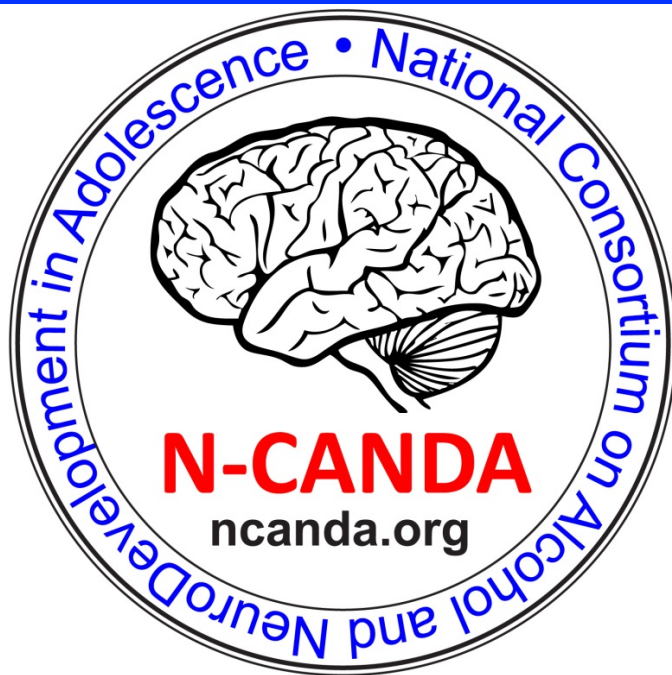


Early Abstinence-Related Improvements Following Adolescent Heavy Episodic Drinking



Susan Tapert,
Nicole Bekman,
Jennifer Winward,
Carmen Pulido,
& Sandra Brown

Recovery from Teen Drinking

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



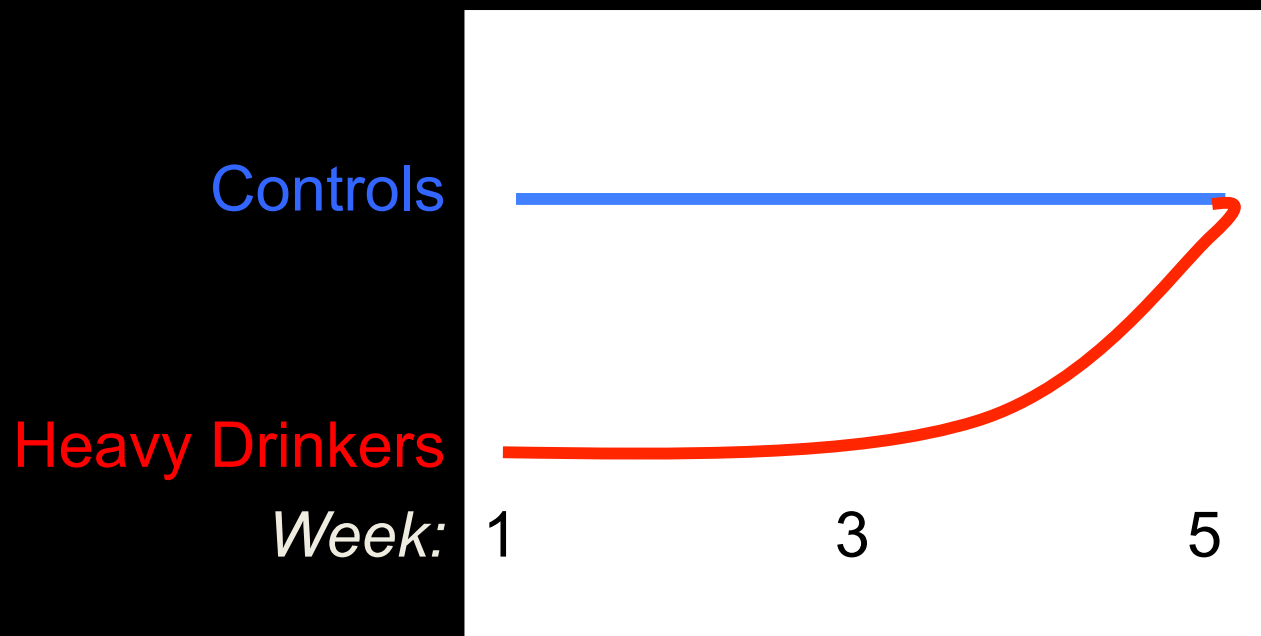
Background

- 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



Design

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



Participants

	Heavy Drinkers (n=39)	Controls (n=26)
* $p < .05$		
Age (range 16-18)	17.7	17.6
% Female	46%	46%
Grade point average	3.3	3.6
CBCL Externalizing T-score *	49.0	41.5
CBCL Internalizing T-score	45.6	43.5
5 th grade language score	345.8	370.3
5 th grade math score	342.3	394.7



Substance Use

Heavy Drinkers:	M \pm SD
Alcohol use occasions, Lifetime	220 \pm 174
Binge drinking occasions, Lifetime	115 \pm 92
Alcohol withdrawal symptoms, Lifetime	4 \pm 2
Max drinks/occasion, Lifetime	11 \pm 5
Marijuana use occasions, Lifetime	59 \pm 76
Other drug use occasions, Lifetime	9 \pm 17



