

Researchers identify neural factors that predict adolescent alcohol use

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Researchers at the University of California San Diego School of Medicine have identified 34 neural factors that predict adolescent alcohol consumption. The list, based upon complex algorithms analyzing

data from neuropsychological testing and neuroimaging studies, was significantly more accurate —approximately 74 percent—than demographic information alone.

The findings are published in the current issue of *American Journal of Psychiatry*.

"Underage [alcohol consumption](#) is a significant problem in this country," said senior author Susan F. Tapert, PhD, professor of psychiatry. "Being able to identify at-risk children before they begin drinking heavily has immense clinical and public health implications. Our findings provide evidence that it's possible to predict which adolescents are most likely to begin drinking heavily by age 18."

Underage drinking is common in the United States, with approximately two-thirds of 18-year-olds reporting alcohol use. Though illegal, the Centers for Disease Control says drinkers between the ages of 12 and 21 account for 11 percent of all alcohol consumed in the United States.

The adverse consequences of adolescent drinking are well-documented: higher rates of violence, missing school, drunk driving, driving with a drunk driver, suicide and risky sexual behavior. Alcohol consumption accounts for more than 5,000 adolescent deaths each year in the U.S.

Individual consequences are no less onerous, with adolescent drinking contributing to memory, learning and behavioral problems, changes in brain development with long-lasting effects and greater likelihood for abuse of other drugs.

A mix of social, psychological and biological mechanisms are believed to contribute to alcohol use during adolescence. Demographic risk factors include being male, having higher levels of psychological problems and associating positive outcomes with alcohol (i.e. drinking is

fun).

The authors note that past neuropsychological and neuroimaging studies have suggested it might be possible to quantify the underlying behavioral mechanisms of risk for substance abuse. These include poorer performance on tests of executive functioning, comparatively less brain activation of working memory, inhibition and reward processing and less brain volume in regions associated with impulsivity, reward sensitivity and decision making.

In the *American Journal of Psychiatry* study, 137 adolescents between the ages of 12 and 14 who were "substance-naïve" (97 percent had never tried alcohol) underwent a battery of neuropsychological tests and [functional magnetic resonance](#) imaging of their brains. They were then assessed annually. By age 18, just over half of the youths (70) were moderate to heavy users of alcohol (based on drinking frequency and quantity); the remaining 67 study participants continued to be nonusers.

The scientists employed a machine learning algorithm known as "random forests" to develop a predictive model. Random forest classification is capable of accommodating large sets of variables while using smaller study samples to produce consistently robust predictions.

Among the findings, 12- to 14-year-olds were more likely to begin drinking by age 18 if:

- They were male and/or came from a higher socioeconomic background
- They reported dating, possessed more externalized behaviors, such as lying or cheating, and believed alcohol would benefit them in social settings
- They performed poorly on executive function tests
- Their neuroimaging results indicated thinner cortices - the outer

layer of neural tissue covering the brain

The authors said neuroimaging significantly increased predictive accuracy, both in terms of clarifying implicated brain morphology and noting the activation of 20 diffusely distributed brain regions involved in alcohol initiation.

The study did not extend to the question of early marijuana use because only 15 percent of the sample reported eventually using marijuana more than 30 times, but the authors said it was possible that the reported risk factors for alcohol use also apply to marijuana and other illicit substances. They said further and larger studies are necessary.

"The value of this particular study is that it provides a documented path for other researchers to follow, to replicate and expand upon our findings," said Tapert. "Ultimately, of course, the goal is to have a final, validated model that physicians and others can use to predict adolescent [alcohol](#) use and prevent it."

More information: Lindsay M. Squeglia et al, Neural Predictors of Initiating Alcohol Use During Adolescence, *American Journal of Psychiatry* (2016). [DOI: 10.1176/APPL.AJP.2016.15121587](https://doi.org/10.1176/APPL.AJP.2016.15121587)

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