Cognitive Impairment in AOD: Assessment and Treatment

A Presentation for the Addiction Leadership Day
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What is Cognitive Impairment?

• Deficits in information processing, including:
  – memory,
  – attention/concentration,
  – visuo-spatial skills,
  – language skills, and/or
  – executive functioning

...relative to population norms or a person’s baseline.

• Multiple causes
Major Causes of Cognitive Impairment
CI Prevalence and Implications in AOD

• The prevalence of cognitive impairment among clients accessing AOD treatment has been estimated to be between 30% and 80% – (Copersino, et al., 2009)

• Marceau et al (2016). Using a Brief Screening Tool to assess Cognitive Impairment in residents of an Alcohol and other drug Therapeutic Community. *Journal of Substance Abuse Treatment*
Marceau et al (2016)

- Residents of an AOD therapeutic community  
  - N=128
- Non-substance using control group  
  - N=37
- All administered the MoCA
- 43.8% AOD treatment clients met criteria for cognitive impairment
<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Mdn, range)</td>
<td>35 (19-56)</td>
</tr>
<tr>
<td>Gender (% male)</td>
<td>70.3</td>
</tr>
<tr>
<td>Education (Mdn, range)</td>
<td>10 (7-16)</td>
</tr>
<tr>
<td>Unemployed (%)</td>
<td>90.5</td>
</tr>
<tr>
<td>Homeless(^a) (%)</td>
<td>7.4</td>
</tr>
<tr>
<td>Arrested during last 3 months(^a) (%)</td>
<td>43.2</td>
</tr>
<tr>
<td>Primary substance of misuse(^b) (%)</td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>30.4</td>
</tr>
<tr>
<td>Heroin</td>
<td>27.7</td>
</tr>
<tr>
<td>Amphetamines</td>
<td>20.5</td>
</tr>
<tr>
<td>Cannabis</td>
<td>8.9</td>
</tr>
<tr>
<td>Tranquilisers</td>
<td>4.5</td>
</tr>
<tr>
<td>Methadone</td>
<td>2.7</td>
</tr>
<tr>
<td>Buprenorphine</td>
<td>1.8</td>
</tr>
<tr>
<td>Cocaine</td>
<td>1.8</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>1.8</td>
</tr>
<tr>
<td>SDS(^c) score(^a) (Mdn, range)</td>
<td>11 (0-15)</td>
</tr>
<tr>
<td>History of overdose (%)</td>
<td>60.2</td>
</tr>
<tr>
<td>Injected during last 3 months (%)</td>
<td>52.6</td>
</tr>
<tr>
<td>K10(^d) score(^a) (M, SD)</td>
<td>29.2 (7.8)</td>
</tr>
<tr>
<td>Hospitalized after head injury (%)</td>
<td>50</td>
</tr>
<tr>
<td>Lost consciousness/concussion after head injury (%)</td>
<td>67.2</td>
</tr>
</tbody>
</table>
Marceau et al (2016)

• **67.2%** of AOD sample had sustained an acquired brain injury
• **50%** of the AOD sample required hospitalisation for their head injury
• History of head injury was a significant predictor of cognitive impairment
• **Executive functioning** (combination of trail-making, phonemic fluency, verbal abstraction, cube-copying and clock-drawing) was the most significant domain difference between the groups.
Fig. 1. Standardized (out of 6) MoCA domain scores for the AOD patients who were hospitalized for head injuries, non-hospitalized for any head injury (includes those who never had a head injury or may have sustained head injuries not requiring hospitalization), and control participants.

- 77 studies covering 48 years of research (1965 to 2013)
- Total sample size of 5,196 recently detoxified alcohol-dependent participants.
- A moderate effect ($g = 0.569$) for executive functioning as a whole
  - Planning and Problem Solving ($g = 0.620$)
  - Inhibition and Self Regulation ($g = 0.565$)
  - Flexibility and Set Shifting ($g = 0.548$)
  - Reasoning and Abstraction ($g = 0.479$)
Mechanisms of Brain Impairment in AOD

63yo Control

59yo ARCD

63yo Korsakoff
Mechanisms of Brain Impairment in AOD

- Neurotoxicity
  - Oxidative stress
  - Hyperthermia
Impact of CI in AOD Treatment

  1. Cognitive Impairment
  2. Younger Age
  3. Personality Disorder
Impact of CI in AOD Treatment

• To overcome addiction, clients need to:
  integrate new information, formulate goals, establish new behavioural strategies and plan for the future

  Executive Functioning

• “those capacities that enable a person to engage successfully in independent, purposive, self-directed, and self-serving behavior” – Lezak et al (2012)
Our Goal

• To develop a frontline user-friendly cognitive remediation program that impacts AOD treatment outcomes
  – Focus on executive functioning
  – Combines bottom-up and top-down approaches to CR
  – Duration and intensity suitable for implementation in residential AOD treatment
  – Targets and results in real-world functional outcomes
Levels of Impact

Premature drop-out from AOD treatment

Limited ability to benefit from AOD treatment program

Memory Impairment

Executive Impairment

WHO ICF Level

PARTICIPATION

RESTRICTION

ACTIVITY

LIMITATION

IMPAIRMENT
Our Pilot - Design

• Nonrandomised controlled trial
  – Cohort allocation to CR and TAU groups
  – CR (Intervention) Group
    • 12 x 2 hour sessions, run 3 times per week over 4 weeks
    • Intervention compromised of:
      – 1 hr of group work-*Top down* (strategies to address memory, attention and executive function weaknesses)
      – 1 hr Lumosity training - *Bottom up* (completed on iPads)
  – Control Group
    • Treatment as usual after washout of CR participants (i.e. once all clients who had completed the intervention had left the service)
Design

• Pre- post- intervention measures
  – Cognitive tests
  – Self-report inventories
  – Everyday goal attainment
  – AOD treatment indicators (treatment completion)

• Maintenance measured by questionnaires/inventories at 3 months following completion of the intervention.