Exclusions

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



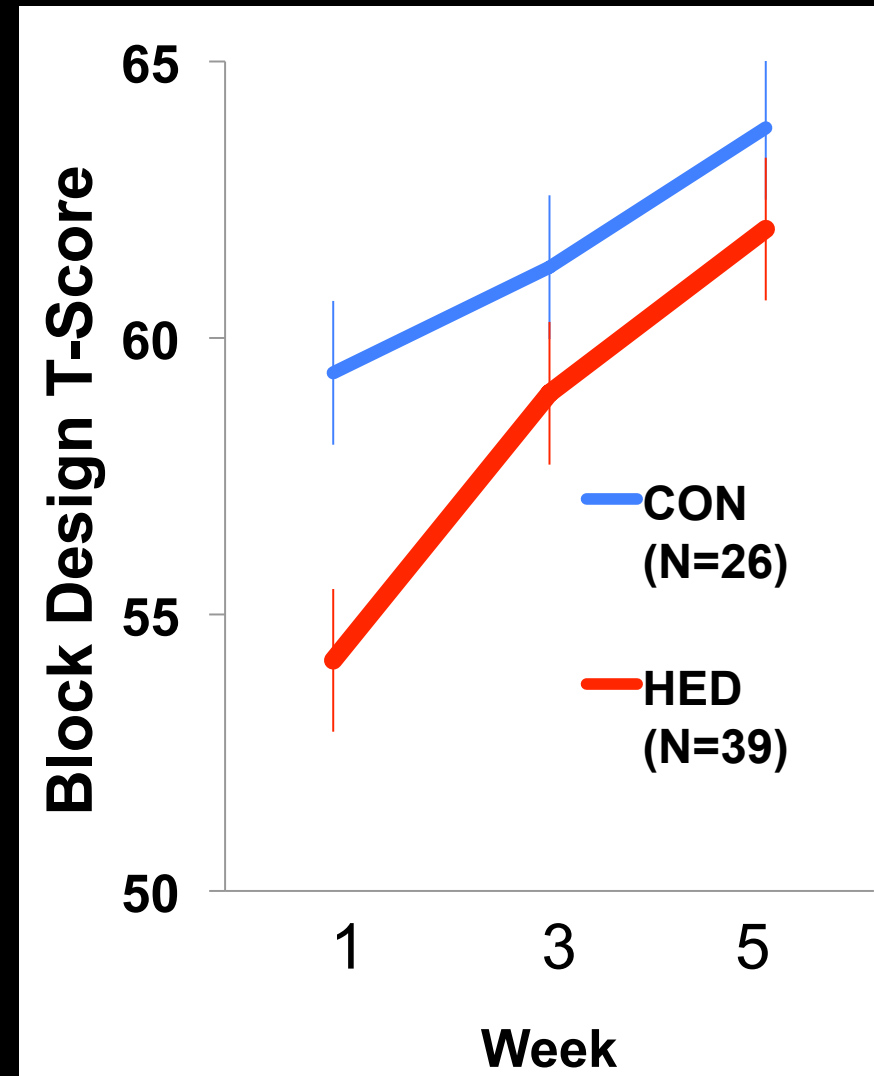
Recovery from Teen Drinking

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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
- → NCANDA $N=850$



Balloon Risk Analog Task (BART)

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

INSTRUCTIONS

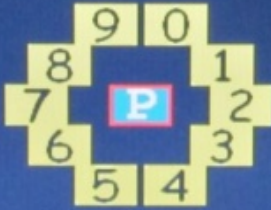

On the yellow dial, select your number of pumps, 1-128. You may use "clear" to change.

Remember

- Pumps must be between 1 and 128.
- 64 pumps is the best overall strategy.
- Select "P" to pump.

clear

explosion point for last balloon



Status Bar

Think
Pump
Wait
Inflate
POP or WIN
Rest

At Stake	<input type="text"/>
Total Earned	<input type="text"/>
Balloon Number	<input type="text"/>

BART: Inflate

The screenshot displays the BART: Inflate game interface. A large blue balloon is inflated and attached to a pump mechanism. Below the pump is a keypad with numbers 0-9. A box above the keypad shows the number 22. To the left, a box shows 120 and 'explosion point for last balloon'. To the right, a 'Status Bar' lists actions: Think, Pump, Wait, Inflate (highlighted in yellow), POP or WIN, and Rest. Below the status bar are three colored boxes: 'At Stake' (\$0.22), 'Total Earned' (\$1.3), and 'Balloon Number' (6).

Status Bar

- Think
- Pump
- Wait
- Inflate**
- POP or WIN
- Rest

At Stake	\$0.22
Total Earned	\$1.3
Balloon Number	6

120
explosion point for last balloon

22

8 9 0 1
7 6 5 4 3 2

BART: Win!

The screenshot displays the BART game interface. A large blue balloon is inflated and attached to a pump mechanism. Below the pump is a keypad with numbers 0-9 arranged in a circular pattern. A status bar on the right lists actions: Think, Pump, Wait, Inflate, Win (highlighted in yellow), and Rest. A table on the right shows game statistics: At Stake (empty), Total Earned (\$3.16), and Balloon Number (11). A box on the left indicates the explosion point for the last balloon at 65.

