Substance Misuse and Brain Injury

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Pre-Injury Alcohol Misuse Among US Adults 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.

The TBI and Substance Use Disorder “Adverse Selection Cascade”

+ History of SUD → Intoxication
  Intoxication → Injury
  > Intoxication → Traumatic Brain Injury
  + History of SUD → worse TBI
  Worse TBI → inpatient rehabilitation
Alcohol Misuse Among US Adults Alive 5 Years after Rehab for TBI

No 86%
Yes 14%

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

Alcohol Consumption 1 Year after Hospitalization
(Horner, et al, 2005 (South Carolina Follow-up Study))

None 30 days 52%
Moderate 11%
Heavy 16%
Light 16%

Past month binge drinking 1 year following hospitalization with a TBI
(Horner, et al, 2005 (South Carolina Follow-up Study))

48% binge drink
30% binge drink

After hospitalization for TBI
General population (matched)
Negative Effects of Substance Misuse and Substance Use Disorders

• Is associated with unemployment, criminal activity, depression, seizure, suicide, and other causes of premature mortality (see Corrigan & Mysiw, 2012)

• 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)

Why does TBI and substance misuse co-associate?

Why TBI facilitates addiction:

• Pathophysiology—structural damage from TBI makes addiction more likely

• Neurobehavioral—TBI changes how we view rewards and consequences

• Developmental—early life TBI may predispose a person to substance use disorders

The brain is set into motion along multiple axial planes
The “fingerprint” of TBI results from damage to the frontal poles and the orbital gyrus of the prefrontal cortex.

The pathways involved in addiction

Addiction is a behavior that was rewarding but now has consequences and cannot be interrupted. A short cut between the human and mouse brain becomes a short circuit.
Addiction as a disorder in processing rewards and punishments

Delay Discounting:
the value of immediate vs. delayed rewards

Regions of greater activation processing immediate rewards

Developmental Contributions

Early childhood TBI, even if mild, may predispose to later substance use problems.

TBI in the Christchurch Health & Development Study
Audrey McKinlay & colleagues

- 1,265 children born in 1977 in Christchurch, New Zealand and followed to age 25
- Annual assessments from 4 months to age 16, then at 18, 21, 25 & 30 (age 35 in progress!)
- TBI’s verified through medical records from physician office, clinic, ED or hospital.
- 79.3% successfully followed through age 25

Early Injury Predicted Later Problems

- Compared to no TBI and outpatient only, by early adolescence (10-13 y.o.) those hospitalized with a mild TBI before age 6 were:
  - More hyperactive and inattentive as rated by parent and teacher
  - More likely dx’d with ADHD, conduct disorder or oppositional defiant behavior
  - More likely to have substance abuse problems
  - More likely to demonstrate mood disorders
Early Injury Predicted Later Problems

- By late adolescence and early adulthood (16-25 years old):
  - Those hospitalized with 1st TBI before age 6, 3 times more likely to have a diagnosis of either alcohol or drug dependence by age 25
  - Those hospitalized with 1st TBI 16-21, 3 times more likely to be diagnosed with drug dependence
  - TBI highly associated with likelihood of arrest

Lifetime History of TBI

- More serious injuries or younger age at 1st injury associated with slower speed of information processing and greater cognitive complaints.
- Addictions more severe for those 1st injured before age 11.
- Uniqueness of early childhood TBI observed for persons with substance use disorders replicated in a sample of prisoners.
Summary

• There is a high co-occurrence of TBI and SUD
• TBI and substance misuse are worse together than either is alone.
• Both structural damage in the frontal lobes and its impact on processing rewards and consequences make addiction more likely
• Early life TBI may predispose to addiction

Co-occurring TBI and substance misuse needs to be addressed by both brain injury rehabilitation and addiction treatment systems.

