

Brain imaging shows alcohol dependence severity relates to impulse-control deficiency

April 18 2017, by Steve Lundeberg

Would you rather receive \$55 today or \$75 two months from now?

If you chose the former – and if you're severely alcohol dependent – [functional magnetic resonance](#) imaging would likely show that you hadn't activated the "cognitive control" region of your brain as much as someone with a lower level of dependency would have.

Research at Oregon State University sheds new light on what happens in the brain when a person with alcohol use disorder, or AUD, is presented with an opportunity for "delay discounting" – forgoing a larger reward later in favor of a significantly smaller one sooner.

The findings are important because they suggest that more effective AUD treatment could involve neuropsychological tasks designed to help patients train themselves to make more-reasoned, better-planned decisions by using cognitive control to rein in impulses.

The collaboration among psychological scientist Anita Cservenka of OSU's College of Liberal Arts and researchers at UCLA involved 17 alcohol-dependent individuals making decisions similar to the \$55 vs. \$75 choice while their brain activity was monitored with [functional magnetic resonance imaging](#), or fMRI.

As they lay still in the MRI tube, each subject read a series of 27 questions on a screen and had five seconds per question to answer via an electronic pad resting on his or her stomach. Choosing a smaller amount

of money sooner was categorized as an SS response; a larger amount later was classified as LL.

On average, participants gave an SS response not quite two-thirds of the time.

"If you just look at the behavior of individuals, those with more severe alcohol use disorder had a trend toward steeper delay discounting," Cservenka said. "How much they preferred smaller, immediate rewards was not significant, but it was a trend; the severity of the alcohol use disorder was positively associated with the wanting of smaller, immediate rewards."

The fMRI scans showed that in the brains of alcohol-dependent people, severity of dependence negatively correlates with activity in the cognitive control regions when participants make impulsive decisions – the more dependent someone is, the less active the control part of his or her brain is.

The scans also indicated dysregulation in other regions associated with decision making and higher-order cognition. The alcohol-dependent individuals showed greater activation of the brain's reward-evaluation regions during "delayed decisions" – choosing the larger, later prize. Activation of those regions during delayed decisions is positively associated with alcohol dependence severity, suggesting individuals with greater dependence may need to activate those areas more to make less [impulsive decisions](#).

"Most people are naturally driven to rewards, but in certain disorders such as AUD there's a tendency to display even greater orientation toward 'meaningful' rewards," Cservenka said. "For example, someone with alcohol use disorder might display much greater orientation to an advertisement for alcohol than an individual who did not have that

disorder. However, in this study we found deficits in [cognitive control](#) may be more related to impulsive [decision](#) making than reward-driven behavior."

Cservenka notes that impulsivity tends to decline with age but that adults with severe alcohol use disorder can show heightened levels of impulsivity compared to individuals without alcohol use problems.

"That's one of the key research questions: Were these individuals who have severe alcohol use disorder especially impulsive as children, prior to the onset of dependency?" she said. "It could very well be that more impulsive individuals have more of a tendency to engage in problem drinking. That's something that long-term studies that track individuals over time are aiming to answer: How much is impulsivity a predictor of [alcohol use disorder](#) severity as opposed to it being a result of using [alcohol](#)?"

More information: Aaron C. Lim et al. Effects of Alcohol Dependence Severity on Neural Correlates of Delay Discounting, *Alcohol and Alcoholism* (2017). [DOI: 10.1093/alcalc/agx015](https://doi.org/10.1093/alcalc/agx015)

Provided by Oregon State University

Citation: Brain imaging shows alcohol dependence severity relates to impulse-control deficiency (2017, April 18) retrieved 20 April 2024 from <https://medicalxpress.com/news/2017-04-brain-imaging-alcohol-severity-impulse-control.html>

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