Status Bar

- Think
- Pump
- Wait
- Inflate
- Win**
- Rest

At Stake	
Total Earned	\$3.16
Balloon Number	11

65
explosion point
for last balloon

67
9 0
8 1
7 2
6 3
5 4

BART: Pop!

Status Bar

- Think
- Pump
- Wait
- Inflate
- Pop**
- Rest

At Stake

Total Earned \$3.16

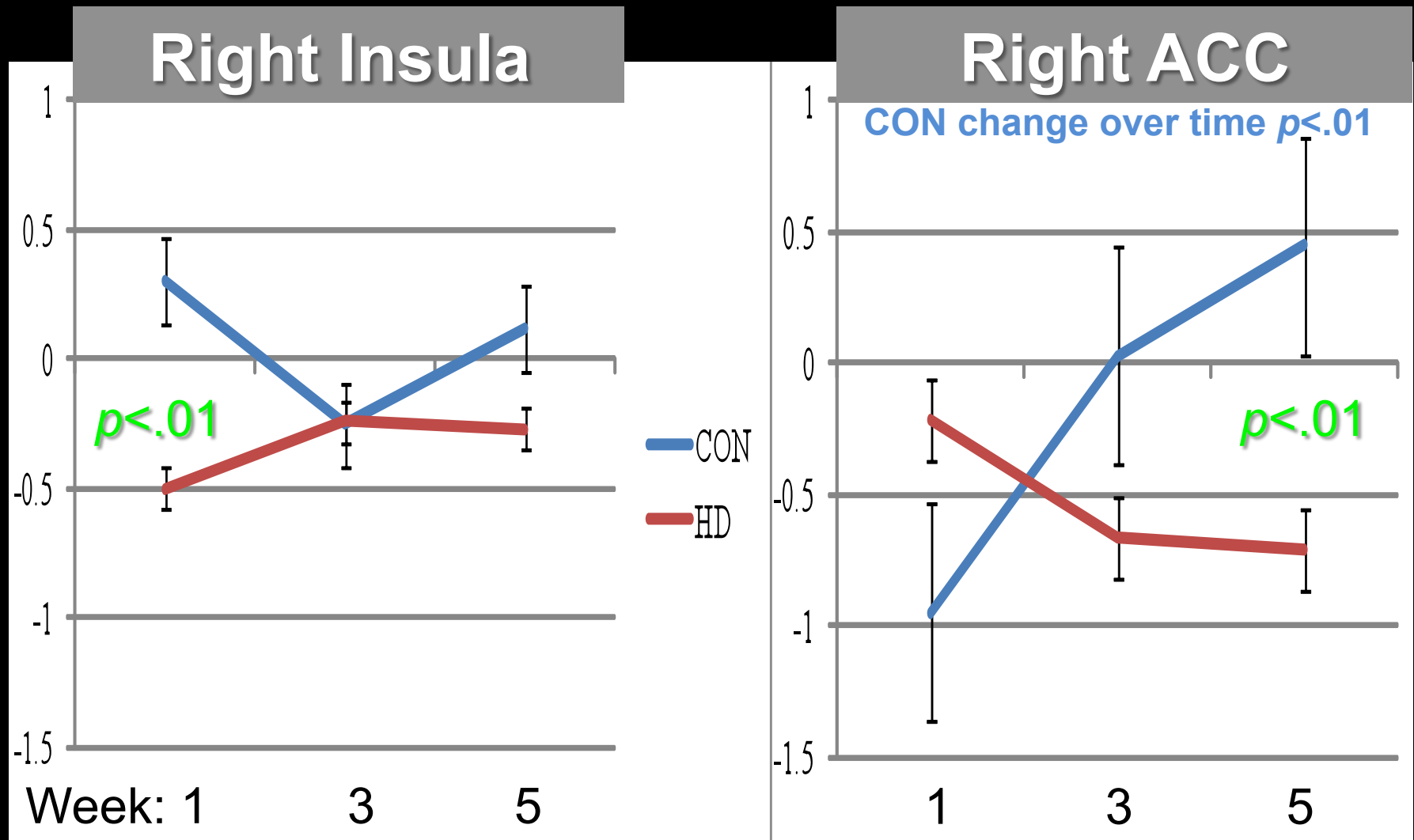
Balloon Number 13

121
explosion point
for last balloon

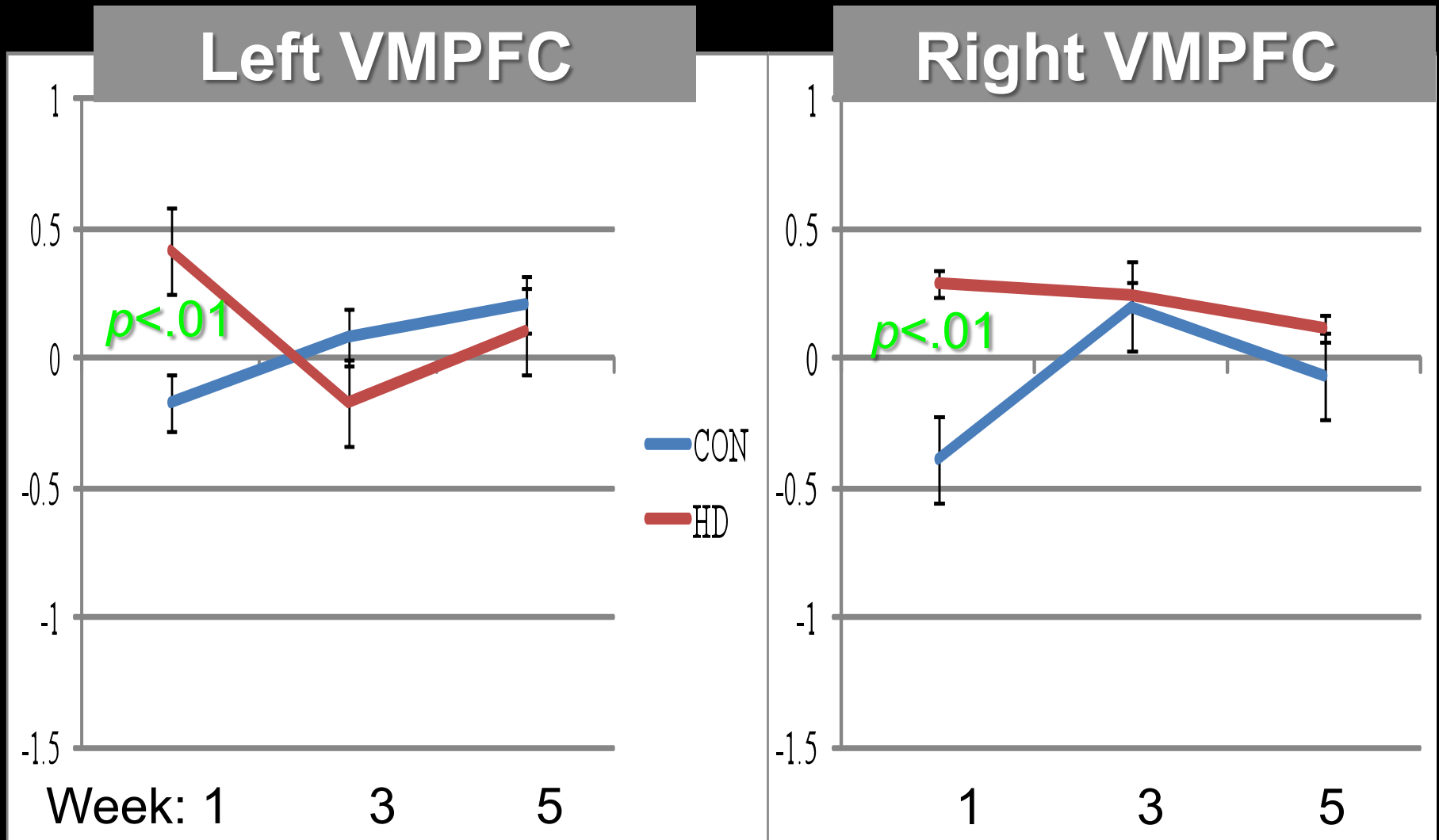
99

8 9 0 1
7 6 5 4 3 2
5 4 3

Anticipation



Loss Outcome



FMRI BART: Drinkers

- **At baseline, heavy drinkers:**
