Early Abstinence-Related Improvements Following Adolescent Heavy Episodic Drinking

Susan Tapert, Nicole Bekman, Jennifer Winward, Carmen Pulido, & Sandra Brown
Recovery from Teen Drinking

- Study design
- Neurocognition
- Alcohol cue reactivity
- Negative affect
- Distress tolerance
Background

• Adolescent heavy drinking is common
• Linked to problems:
  – Neurocognitive performance
  – Risk taking circuitry
  – Alcohol cue reactivity
  – Affect
  – Distress tolerance
• Recover with abstinence?
Hypotheses

• Heavy drinkers worse at week 1-3
• Improved after 3 weeks of abstinence
Monitored Abstinence Period:
- Utox 3x/week
- Daily text mood ratings

Baseline
Scan
NP
Interview
~5 days abstinent

+2 weeks
Scan
NP
Interview
~19 days abstinent

+4 weeks
Scan
NP
Interview
~33 days abstinent

Design

National Consortium on Alcohol and NeuroDevelopment in Adolescence
Participants

<table>
<thead>
<tr>
<th>* $p&lt;.05$</th>
<th>Heavy Drinkers ($n=39$)</th>
<th>Controls ($n=26$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (range 16-18)</td>
<td>17.7</td>
<td>17.6</td>
</tr>
<tr>
<td>% Female</td>
<td>46%</td>
<td>46%</td>
</tr>
<tr>
<td>Grade point average</td>
<td>3.3</td>
<td>3.6</td>
</tr>
<tr>
<td>CBCL Externalizing T-score *</td>
<td>49.0</td>
<td>41.5</td>
</tr>
<tr>
<td>CBCL Internalizing T-score</td>
<td>45.6</td>
<td>43.5</td>
</tr>
<tr>
<td>5th grade language score</td>
<td>345.8</td>
<td>370.3</td>
</tr>
<tr>
<td>5th grade math score</td>
<td>342.3</td>
<td>394.7</td>
</tr>
</tbody>
</table>
### Substance Use

<table>
<thead>
<tr>
<th>Heavy Drinkers:</th>
<th>M ±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol use occasions, Lifetime</td>
<td>220 ±174</td>
</tr>
<tr>
<td>Binge drinking occasions, Lifetime</td>
<td>115 ±92</td>
</tr>
<tr>
<td>Alcohol withdrawal symptoms, Lifetime</td>
<td>4 ±2</td>
</tr>
<tr>
<td>Max drinks/occasion, Lifetime</td>
<td>11 ±5</td>
</tr>
<tr>
<td>Marijuana use occasions, Lifetime</td>
<td>59 ±76</td>
</tr>
<tr>
<td>Other drug use occasions, Lifetime</td>
<td>9 ±17</td>
</tr>
</tbody>
</table>
### Exclusions

- No guardian
- MRI contraindications
- Prenatal substance exposure
- Hx psychiatric or neurological disorder
- Psychoactive medications
- Left-handed
Recovery from Teen Drinking

✓ Study design
  • Neurocognitive performance
  • Alcohol cue reactivity
  • Negative affect
  • Distress tolerance
Recovery of Visuospatial Deficits

- Linear mixed effects models
- Controlled for:
  - Externalizing behavior
  - FH SUD
- Different domains show different patterns of improvement
  - Improvement beyond practice alone
  - Low power
- \( \rightarrow \) NCANDA \( N=850 \)

Winward et al., under review
Balloon Risk Analog Task (BART)

- Rapid event-related design
- 20 balloons; predetermined explosion points

Lejuez et al., 2002….2013
BART: Inflate

Lejuez et al., 2002….2013
BART: Win!

Lejuez et al., 2002....2013
BART: Pop!

Lejuez et al., 2002....2013
Anticipation

Right Insula

Week: 1 3 5

CON change over time $p<.01$

Right ACC

CON change over time $p<.01$

Bazinet et al., in preparation
Loss Outcome

Left VMPFC

Right VMPFC

Bazinet et al., in preparation
FMRI BART: Drinkers

• At baseline, heavy drinkers:
  – $\downarrow$ insula activation during anticipation
  – $\uparrow$ VMPFC activation as evaluate negative outcomes
  – No differences after 2-3 weeks of abstinence

• With abstinence:
  – $\downarrow$ ACC activation during anticipation vs Controls
  – Suggests some neural recovery

Bazinet et al., in preparation
Recovery from Teen Drinking

✓ Study design
✓ Neurocognitive performance
  • Alcohol cue reactivity
  • Negative affect
  • Distress tolerance
FMRI: Alcohol Cue Reactivity

- Enhanced response in heavy drinkers
- Reduce with abstinence?

Task Stimuli

Shuffled  Non-Alcohol  Alcohol

Pulido et al., 2010, Addictive Behaviors
Alcohol Cue Reactivity Task

Picture Type
- Alcohol
- Non-alc
- Shuffled
- Fixation

Trial: 2s
Fixation: 2, 4, or 6s

750 ms
1250 ms
2000 ms

Pulido et al., 2010, Addictive Behaviors
Week 1: Alcohol vs. non-alc cues

Heavy Drinking > Control
adolescents in 6 regions:

1. Right superior frontal gyrus
2. Left medial frontal/striatum
3. Bilateral cerebellum
4. Left cingulate
5. Left pre/post-central gyrus
6. Left middle temporal gyrus

Pulido et al., in preparation
Weeks 3+: Alcohol vs. non-alc cues

- 3 weeks abstinent:
  - HED similar to Controls in 5 of 6 brain regions.
  - Right superior frontal, HED > Controls

- 5-6 weeks abstinent: no differences

Pulido et al., in preparation
Recovery from Teen Drinking

- Study design
- Neurocognitive performance
- Alcohol cue reactivity
  - Negative affect
  - Distress tolerance
Affect

Bekman et al., 2013, ACER
Recovery from Teen Drinking

- Study design
- Neurocognitive performance
- Alcohol cue reactivity
- Negative affect
  - Distress tolerance
Distress Tolerance: PASAT-D

Winward et al., in preparation
Recovery after 4 Weeks Abstinent

- **Neurocognition**
  - Some recovery

- **Alcohol cue reactivity**
  - Full recovery

- **Negative affect**
  - Recovery for boys, slower for girls

- **Distress tolerance**
  - Emotional reactivity largely resolve
Adolescent Neurocognitive Recovery Models

MODERATORS
- Gender
- Family History
- White Matter Integrity
- Intellectual Baseline
- Externalizing Symptoms
- Internalizing Symptoms
- Lifetime Alcohol Exposure

MEDIATORS
- Neuroanatomical Changes
- Negative Affect
- Neurocognitive Performance
- Sleep

Time

Severities of Recent Alcohol Use
Acknowledgements

• NIAAA R21 AA017321 (PI: Sandra Brown)
  – Project staff:
    • Karen Hanson, Ph.D.
    • Nicole Bekman, Ph.D.
    • Alissa Bazinet, Ph.D.
    • Jennifer Winward
    • Chase Wagner
    • Stephan Jordan
• U01 AA021695 (Brown)
• U01 AA021692 (Tapert)