Brain Injuries and Substance Use Disorders: Understanding the Complexity of Co-occurring Disorders and Providing Effective, Evidence-based Treatment

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Thank you to the Brien Center

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“This is a funny thing. concussion is very strange – and I have been studying it: double vision, hearing comes and goes, your capacity for scenting (smelling something) can become acute beyond belief”

Ernest Hemingway - letter from Kenya February 2, 1954 one week after surviving his second plane crash in 24 hours
Your Brain on Drugs in the 1980’s

this is your brain on drugs.
What’s going on in there?
The Effects of Heavy Drinking on the Teen Brain

15 Year-old Non-Drinker

15 Year-old Heavy Drinker

Functional MRI scans of two teens while they took a working memory test. The images show that the heavy drinker isn't using those brain areas normally used to complete a memory test, while the non-drinker is. Researchers suggest that in school, heavy drinkers may not be activating those regions of the brain required to remember a lesson.
Concussion

Severe Traumatic Brain Injury

Normal

The Brain Wants To Rest After TBI
The Neuron: How the Brain’s Messaging System Works

- Dendrites
- Cell body (the cell’s life support center)
- Axon
- Myelin sheath
- Neuronal Impulse
- Terminal branches of axon
Serotonin Present in Cerebral Cortex Neurons

Control

2 weeks after Ecstasy

7 years after Ecstasy
TBI, SUD and Brain Volume

Hippocampus Volume

<table>
<thead>
<tr>
<th>Group</th>
<th>HIP Volume (cm³)</th>
</tr>
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<tbody>
<tr>
<td>TBI Substance Abuse</td>
<td>2.5 ± 0.5</td>
</tr>
<tr>
<td>TBI No Substance Abuse</td>
<td>2.0 ± 0.5</td>
</tr>
<tr>
<td>No TBI Substance Abuse</td>
<td>2.2 ± 0.6</td>
</tr>
<tr>
<td>No TBI No Substance Abuse</td>
<td>2.8 ± 0.7</td>
</tr>
</tbody>
</table>
Ventricle to Brain Ratio (VBR)

- TBI Substance Abuse
- TBI No Substance Abuse
- No TBI Substance Abuse
- No TBI No Substance Abuse
THC Binding
Opioid Binding in the Brain
(a) Structures of endorphin and morphine
Heroin Use Has INCREASED Among Most Demographic Groups

<table>
<thead>
<tr>
<th>SEX</th>
<th>2002-2004*</th>
<th>2011-2013*</th>
<th>% CHANGE</th>
</tr>
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<tbody>
<tr>
<td>Male</td>
<td>2.4</td>
<td>3.6</td>
<td>50%</td>
</tr>
<tr>
<td>Female</td>
<td>0.8</td>
<td>1.6</td>
<td>100%</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>AGE, YEARS</th>
<th>2002-2004*</th>
<th>2011-2013*</th>
<th>% CHANGE</th>
</tr>
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<tbody>
<tr>
<td>12-17</td>
<td>1.8</td>
<td>1.6</td>
<td>--</td>
</tr>
<tr>
<td>18-25</td>
<td>3.5</td>
<td>7.3</td>
<td>109%</td>
</tr>
<tr>
<td>26 or older</td>
<td>1.2</td>
<td>1.9</td>
<td>58%</td>
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<table>
<thead>
<tr>
<th>RACE/ETHNICITY</th>
<th>2002-2004*</th>
<th>2011-2013*</th>
<th>% CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Hispanic white</td>
<td>1.4</td>
<td>3</td>
<td>114%</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>1.7</td>
<td>--</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>ANNUAL HOUSEHOLD INCOME</th>
<th>2002-2004*</th>
<th>2011-2013*</th>
<th>% CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $20,000</td>
<td>3.4</td>
<td>5.5</td>
<td>62%</td>
</tr>
<tr>
<td>$20,000-$49,999</td>
<td>1.3</td>
<td>2.3</td>
<td>77%</td>
</tr>
<tr>
<td>$50,000 or more</td>
<td>1</td>
<td>1.6</td>
<td>60%</td>
</tr>
</tbody>
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<thead>
<tr>
<th>HEALTH INSURANCE COVERAGE</th>
<th>2002-2004*</th>
<th>2011-2013*</th>
<th>% CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>4.2</td>
<td>6.7</td>
<td>60%</td>
</tr>
<tr>
<td>Medicaid</td>
<td>4.3</td>
<td>4.7</td>
<td>--</td>
</tr>
<tr>
<td>Private or other</td>
<td>0.8</td>
<td>1.3</td>
<td>63%</td>
</tr>
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Heroin Addiction and Overdose Deaths are Climbing

Heroin-Related Overdose Deaths (per 100,000 people)

286% increase

Heroin Addiction (per 1,000 people)

NARCAN
Reverses Overdose Due to Opioid
How Long Does Narcan Last?