 - ↓ insula activation during anticipation
 - ↑ VMPFC activation as evaluate negative outcomes
 - No differences after 2-3 weeks of abstinence
- **With abstinence:**
 - ↓ ACC activation during anticipation vs Controls
 - Suggests some neural recovery

Recovery from Teen Drinking

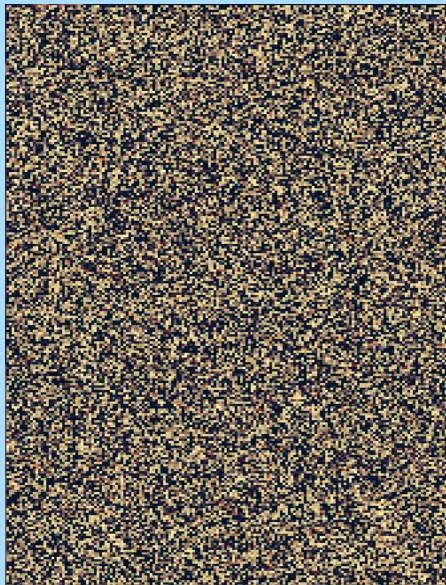
- ✓ Study design
- ✓ Neurocognitive performance
 - Alcohol cue reactivity
 - Negative affect
 - Distress tolerance



FMRI: Alcohol Cue Reactivity

- Enhanced response in heavy drinkers
- Reduce with abstinence?

