

Intersection of Brain Injury, Suicide, and Addiction

Presented by: Matthew E. Peters, MD April 15, 2021



Addiction Technology Transfer Center Network Funded by Substance Abuse and Mental Health Services Administration



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Mid-America ATTC & Mountain Plains ATTC



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Technology Transfer Center Network



* Map not to scale.

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In accordance with continuing education guidelines, the speakers and planning committee members have disclosed commercial interests/financial relationships with companies whose products or services may be discussed during this program.

Speaker: Matthew E. Peters, MD has nothing to disclose.

Planning Committee:

Pat Stilen, Bree Sherry, Carissa Ruf, Angela Bolen, Abby Moore, Thomasine Heitkamp, and Sharon Colbert have nothing to disclose. Jacki Witt serves on the advisory board for Mayne Pharmaceuticals. (Resolved). Kristin Metcalf-Wilson serves on the board for Mayne and Afaxys Pharmaceuticals board (Resolved).

Accreditation Statements



NAADAC

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- Iowa Board of Certification
- Missouri Credentialing Board
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- Nebraska (deemed alcohol and drug specific accepted for continuing education for licenses alcohol and drug counselors in NE)
- NASW
- CRC

Housekeeping Items

- All attendees are muted and attendees cannot share video during this session.
- Remember to ask questions using the Q&A feature
- How to access training materials

Today's Facilitator



Dr. Matthew Peters





- Provide a background on suicide and the connection to TBI
- Explore the relationship between TBI, suicide, and substance use
- Comment on mechanisms for this tridirectional relationship



Demographics

- Suicide rates are increasing compared to generally declining mortality
 - 24% increase between 1999 and 2014
- One of the 10 leading causes of death overall
 In 2018, 48,344 recorded suicides
- Women more likely to attempt, men more likely to complete
- Veterans at higher risk than general population



Suicide Rates, by Sex: U.S., 1999-2014



April 16, 2021



Suicide Rates for Females, by Age: U.S., 1999 and 2014



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Suicide Rates for Males, by Age: U.S., 1999 and 2014



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Suicide Deaths, by Method and Sex: U.S., 1999 and 2014



April 16, 2021



Definitions

- Suicide-related Ideation
 - When questioned, any thoughts of engaging in suiciderelated behaviors, regardless of intent or plan
- Suicide-related Communications
 - Same as above, but spontaneously initiated via verbal or non-verbal communication
- Suicidal Behavior
 - Preparatory behavior or self-inflicted potentially injurious behavior for which there is evidence of intent to die



Definitions

- Warning Signs
 - Behaviors a person shows (e.g., buying a gun) or statements that they make (e.g., "I'd be better off dead") that suggest a risk of suicide
- Risk Factors
 - Predictors of suicidal behavior
- Protective Factors
 - Counterbalance suicide risk



Risk Factors (not a complete list)

- Previous suicide attempts
- Access to means
- Family history of suicide
- Alcohol / substance abuse
- Previous psychiatric diagnosis
- Co-morbid health problems
- Impulsivity and poor self control
- Recent losses financial, physical, personal
- Hopelessness



Protective Factors (not a complete list)

- Sense of responsibility to family
- Spirituality
- Life satisfaction
- Children in the home
- Positive social support
- Positive therapeutic relationship



Common Risk Factors

- Shared risk factors include:
 - Age
 - Male
 - Substance use
 - Psychiatric disorders
 - Aggressive behavior
- Additionally, sustaining a TBI may lead to changes in roles and impairment of problem-solving strategies



Research Study Looking at First Year Post-TBI

- Participants were from a clinical trial
- 559 adult patients admitted to Harborview Medical Center in Seattle, Washington
- Complicated mild, moderate, or severe TBI
- 25% of sample reported suicidal ideation during one or more assessments over a one-year period post-TBI (22% at 3 or more)
 - This is a rate seven times higher than in the general population



Research Study Looking at First Year Post-TBI



https://pubmed.ncbi.nlm.nih.gov/24832143/



Research Study Looking at First Year Post-TBI

- Strongest predictor of suicidal ideation was initial depression score (on PHQ8) after injury
 - 53% reported depression at first assessment
- Other predictors:
 - Prior suicide attempt (12%) or psychiatric hospitalization
 - History of depressive, bipolar, or anxiety disorder
 - Less than high school education
 - Medicaid insurance
- 47% of participants with suicidal ideation were already receiving mental health treatment at time of injury compared to 23% without suicidal ideation



Takeaways

- Suicidal ideation was seen in 25% of participants within a year of TBI
- Unlike conditions like cancer, where risk increases acutely after diagnosis and then decreases, suicidal ideation appears to increase after TBI and remain elevated through at least the first year
- Risk factors for reporting suicidal ideation are easily collected via clinical interview
- How this translates into suicide attempts / completions is not clear from this study