• 30-90 minutes
Why Do People Take Drugs in The First Place?

To Feel Good
To have novel:
  feelings
  sensations
  experiences
  AND
  to share them

To Feel Better
To lessen:
  anxiety
  worries
  fears
  depression
  hopelessness
Genetics is a Big Contributor to the Risk of Addiction…

And...

The Nature of this Contribution Is Extremely Complex
Downward Spiral of Addiction
Circuits Involved In Drug Abuse and Addiction

All of these brain regions must be considered in developing strategies to effectively treat addiction.
TRAUMATIC BRAIN INJURIES: OPEN AND CLOSED BRAIN INJURY

Open

Closed

MAY NOT BE AS APPARENT AS AN OPEN INJURY
CLOSED HEAD INJURY
(COUP AND CONTRECoup INJURY)

NORMAL

AXIAL VIEW
Comparison of Annual Incidence

Data compiled and arranged by the Brain Injury Association of America based on data from the Centers for Disease Control and Prevention, American Cancer Society and National Multiple Sclerosis Society.
What’s the relationship between TBI and SUD?

• Active substance use increases risk of TBI

• People in treatment for SUD are more likely to have had TBI in past

• TBI associated with increased risk of depression, anxiety, impulsivity, > sensitivity to substances and > risk of SU
What is the Data?

• Alcohol is present in more than half of all brain injuries. Alcohol is a factor in 66% of brain injuries caused by moving vehicles, and 60% of brain injuries involving violence.

• At least 20% of adolescents and adults who are hospitalized and at least 30% of those requiring rehabilitation are intoxicated at the time of their injury.
How Common is a History of Substance Use Disorder Prior to TBI?
Intoxication and Occurrence of TBI
(Savola, Niemela & Hillbom, 2005)

Blood Alcohol Content
Odds Ratio for Having a TBI

- .01-.999: 1.24
- .10-.149: 1.64
- .15-.199: 3.20
- ≥ .20: 9.23
What is the Risk of Addiction AFTER sustaining a TBI?

10+% of people with TBI will develop a SUD after sustaining the TBI
Binge Drinking 1 Year after Hospitalization for TBI

[Horner, et al, 2005 (South Carolina Follow-up Study)]

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<tr>
<th></th>
<th>TBI (SCTBIFR)</th>
<th>Gen'l Pop (BRFSS)</th>
</tr>
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<tbody>
<tr>
<td>none</td>
<td>52%</td>
<td>70%</td>
</tr>
<tr>
<td>1 or 2</td>
<td>22%</td>
<td>14%</td>
</tr>
<tr>
<td>3 or more</td>
<td>26%</td>
<td>16%</td>
</tr>
</tbody>
</table>

# binging occasions last 30 days
How do SUDs impact post-TBI?

• Prolonged recovery

• More sensitive to substances
  Impaired, impulsivity, memory, gait

• Negative interaction with prescribed medications

• Greater depression and anxiety and insomnia

• INCREASED RISK OF ANOTHER BRAIN INJURY
How common is TBI among persons receiving substance abuse treatment?

- Studies suggest 50% or more
How common is a history of TBI for people currently being tx for SUD?
% Clients in Substance Abuse Treatment with Histories of TBI

- 23% Adolescent resid. tx
- 53% Adult resid., IOP
- 50% Prisoners in TC
- 72% Dual dx tx program
Treatment
“Whatever it takes”

“I need all the help I can get”
We Need to Keep Our Eye on the Real Targets!

Abstinence

Functionality in Family, Work and Community

NIDA
Barriers to Care

- Behaviour resulting from the cognitive impairment that appears uncooperative or unmotivated
- Difficulty recalling information learned
- Difficulty generalizing
- Difficulty predicting and managing behaviour
HELPFUL HINTS WHEN WORKING WITH TBI PATIENTS

- Flexibility
- Understanding (TBI educated)
- Patience
- Respect
HELPFUL HINTS WHEN WORKING WITH TBI PATIENTS

• Groups
  • Provide notebooks for taking notes during group
    • Will need to change group therapy rules to allow for note taking – not usually allowed in group setting
  • Experiential activities work well – allows for multiple pathways for processing information
HELPFUL HINTS WHEN WORKING WITH TBI PATIENTS

• Group Issues that may need to be addressed
  • Significant Grief/Loss:
    • Loss of memory/skills/abilities
    • Loss of identity
    • Loss of power /control
    • Loss of anticipated future (dreams/career)
    • Relationship issues (possible loss of relationships)
    • Spiritual confusion/crisis
    • Isolation related to all of the above
Helpful Hints When Working with TBI Patients

• Encourage TBI patients who want to leave treatment AMA to sit quietly without distraction for several minutes so they may process their decision.