TASK STIMULI



Shuffled



Non-Alcohol



Alcohol

Alcohol Cue Reactivity Task

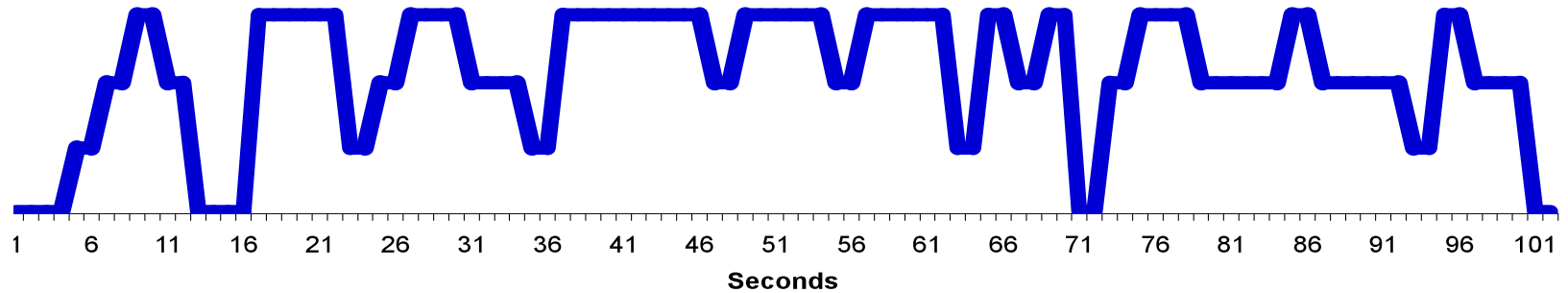
Picture Type

Alcohol

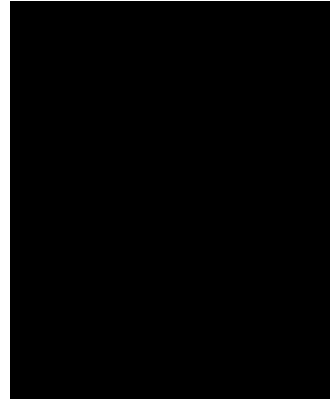
Non-alc

Shuffled

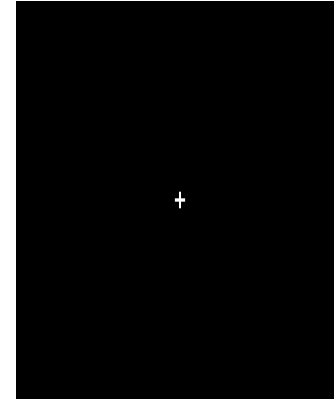
Fixation



750ms



1250ms



2000ms

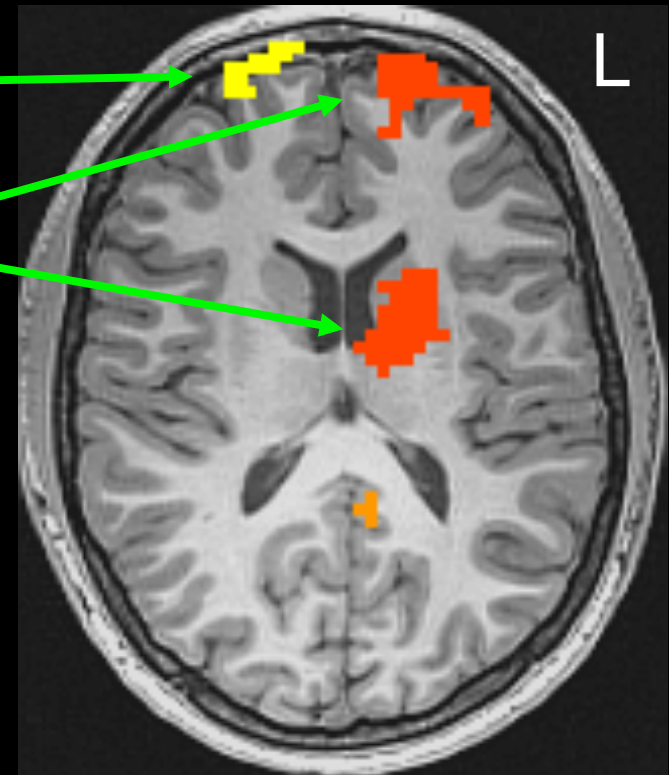
Trial: 2s

Fixation: 2, 4, or 6s

Week 1: Alcohol vs. non-alc cues