Danish National Patient Registry

- Danish National Patient Registry data from 1977-2014 of over 7 million individuals with 567,823 individuals (7.6%) with a medical contact for TBI
- Of 34,529 individuals who died by suicide during that time, 3536 (10%) had medical contact for TBI
 - 2701 mild TBI
 - 661 severe TBI
 - 174 skull fracture without documented TBI



Danish National Patient Registry

- Risk increased with:
 - Closer temporal proximity to TBI
 - More medical contacts for TBI
 - Increasing number of days in treatment for TBI
- Severe TBI higher risk than mild TBI
- Higher risk in individuals with a psychological illness before or after TBI

Danish National Patient Registry – Time Since Last TBI



https://pubmed.ncbi.nlm.nih.gov/30120477/

Danish National Patient Registry – Distinct Contacts for TBI



Danish National Patient Registry – Days in Treatment for TBI



Danish National Patient Registry – TBI vs. Other Injury



31

Suicide Risk Following mild TBI



Meta-analysis

- Meta-analysis looking at mild TBI / concussion using a systematic review of the literature, including:
 - 10 cohort studies (n=713,706)
 - 5 cross-sectional studies (n=4420)
 - 2 case-control studies (n=446)
- Experiencing mild TBI / concussion was associated with a 2-fold higher risk of suicide
- Also associated with a higher risk of suicide attempt and suicide ideation
- Seen in studies with and without military personnel

Suicide Risk Following mild TBI



Meta-analysis

Figure 2. Meta-analysis of Risk of Suicide After Concussion and/or Mild Traumatic Brain Injury



https://pubmed.ncbi.nlm.nih.gov/30419085/



Takeaways

- Large population-based study showed increased risk of suicide completions post-TBI
- Significant risk factors
 - Higher TBI severity
 - Psychological illness before or after TBI
 - More medical contacts for TBI (assume distinct TBI events)
 - Increasing number of days in treatment for TBI
 - Closer temporal proximity to TBI
- Meta-analysis confirmed that even mild TBI / concussion associated with 2-fold higher suicide risk

Substance Use & TBI Overview



- Substance use my precipitate TBI by increasing risk mechanisms (e.g., falls, violence, and MVAs)
- TBI can precipitate substance use disorders due to impulse control deficits, psychological distress, and maladaptive coping mechanisms
- Substance use may confound mental status assessment at time of post-TBI examination
- There is evidence that substance use decreases acutely following TBI, but eventually returns to preinjury levels

Active Substance Use and TBI Findings from TRACK-TBI



- The Transforming Research and Clinical Knowledge in TBI (TRACK-TBI) pilot included ED urine toxicology results.
- Those with a positive urine toxicology were more likely to:
 - Be younger
 - Have a history of seizure disorder, substance use disorder, prior TBI with hospitalization
 - Have a presenting GCS of <15
 - Have a normal head CT
 - Have positive blood alcohol level
 - Be evaluated further prior to hospital discharge

https://pubmed.ncbi.nlm.nih.gov/32173156/

Active Substance Use and TBI Findings from TRACK-TBI



- The TRACK-TBI pilot included ED urine toxicology results.
- At six months, those with a positive urine toxicology were more likely to:
 - Score above the threshold for clinical screening for PTSD
- At six months, there was no difference observed in functional outcome, post-concussive symptoms, or satisfaction with life scores

Substance Use Treatment and TBI Findings from A Large Community Substance Use Program



- Data from 7784 adults receiving substance abuse treatment in state-funded facilities in Kentucky.
- The majority of participants reported no lifetime TBI with loss of consciousness (LOC), however,
 - 19.8% reported one lifetime TBI with LOC
 - 11.9% reported two or more lifetime TBI with LOC
- Significantly more individuals with at least one lifetime TBI-LOC were men, white, and unemployed.

Substance Use Treatment and TBI Findings from A Large Community Substance Use Program



TABLE 2 Substance use in the past 12 months by traumatic brain injury with loss of consciousness (TBI-LOC) group^{*,†}

	No lifetime TBI-LOC (<i>n</i> = 5319)	1 lifetime TBI-LOC (<i>n</i> = 1541)	2 or more lifetime TBI-LOCs (<i>n</i> = 924)
Alcohol [‡]	5.1	5.4	5.6
Any illicit drugs [§]	5.6 _{a.b}	6.0 _a	6.3 _b
Marijuana [‡]	3.2 _a	3.5	3.7 _a
Opiates [§]	2.3 _a	2.6 _b	3.1 _{a.b}
Tranquilizers [§]	1.7 _{a.b}	2.2 _{a.c}	2.7 _{b.c}
Cocaine	1.9	2.0	2.1

*Values indicate mean no. of months of substance use in the past 12 months.

