Teen Drinking: New Insights on Causes and Consequences

Megan Brooks
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TORONTO — Two studies released today provide new insight into the causes and consequences of heavy alcohol consumption in adolescence and young adulthood.
One study links heavy drinking in adolescence to abnormalities in the developing brain. The other study finds that hypermethylation of a gene involved in impulsiveness is associated with alcohol use disorder in young people.
The studies were presented here at the American Psychiatric Association (APA) 2015 Annual Meeting and were simultaneously published online in the *American Journal of Psychiatry.*

Clear Brain Changes

In the first study, Susan F. Tapert, PhD, of the University of California, San Diego, and colleagues examined gray and white matter volume trajectories in 134 adolescents. During a period of roughly 3.5 years, 75 transitioned to heavy drinking, and 59 remained light drinkers or nondrinkers. Each adolescent underwent two to six MRI scans between the ages of 12 and 24 years and was followed for up to 8 years.
Heavy drinkers showed accelerated reductions in gray matter in cortical lateral frontal and temporal volumes and attenuated white matter growth of the corpus callosum and pons relative to nondrinkers. The results were similar in boys and girls and were largely unchanged when use of marijuana and other drugs were examined.
"This is the largest longitudinal brain imaging study so far, looking at 134 adolescents who transitioned into heavy drinking and who did not," Dr Tapert told *Medscape Medical News.*
"We found that teenage boys and girls who started to have some heavy drinking showed different patterns of brain development in late adolescence, compared to teenagers of similar backgrounds who did not initiate drinking. Specifically, the usual white matter growth that teens show at this stage was more limited after heavy drinking started. Also, the typical gray matter reductions that we see in nondrinking teens were accelerated," she noted.
"These findings suggest that heavy drinking during adolescence could cause alterations in brain development. Taken together with other studies that have shown some disadvantages in thinking and memory abilities in adolescent heavy drinkers, teenagers, parents, educators, and policy makers should be aware of these findings. For this and other health and psychosocial reasons, teenagers should avoid heavy drinking," Dr Tapert said.
In an interview with *Medscape Medical News* here at APA 2015, *American Journal of Psychiatry* editor-in-chief Robert Freedman, MD, said this is a "very meticulous study conducted over many years that has [brain] development and alcohol superimposed. The study shows that heavy-drinking adolescents are damaging the very parts of the brain that help adolescents learn and also learn to exercise control, the frontal lobe." Dr Freedman is from the University of Colorado Denver School of Medicine, in Aurora.

Epigenetic Marker of Risk?

In the second study, Gunter Schumann, MD, and colleagues with the IMAGEN project, led by King's College London, United Kingdom, examined 18 identical twin pairs in which one twin developed alcohol use disorder between age 18 and 24 years and one did not.
They observed increased methylation in the 3'-protein-phosphatase-1G (*PPM1G*) gene in the twin with alcohol use disorder.

In an independent population-based sample of nearly 500 adolescents, similar changes in the *PPM1G* gene were associated with higher impulsivity at age 14 years and with increased alcohol drinking during the next 2 years.

This study provides "the first evidence for an epigenetic marker associated with alcohol consumption and its underlying neurobehavioral phenotypes," the authors note in their article.

Dr Schumann told *Medscape Medical News* that this initial study is "predominantly to understand biological mechanisms by which environmental influences affect brain function and behavior. While it is not immediately clinically relevant, it may help us to identify targets for specific prevention and interventions to counteract environmental influences which result in psychopathology and addictive behavior."

"We are currently carrying out extensive analyses to investigate the effect of environmental factors on genome-wide methylation and brain function," Dr Schumann added.

"This is a very clever study that identifies an epigenetic factor for adolescent drinking and also predicts loss of behavioral control." Going forward, *PPM1G* is "a gene to target and really figure out what it is doing," said Dr Freedman.

In an editorial published with the studies, George Koob, PhD, director of the National Institute on Alcohol Abuse and Alcoholism, notes that the brain regions most affected in these two studies are critically involved in the addiction cycle of binge drinking and preoccupation with drinking.

"It is possible that such epigenetic changes, by increasing impulsivity, predispose adolescents to engage in excessive drinking and that the alterations in brain circuitry that follow excessive drinking, by disrupting executive function, make it harder to stop," Dr Koob writes. "If such changes are not reversible, then they could help explain the increased risk of enduring alcohol use disorders in adulthood following excessive drinking during adolescence."

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