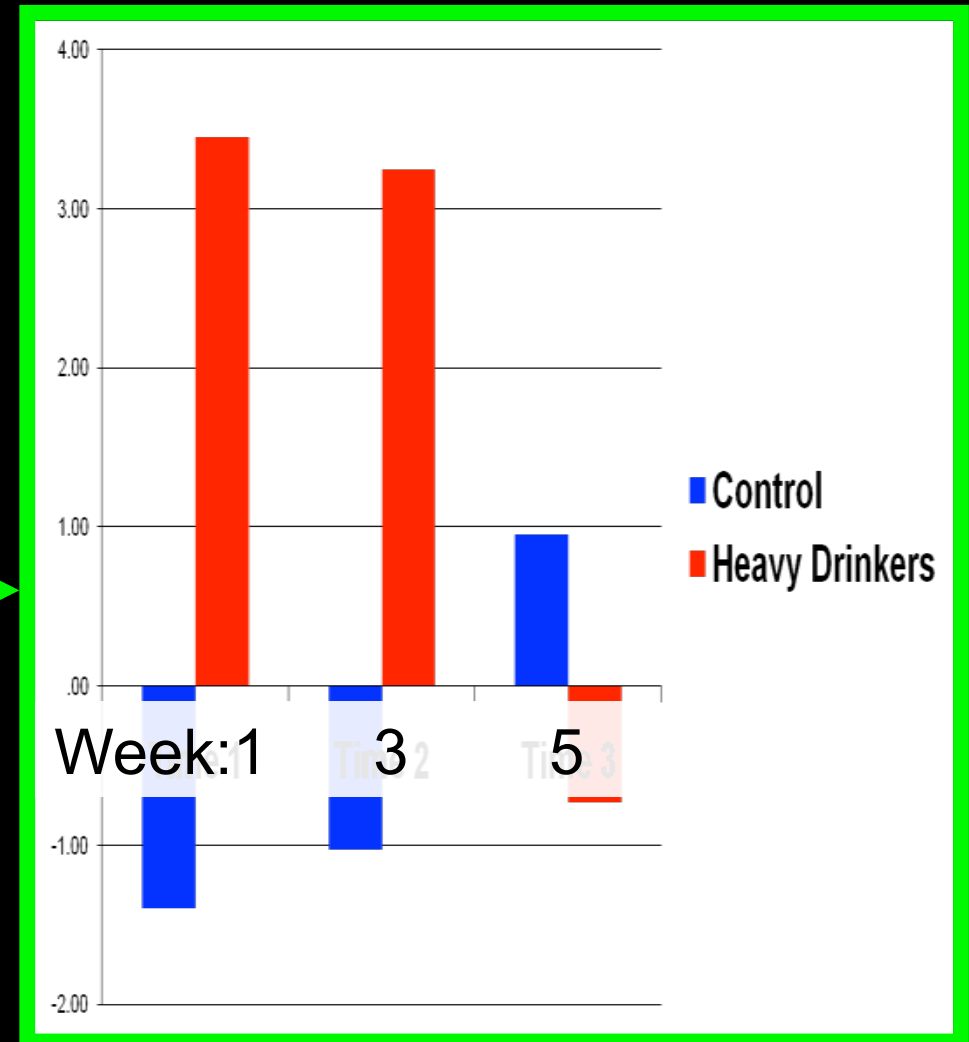
Heavy Drinking > **Control**
adolescents in 6 regions:

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



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



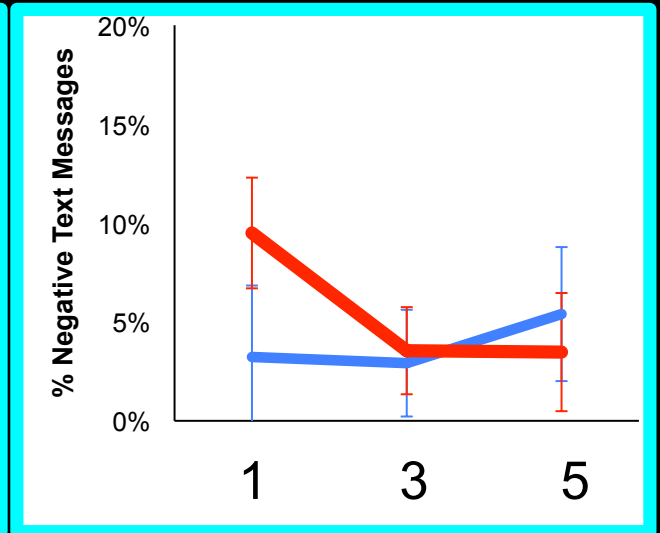
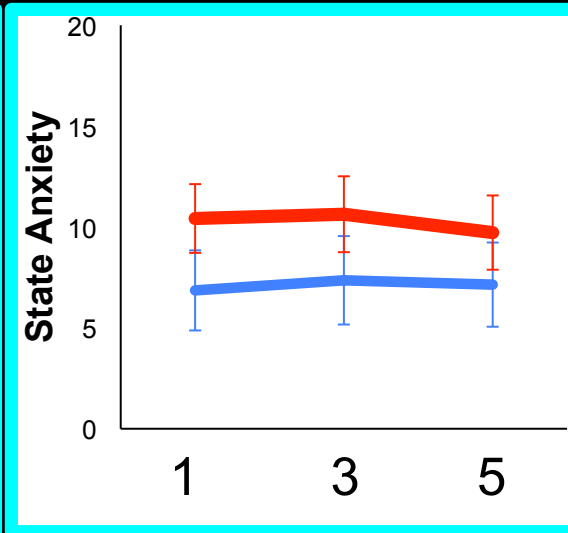
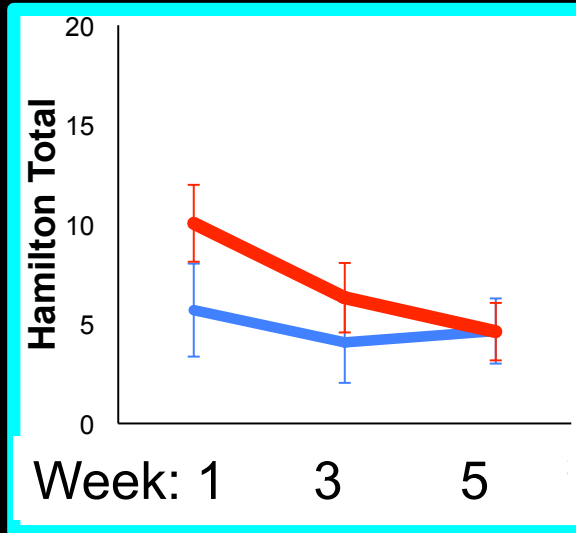
Recovery from Teen Drinking