• Encourage slow decision-making process.
Provide direct feedback regarding inappropriate behaviors

Do not assume the individual knows and is choosing to do so. Inform person that behavior is inappropriate
Assist the individual to compensate for a unique learning style

• Modify written material to make it concise and to the point.

• Paraphrase concepts, use concrete examples, incorporate visual aids, or otherwise present an idea in more than one way.

• If it helps, allow the individual to take notes or at least write down key points for later review and recall.

• Encourage the use of a calendar or planner; if the treatment program includes a daily schedule, make sure a "pocket version" is kept for easy reference.

• Make sure homework assignments are written down.

• After group sessions, meet individually to review main points.

• Provide assistance with homework or worksheets; allow more time and take into account reading or writing abilities.

• Enlist family, friends or other service providers to reinforce goals.

• Do not take for granted that something learned in one situation will be generalized to another.

• Repeat, review, rehearse, repeat, review, rehearse.
Determine a person’s unique communication and learning styles

• Ask how well the person reads and writes

• Evaluate comprehension of both written and spoken language

• If someone is not able to speak (or speak easily), inquire as to alternate methods of expression (e.g., writing or gestures)

• Ask & observe a person’s attention span. Attentional changes in busy versus quiet environments?

• Ask & observe a person’s capacity for new learning; inquire as to strengths and weaknesses or seek consultation to determine optimum approaches
Provide direct feedback regarding inappropriate behaviors
TBI-SUD Specific Treatment Models

• Engagement in meaningful activity (incompatible with substance use and addresses mood/behaviour)

• Skills training

• Treatment may begin before insight/readiness to change
Psychotherapies for the Recovering Mind

• Motivation Enhancement

• Relapse Prevention Skills (CBT)

• 12 Step Facilitation

PROJECT MATCH
Equal Efficacy of 3 Treatments
NIAAA, SAMHSA
Stages of Change

Stages of change model:
- Pre-contemplation
- Contemplation
- Preparation
- Action
- Maintenance
- Relapse
- Stable behavior
Motivational Interviewing

• Improved motivational

• Reduced negative affect

• Reduced substance use
Be cautious when making inferences about motivation based on behaviors

• Do not assume non-compliance arises from lack of motivation or resistance

• Lack of awareness of deficits can arise as a result of specific damage to the brain and may not always be due to denial

• Confrontation shuts down thinking and elicits rigidity; roll with resistance

• Do not discharge for non-compliance; follow-up and find out why someone has no-showed or otherwise not followed through
The Ability to Change Brains Decreases Over Time

- Normal Brain Plasticity Influenced by Experience
- Physiological "Effort" Required to Enhance Neural Connections

Source: Levitt (2009)
Create a Treatment Plan that is “Long Enough for Recovery”
Treatment Outcome

- Abstinence
- Productivity
- Life Satisfaction

- Treated (n=62)
- Premature Termination (n=59)
- Eligible but Untreated (n=48)
**Extended Abstinence is Predictive of Sustained Recovery**

It takes a year of abstinence before less than half relapse.

After 5 years – if you are sober, you probably will stay that way.

**Graph:**
- **36%** for 1 to 12 months (n=157, OR=1.0)
- **66%** for 1 to 3 years (n=138, OR=3.4)
- **86%** for 3 to 5 years (n=59, OR=11.2)
- **86%** for 5+ years (n=96, OR=11.2)

*Dennis et al, Eval Rev, 2007*
Case Management Models

- Access to substance abuse services/mental Health Services

- ABI consultation
  - Explain Neuro-cognitive Impairment
  - Adapt treatment plans
  - Trouble-shoot

- Assist with access to other support services
Corrigan Review (2005)

• Treatment is likely to be protracted

• Successful programs will address engagement in treatment

• Early intervention is important
Findings

N=195 (138, male; 57 female)
Mean age = 36.6 (range = 18 to 72)
Mean time since injury = 8.0 (range = 3 weeks to 55 years)
6-Month Follow-up Data

- By 6-months over 30% had terminated therapy
- 50% improvement over control for Barrier Reduction and Financial Incentives
- Brief phone intervention makes a big difference

Still in treatment or successfully terminated
5 Principles for Working with ABI clients

• **P**ace communications (one concept at a time)
• **R**epeat important concepts
• **I**llustrate using concrete examples
• **M**emory Aids for use in session and outside
• **E**nvironmental modifications (including involvement of caregivers)
• **R**e-direction sometimes necessary to move client to problem-solve or address tangential speech
Relapse Rates Are Similar for Drug Addiction & Other Chronic Illnesses

McLellan et al., JAMA, 2000.