[†]Values sharing the same subscript differ at P < .01.

 $^{\ddagger}P < .01.$

 $^{\$}P < .001.$

https://pubmed.ncbi.nlm.nih.gov/18025968/

Substance Use Treatment and TBI Findings from A Large Community Substance Use Program



TABLE 3 Mental health problems in the past 12 months by TBI-LOC group^{*,†}

	No lifetime	1 lifetime	2 or more
	TBI-LOC	TBI-LOC	lifetime TBI-LOCs
	(<i>n</i> = 5319)	(<i>n</i> = 1541)	(<i>n</i> = 924)
Serious depression [‡]	45.5 _{a,b}	55.7 _{a,c}	67.4 _{b,c}
Serious anxiety [‡]	50.2 _{a,b}	63.6 _{a,c}	74.5 _{b,c}
Hallucinations [‡]	8.6 _{a,b}	13.6 _{a,c}	21.5 _{b,c}
Trouble understanding, concentrating, or remembering [‡]	43.7 _{a,b}	58.0 _{a,c}	65.7 _{b,c}
Trouble controlling violent behavior [‡]	18.5 _{a,b}	28.1 _{a,c}	34.5 _{b,c}
Suicidal thoughts [‡]	13.9 _{a,b}	21.4 _{a,c}	27.8 _{b,c}
Took prescribed medication for mental health problems [‡]	28.5 _{a,b}	36.5 _{a,c}	44.8 _{b,c}

*Values indicate the percent of clients reporting mental health problems in the past 12 months.

[†]Values sharing the same subscript differ at P < .01.

 $^{\ddagger}P < .001.$

https://pubmed.ncbi.nlm.nih.gov/18025968/

Substance Use and TBI Takeaways



- The association between substance use and TBI is anecdotally assumed and increasingly established via research
- Active substance use at time of TBI may influence mental state evaluations and make discharge planning more difficult
- Co-morbid substance use and TBI are associated with increased risk of psychopathology
 - This includes suicidal thoughts and suicide attempts



Considering Mechanisms







Considering Mechanisms

- The structure-function relationships of the most common cognitive (e.g., executive dysfunction) and other neuropsychiatric syndromes (e.g., depression, anxiety) presenting post-TBI have been theorized
- Outside of just conceptualizing cause, these relationships are important for biomarker development



Considering Mechanisms



https://pubmed.ncbi.nlm.nih.gov/29022277/



Considering Mechanisms – Dorsolateral Prefrontal Loop

- Modulates cognitive processes, such as working memory and executive function
- In dysexecutive syndrome, the brain's ability to act as an executive is down
 - Trouble retrieving stored information
 - Difficulty planning complex tasks
 - New onset depressive symptoms



Dysexecutive Syndrome



Considering Mechanisms – Orbitomedial Frontal Loop

- Determines the time, place, and strategy for environmentally elicited behavioral responses
- In disinhibition syndrome, the number of inappropriate behaviors is up:
 - Increased emotional lability
 - Impulsivity
 - Lack of social tact



Orbitomedial Frontal Loop Disinhibition Syndrome



Considering Mechanisms – Anterior Cingulate Loop

- Modulates motivated and rewardrelated behaviors
- In apathy syndrome, there is a global loss (flattening) of motivation and emotional responsivity:
 - Decrease in goal-directed behaviors
 - Lack of emotion
 - Lack of desire, passion, motivation



Anterior Cingulate Loop Apathy Syndrome



Considering Mechanisms - Takeaways

- The reason these circuits are important is that the cause of suicidality and risk of substance use may vary depending on the circuit damaged
 - Disinhibition can lead to substance use and suicidal / dangerous behavior
 - Depression can be a driver of both substance use and suicidal / dangerous behavior

Conclusions



- TBI and suicide have some common risk factors:
 - e.g., substance use, psychiatric diagnoses, role change
- Post-TBI, suicidal ideation is seen in 25% of individuals and this risk remains through at least a year post-TBI
- In both general and military populations, TBI appears to double risk of suicide

Conclusions



- These studies confirm established risk factors, many of which are easily accessible from clinical interview:
 - Higher TBI severity
 - Previous or new onset psychiatric diagnosis, including substance abuse
 - Previous suicide attempts
- Access to firearms important consideration, especially in veteran's





- Considering the most common underlying circuit damage, which was been welltheorized in TBI, can assist in treatment planning
- Neuropsychiatrists and behavioral neurologists trained in TBI-related cognitive and other neuropsychiatric syndromes are uniquely poised to treat these individuals





 Suicide is a rare event, TBI is hard to accurately diagnose, and substance use disorders make the whole picture more complicated





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