

Neural Response to Reward in Young Men with Cannabis Use Disorders



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Introduction

- Cannabis
 - one of the most widely used drugs, especially among adolescents
 - adult studies indicate cannabis use disorders influence reward related brain function by attenuating the responding in the striatum
- little is known about the neural response to reward in younger cannabis users
- hypothesized that cannabis use disorders would be associated with an altered neural response to monetary reward

Method

Participants

- 19 young men with lifetime cannabis use disorders
- 44 young men with no history of psychiatric or substance use disorders
- M age = 20, 51% European American, 44% African American, 5% Other
- Cannabis Use disorders were measured using the Structured Clinical Interview for the DSM (SCID; First et al., 1997) with AUD/SUD module
- functional magnetic resonance imaging study with guessing task that includes anticipation and receipt of reward

fMRI

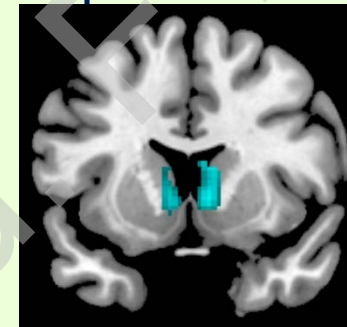
- 3T Siemens Allegra scanner
- task: event-related card guessing with monetary reward
- SPM8 preprocessing and analysis
- 2 regions of interest: ventral striatum and medial prefrontal cortex (mPFC)
- analysis constrained by main effects results

Cannabis Use

- **age of initiation** measured using Lifetime History of Drinking and Drug Use (Skinner, 1982)
 - $n = 30, M = 14.91, SD = 1.76$
- **frequency of current use** measured using Alcohol and Drug Consumption Questionnaire (Cahalan et al., 1969)
 - $n = 25, M = 4.4$ (1-2 times/month), $SD = 3.18$

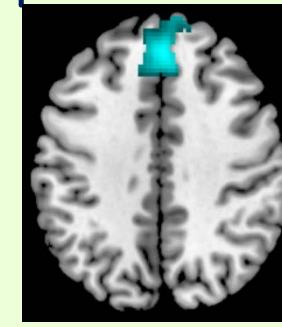
Main Effects of Task

Anticipation Striatum



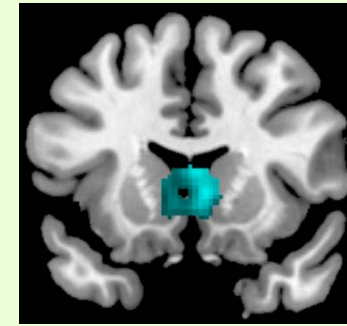
caudate: (6,13,4), 520 voxels, $t = 3.99, p_{FDR} < .050$

Anticipation Medial PFC



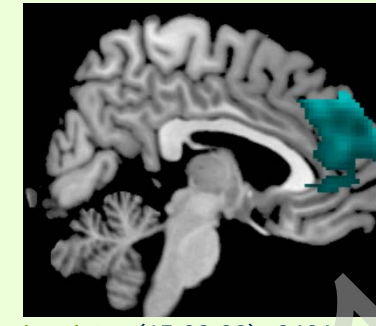
anterior cingulate: (12,40,14), 478 voxels, $t = 5.05, p_{FDR} < .005$

Outcome Striatum



caudate: (5,15,6), 1057 voxels, $t = 5.25, p_{FDR} < .005$

Outcome Medial PFC

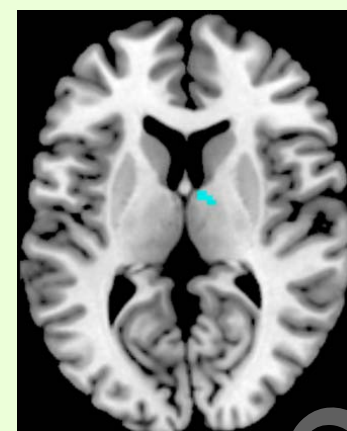


anterior cingulate: (15,28,22), 3436 voxels, $t = 6.69, p_{FDR} < .001$

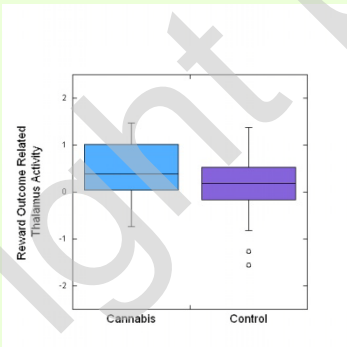
Result

- task engaged typical reward-related areas such as striatum and medial prefrontal cortex (mPFC)
- cannabis disorder group had more activity in medial PFC and thalamus during reward outcome
- early age of initiation associated with greater response in the striatum and medial PFC during reward outcome
- also, greater frequency of use was associated with greater mPFC response to anticipation of reward (medial frontal gyrus: (8,31,38) 18 voxels, $t = 3.97, p_{uncorrected} < 0.05$)