- **n=126**
  - SUD group recruited from outpatient and residential treatment facilities

- **n=32**
  - convenience sample control group

- **Compared sensitivity of performance-based and inventory-based measures of EF**
  - Performance based measures
    - IGT, Stroop, TMT
  - Inventory-based measure
    - Behavior Rating Inventory of Executive Functioning (BRIEF-A)

- The BRIEF-A was **more sensitive** at differentiating between the groups compared with performance-based measures.

- The BRIEF-A was **associated with social adjustment indicators**
  - criminal lifestyle
  - conflict with caregiver
  - stable housing

- Recommended BRIEF-A to be considered as an integral measure of EF in patients with SUD
Overall BRIEF-A Results

- Hagen et al (2016) SUD
- Marceau et al (2016) Pre-CR
- Marceau et al (2016) 3 Months

Legend:
- Blue: Behavior Regulation Index
- Red: Metacognition Index
BRIEF-A Global Executive Composite Baseline and 3 months post-intervention
Table 2
Post-intervention effects of cognitive remediation vs. treatment as usual on executive functions, self-regulation and quality of life in residents of a female-only substance use therapeutic community

<table>
<thead>
<tr>
<th>Dependent measures</th>
<th>Cognitive Remediation (CR) Adjusted ( M (SE) )</th>
<th>Treatment As Usual (TAU) Adjusted ( M (SE) )</th>
<th>( F )</th>
<th>( p )</th>
<th>Partial ( \eta^2 )</th>
<th>Cohen's d conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-intervention score</td>
<td>Post-intervention score</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Executive functions</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMI</td>
<td>96.97 (1.52)</td>
<td>95.85 (1.48)</td>
<td>0.28</td>
<td>0.60</td>
<td>0.009</td>
<td>0.756</td>
</tr>
<tr>
<td>Inhibition vs. Colour Naming</td>
<td>11.44 (0.43)</td>
<td>10.18 (0.42)</td>
<td>4.29</td>
<td>0.047*</td>
<td>0.125</td>
<td></td>
</tr>
<tr>
<td>Inhibition/Shifting vs. Colour Naming</td>
<td>11.44 (2.19)</td>
<td>10.77 (2.05)</td>
<td>1.41</td>
<td>0.25</td>
<td>0.043</td>
<td></td>
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<tr>
<td>TMT (B-A; time s)&lt;sup&gt;b,c&lt;/sup&gt;</td>
<td>36.50 (20.01)</td>
<td>29.41 (12.44)</td>
<td>1.80</td>
<td>0.19</td>
<td>0.058</td>
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<tr>
<td>BRIEF-A</td>
<td></td>
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<tr>
<td>Global Executive Composite</td>
<td>53.07 (1.74)</td>
<td>59.35 (1.68)</td>
<td>6.38</td>
<td>0.017*</td>
<td>0.175</td>
<td>0.9211</td>
</tr>
<tr>
<td>Behavioral Regulation Index</td>
<td>55.28 (1.94)</td>
<td>60.32 (1.88)</td>
<td>3.34</td>
<td>0.08</td>
<td>0.100</td>
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<tr>
<td>Metacognition Index</td>
<td>51.46 (1.62)</td>
<td>57.04 (1.57)</td>
<td>5.69</td>
<td>0.024*</td>
<td>0.160</td>
<td>0.873</td>
</tr>
<tr>
<td>Self-regulation</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>BIS-11</td>
<td>70.57 (1.85)</td>
<td>76.11 (1.79)</td>
<td>4.61</td>
<td>0.04*</td>
<td>0.133</td>
<td>0.783</td>
</tr>
<tr>
<td>BSCS&lt;sup&gt;d&lt;/sup&gt;</td>
<td>2.90 (0.11)</td>
<td>2.55 (0.10)</td>
<td>5.53</td>
<td>0.026*</td>
<td>0.160</td>
<td></td>
</tr>
<tr>
<td>DERS&lt;sup&gt;b,d,e&lt;/sup&gt;</td>
<td>94.93 (33.15)</td>
<td>94.47 (16.38)</td>
<td>0.44</td>
<td>0.51</td>
<td>0.014</td>
<td></td>
</tr>
<tr>
<td>PACS&lt;sup&gt;f&lt;/sup&gt;</td>
<td>7.84 (1.39)</td>
<td>11.48 (1.39)</td>
<td>3.41</td>
<td>0.08</td>
<td>0.105</td>
<td></td>
</tr>
<tr>
<td>Quality of life</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Q-LES-Q-SF&lt;sup&gt;a,d&lt;/sup&gt;</td>
<td>0.71 (0.06)</td>
<td>0.61 (0.16)</td>
<td>7.68</td>
<td>0.01**</td>
<td>0.204</td>
<td>1.013</td>
</tr>
</tbody>
</table>

* \( p \leq .05 \) ** \( p \leq .01 \)
Treatment Completion Gains

- CR participants were **165%** more likely to complete the program than the control group.
Acknowledgements

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