

MRI brain scans may help identify risks, prevent adolescent substance abuse

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A brain scan done with magnetic resonance imaging. Credit: Oregon State University

Neuroimaging of the brain using technologies such as magnetic resonance imaging, or MRIs, increasingly is showing promise as a technique to predict adolescent vulnerability to substance abuse disorders, researchers conclude in a new analysis.

A greater understanding of what such technologies offer and continued research to perfect the use of them may ultimately help identify youth at the highest risk for these problems and allow prevention approaches.

These might include neuropsychological intervention exercises that can strengthen vulnerable cognitive networks in the brain.

The findings are of importance, researchers say, because underage alcohol and drug use is increasingly being recognized as a public health and social problem, with long-term consequences that include poorer academic performance, neurocognitive deficits and psychosocial problems.

Youth who begin drinking before age 15 have four to six times the rate of lifetime alcohol dependence than those who do not drink by age 21, researchers noted in this analysis, which was recently published in *Current Opinion in Behavioral Sciences*.

"Structural and neural alterations in the brain from drug and alcohol abuse have now been well established," said Anita Cservenka, an assistant professor in the College of Liberal Arts at Oregon State University, and co-author of the study.

"It's also becoming clear that some of these alterations can exist before any [substance abuse](#), and often are found in youth who have a [family history](#) of alcohol and drug use disorders. These familial [risk factors](#) can play a role in future substance abuse, along with [environmental risk factors](#) such as peer influence, personality and psychosocial interactions."

Family history of alcohol-use disorder is a strong predictor of substance abuse, Cservenka said, as it raises the risk for the development of alcohol-use disorder in adolescents by three to five times. Neuroimaging studies show significant overlap in brain scans between those with a family history of alcohol- and substance-use disorders and youth who begin using substances during adolescence.

Some of the findings in youth with family history of alcohol- and substance-use disorder include a smaller volume of limbic brain regions, sex-specific patterns of hippocampal volume, and a positive association of familial risk with "nucleus accumbens" volume in the brain. Other risk factors for adolescent substance use that have been identified include poorer performance on executive functioning tasks of inhibition and working memory, smaller brain volumes in reward and cognitive control regions, and heightened response to rewards.

A factor contributing to a peak in substance use during adolescence, researchers say, may be emotion and reward systems that develop before cognitive control systems, leaving youth more vulnerable to risk-taking behaviors.

Almost two thirds of 18-year-olds, for instance, support lifetime alcohol use; 45 percent marijuana use; and 31 percent smoking cigarettes.

Various studies, Cservenka said, are examining such issues, including the National Consortium on Alcohol and Neurodevelopment in Adolescence, which includes five sites across the U.S. following 800 youth ages 12-21.

"We're just beginning to understand the risk factors for substance abuse and the consequences of adolescent substance use with these types of large, long-term studies," she said. "Ultimately such information should help inform us about who might be at most risk and what brain areas are most vulnerable, so we can target them and work to prevent the problems."

If an MRI showed weakness in working memory, for instance, computer games or behavioral tasks might help strengthen the area of the [brain](#) that is deficient. Similar approaches might also be used to help address issues such as stress and depression, Cservenka said.

Provided by Oregon State University

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