

Brain Development in Heavy-Drinking Adolescents

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Background: Heavy alcohol use during adolescence may alter the trajectory of normal brain development. The authors measured within-subject changes in regional brain morphometry over longer intervals and in larger samples of adolescents than previously reported and assessed differences between adolescents who remained nondrinkers and those who drank heavily during adolescence as well as differences between the sexes.

Methods: The authors examined gray and white matter volume trajectories in 134 adolescents, of whom 75 transitioned to heavy drinking and 59 remained light drinkers or nondrinkers over roughly 3.5 years. Each underwent MRI scanning two to six times between ages 12 and 24 and was followed for up to 8 years. The volumes of the neocortex, allocortex, and white matter structures were measured using atlas-based parcellation with longitudinal registration. Linear mixed-effects models described differences in trajectories of heavy drinkers and nondrinkers over age; secondary analyses considered the contribution of other drug use to identified alcohol use effects.

Results: Heavy-drinking adolescents showed accelerated gray matter reduction in cortical lateral frontal and temporal volumes and attenuated white matter growth of the corpus callosum and pons relative to nondrinkers. These results were largely unchanged when use of marijuana and other drugs was examined. Male and female drinkers showed similar patterns of development trajectory abnormalities.

Discussion: Longitudinal analysis enabled detection of accelerated typical volume decline in frontal and temporal cortical volumes and attenuated growth in principal white matter structures in adolescents who started to drink heavily. These results provide a call for caution regarding heavy alcohol use during adolescence, whether heavy drinking is the sole cause or one of several in these alterations in brain development.

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