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

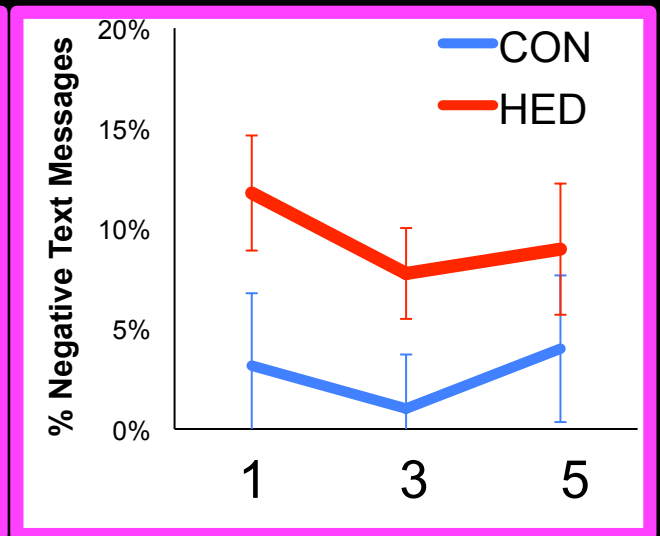
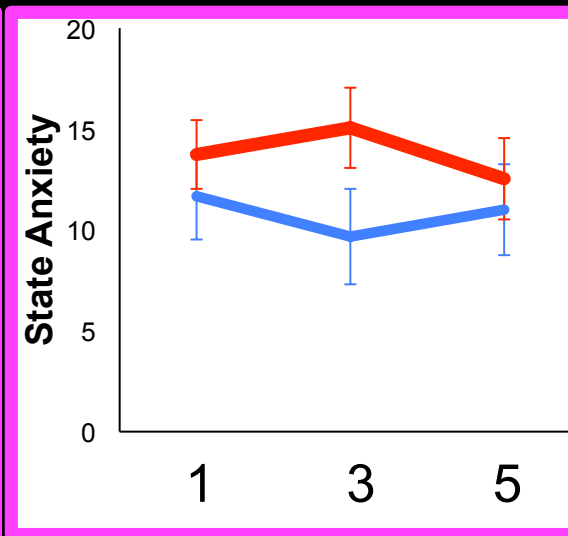
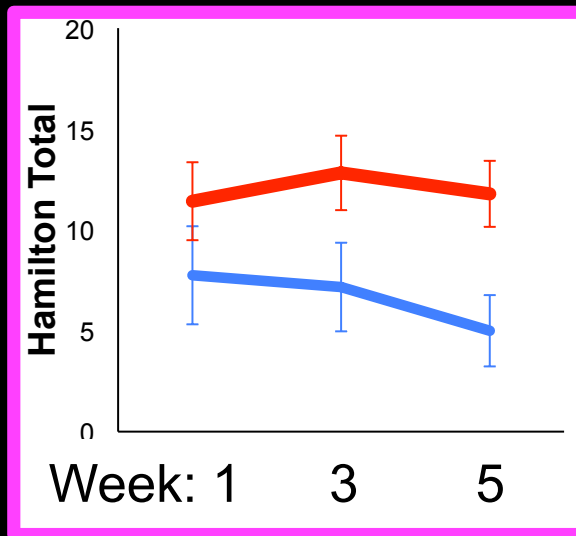


