

Adolescent-onset alcohol and marijuana use: A longitudinal examination of impacts on brain development and behavior

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Alcohol and marijuana use (MJU) have accelerated among young people in the United States, representing an ongoing public health concern. MJU has been associated with cognitive deficits such as lower-than-expected IQs, impaired learning and memory, and executive dysfunction. Neuroimaging studies suggest deviations in cortical white matter microstructure. MJU onset prior to age 17 appears to confer an increased risk for impairment. Similarly, alcohol use in excessive quantities has deleterious effects on brain structure and behavior in adults and during periods of rapid neurodevelopment, such as prenatally. It is suspected that negative outcomes also result from use during other neurodevelopmental periods, such as adolescence, and even in the context of subclinical levels of use. Given that most studies of adolescent substance users are cross-sectional, causal attributions to explain observed effects are limited. Moreover, until recently, sophisticated techniques to assess functional connectivity and how it may change in the context of use have been lacking. Initiated in 2004 and now in its fifth assessment wave, the current project has longitudinally followed a cohort (n=200) of typically developing adolescents and young adults from a baseline assessment, where no experience with substances was present, through adolescence and into young adulthood, when some individuals transitioned into regular use. A cohort of adolescent-onset heavy marijuana users has also been longitudinally studied. Resting state, diffusion tensor imaging (DTI), and volumetric scans were collected on a 3T Siemens Tim Trio scanner at each time point. A comprehensive neurobehavioral battery was administered, including multiple executive function measures, measures of verbal learning and memory, attention, motor function, and reward-related decision-making. This presentation will focus on major findings, which suggest deviations in patterns of typical neurodevelopment following alcohol use initiation in mid-adolescence. We also find differences in white matter organization as well as structural and functional connectivity that emerge with continued marijuana use. Discussion will focus on challenges in identifying behavioral correlates of these neurodevelopmental alterations and, in the case of marijuana, the potential impacts of legalization.

Funding for this work was provided by the National Institute on Alcohol Abuse and Alcoholism (AA020033), the National Institute on Drug Abuse (DA017843), by BTRC P41 EB015894 and P30 NS076408 grants awarded to the University of Minnesota's Center for Magnetic Resonance Research, by the University of Minnesota's Center for Neurobehavioral Development and by the Minnesota Supercomputing Institute.