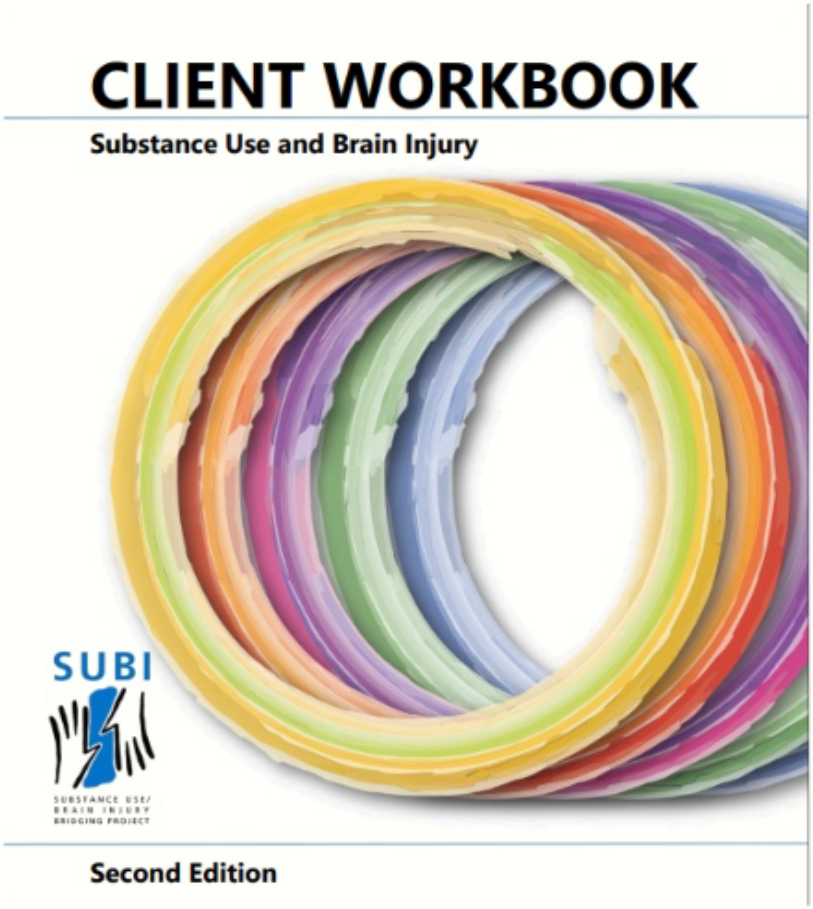
SUBI Client Workbook

Ohio Brain Injury Program

Purpose: For people who are living with the effects of a brain injury and are wondering how their substance use may be affecting them. Strongly recommended that clients review the Workbook with a trusted person who is familiar with addictions and/or helping people after brain injury.

- Target audiences are clients with brain injury and SUD as well as professionals who are experts in SUD or brain injury but not both
- Can be used in group settings or individually
- Each section is organized as follows:
  - Goals
  - Information
  - Check-in (self-assessment)
  - Worksheet
  - Planning tools

Ohio Brain Injury Program



Client Workbook
Substance Use and Brain Injury

This workbook was created for people who are living with the effects of a brain injury and are wondering how their substance use may be affecting them.
If you do not have a particular expertise in the area of brain injury or substance use disorders, you are strongly encouraged to get consultation from a professional who can provide support and guidance.

www.nashia.org/resources-list/sudtoolkit

Summary

1. Brain injury affects behavioral self-regulation which increases the likelihood of substance use disorders.
2. Brain injury is common among persons in substance use disorder treatment.
3. Brain injury presents unique clinical issues that require accommodation in treatment.
4. Behavioral health professionals need to know how to screen for history of brain injury.
5. Behavioral health professionals need to know how to provide neurologic-informed care.

THANK YOU