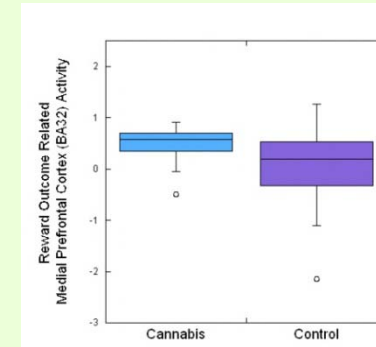
Group Differences in Neural Response to Outcome



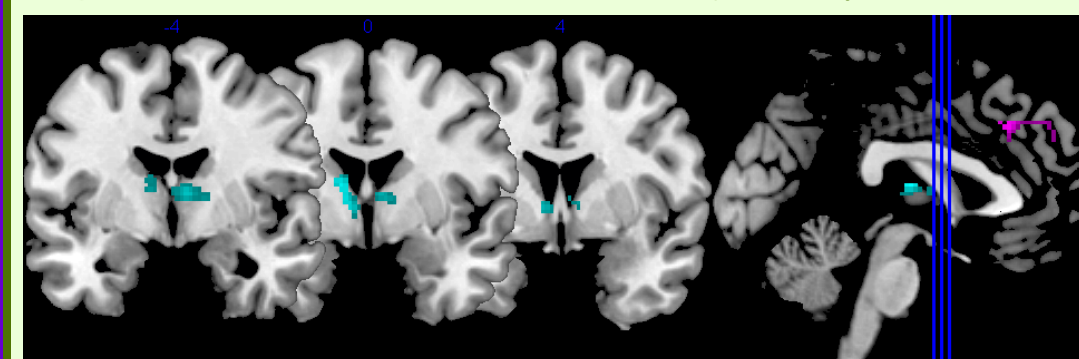
Thalamus: (10,-9,16), 16 voxels, $t = 1.89, p_{uncorrected} < .05$



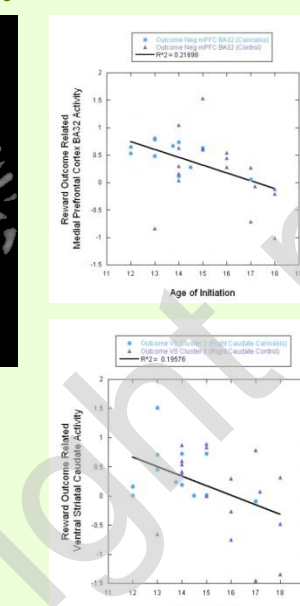
BA32: (5,38,22), 41 voxels, $t = 2.45, p_{uncorrected} < .01$
BA6: (4,35,36), 42 voxels, $t = 2.07, p_{uncorrected} < .05$



Early Age of Initiation Is Associated with Greater Striatal and Medial PFC Activity



Reward Outcome
caudate: (4,-6,11), 114 voxels, $t = 2.47, p_{uncorrected} < .01$
caudate: (-12,-3,15), 77 voxels, $t = 3.27, p_{uncorrected} < .01$
BA32/BA6: (-3,23,42), 196 voxels, $t = 3.25, p_{uncorrected} < .005$



Conclusions

- this large study of high-risk young men allows the examination of reward circuitry function in relation to cannabis use in participants with
 - fairly recent initiation of use
 - ongoing brain development
- *greater* response to reward outcome in thalamus/caudate in those with cannabis use disorders suggests that cannabis use disorders early in the lifespan could reflect greater sensitivity to reward
- future studies should use prospective designs and consider developmental factors and duration of exposure when examining reward function in cannabis addiction

References

- Cahalan, D., Cisin, I., & Crossley, H. (1969). *American drinking practices*. New Brunswick, N.J.: Center of Alcohol Studies, Rutgers University.
- First, M.B., Gibbon, M., Spitzer, R.L., Williams, J.B.W., & Benjamin, L.S. (2002). *Structured Clinical Interview for DSM-IV-TR Axis I Disorders*. New York: Biometrics Research, New York State Psychiatric Institute
- Skinner, H. (1982). *Development and validation of a lifetime alcohol consumption assessment procedure. Substudy No. 1248*. Toronto: Addiction Research Foundation.

Acknowledgments

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