Intervention and Treatment

• Models proposed initially for TBI were designed for residential settings (e.g., Blackerby & Baumgartner, 1990; Lingley, 1991; Hensold, 2006)

• Quasi-experimental support for:
  – motivational interviewing (Bombardier & Rimmle, 1999; Cox, et al., 2003)
  – skills-based treatment (Vungkhanching et al., 2007)

Intervention and Treatment (cont’d)

• Painfully little study of the effectiveness of proven treatment interventions with this population, whether behavioral, pharmacologic or systemic.

• Need for treatment going unmet–among persons with problems controlling use 1 year after TBI, a high proportion not getting assistance (Corrigan, Whiteneck & Mellick, 2004; Pickelsimer et al, 2007).
Percentage With Needs Unmet at 1 Year

<table>
<thead>
<tr>
<th>Activity</th>
<th>Low Severity</th>
<th>High Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal assistance</td>
<td>12.7%</td>
<td>19.8%</td>
</tr>
<tr>
<td>Self-care</td>
<td>26.8%</td>
<td>29.5%</td>
</tr>
<tr>
<td>Traveling in the community</td>
<td>33.1%</td>
<td>44.2%</td>
</tr>
<tr>
<td>Home making</td>
<td></td>
<td>55.6%</td>
</tr>
<tr>
<td>Coordinating services</td>
<td></td>
<td>68.0%</td>
</tr>
<tr>
<td>Managing money</td>
<td></td>
<td>71.0%</td>
</tr>
<tr>
<td>Managing stress</td>
<td></td>
<td>73.6%</td>
</tr>
<tr>
<td>Participating in recreation</td>
<td></td>
<td>78.3%</td>
</tr>
<tr>
<td>Improving cognition</td>
<td></td>
<td>83.0%</td>
</tr>
<tr>
<td>Controlling temper</td>
<td></td>
<td>95.9%</td>
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4 Quadrant Model: Types of Services

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<thead>
<tr>
<th>Quadrant I</th>
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<th>Quadrant III</th>
<th>Quadrant IV</th>
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<tr>
<td>Acute Medical Settings and Primary Care</td>
<td>Rehabilitation Programs &amp; Services</td>
<td>Substance Abuse System Screening, Accommodation &amp; Linkage</td>
<td>Specialized TBI &amp; Substance Abuse Services Integrated Programming</td>
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**Review Article**

**Screening and Brief Intervention for Substance Misuse Among Patients With Traumatic Brain Injury**

John D. Corrigan, PhD, Jennifer Rogers, PhD, Daniel W. Shairsfeld, PhD, and Katherine Schmier, MD

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Quadrant IV: Specialized TBI & Substance Abuse Services
- Integrated Programming

Substance Abuse Treatment Clients Who Have Had a TBI with Loss of Consciousness
- Adolescent resid. tx
- Adult resid., IOP
- Prisoners in TC
- Dual dx tx program
Substance Abuse Treatment Clients with TBI
(Corrigan & Mysiw, 2012)

- first used at a younger age
- have more severe SUD (worse use and more prior treatments)
- have more co-occurring mental health problems
- have poorer prognosis for successful treatment outcome (more so earlier the age at first TBI?)

Two Consistent Clinical Observations Regarding Effect of TBI on Substance Abuse 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.

4 Quadrant Model: Types of Services
8 Principles of Integrated Treatment for TBI and Substance Use Disorders

1. Goals for SUD and TBI are interwoven—not sequential and not just parallel.

2. Treatment is holistic—addressing all aspects of lifestyle, not just TBI and substance use.

3. Consumer and clinician collaborate to develop a mutually agreed upon treatment plan.

4. Clinicians help consumers develop awareness and hopefulness so that motivation for recovery is internalized.

5. Different services will be helpful at different points in recovery—staging—which must be incorporated into the overall treatment model.

6. Treatment is longer-term.

7. Key staff are cross-trained to work with both TBI and substance use disorders.

8. Staff are more experienced and have smaller caseloads.

Further Resources

www.SynapShots.org
www.BrainLine.org

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