Affect

MALES



FEMALES

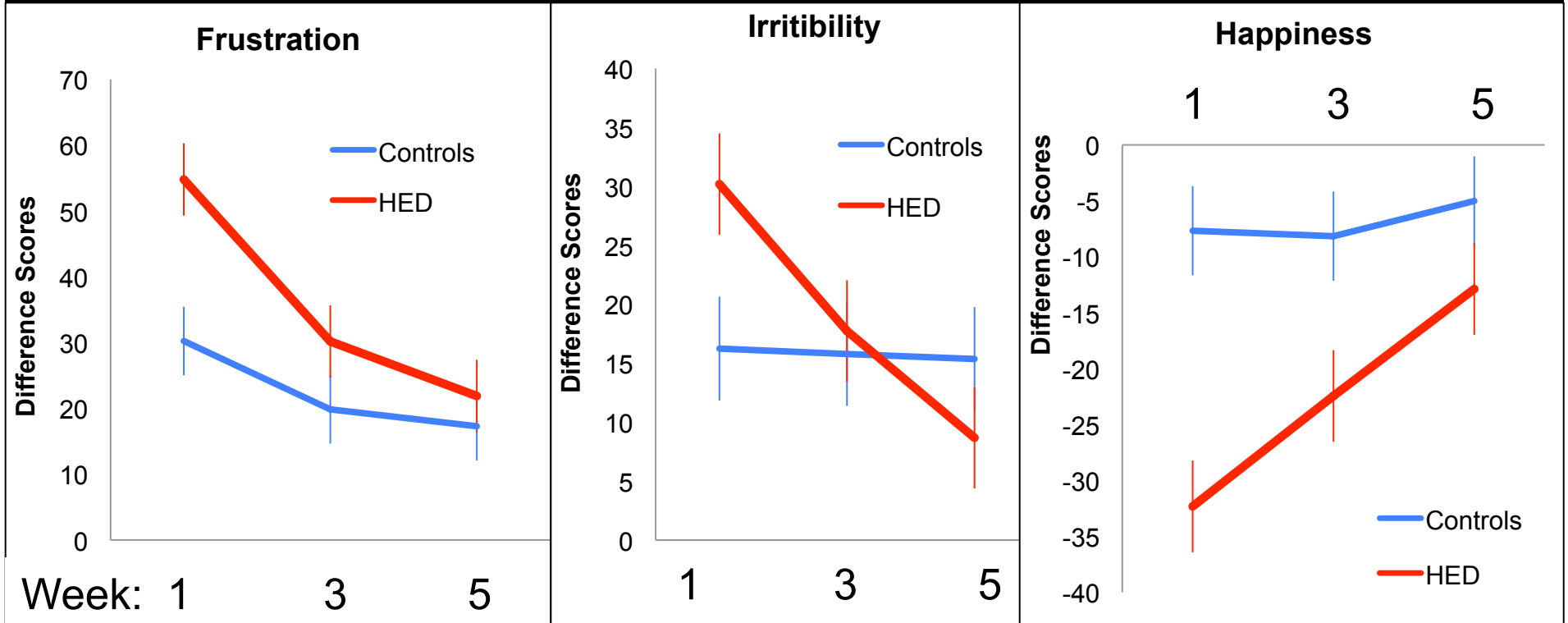


Recovery from Teen Drinking

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



Distress Tolerance: PASAT-D



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

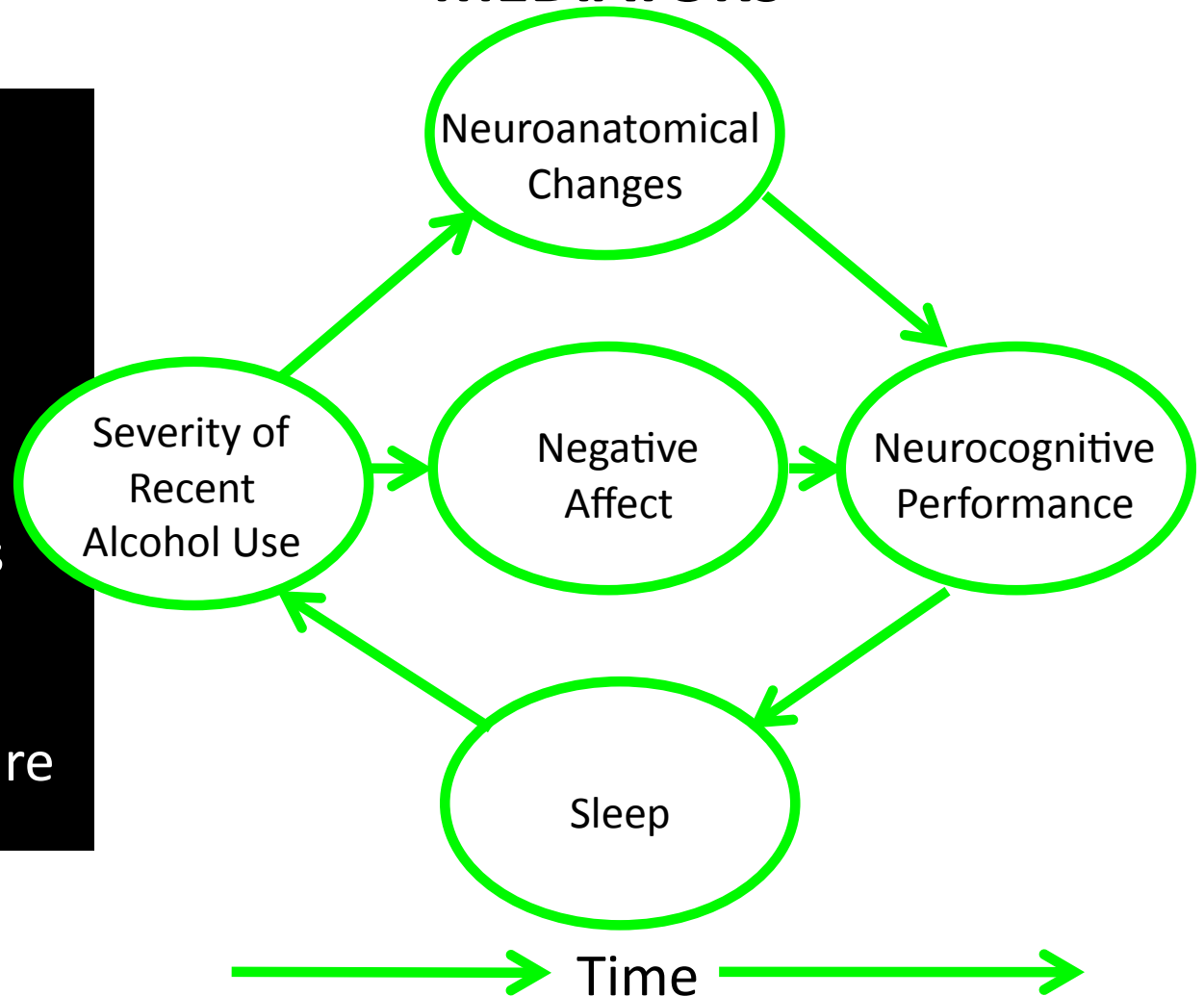


Adolescent Neurocognitive Recovery Models

MODERATORS

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

MEDIATORS



Acknowledgements

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- U01 AA021692 (Tapert)

