

Neuroimaging of Adolescent Brain Development: Challenges and Opportunities from NCANDA

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In vivo neuroimaging studies have consistently revealed that the human brain continues to change in regional tissue morphology and microstructural constituents throughout adolescence, a time of increased risk taking and experimentation with alcohol and drugs. The progression is heterogeneous with respect to numerous endogenous, environmental, and genetic factors, which also contribute to heterochronicity, whereby different regions and tissues mature at different rates. Typically, gray matter volume and thickness of the cortical mantle expand until about age 10 years but then decline thereafter, perhaps with fine-tuning through "pruning." At the same time, white matter volume expands and does so into early adulthood. Longitudinal study is essential for capturing these growth trajectories and interactions with biological factors and environmental influences, such as the initiation of alcohol and drug consumption. Indeed, to identify factors that could contribute to maturation, large samples of youth spanning the adolescence to young adulthood are essential. Recruitment of adequate samples generally relies on multi-site consortia but comes with many challenges, such as merging data acquired on different platforms. These challenges occur at several levels of processing: defining the primary study aims (e.g., cause vs. effect), harmonizing imaging data collection, calibrating neuropsychological and behavioral assessment, and managing and analyzing multi-site data. These considerations are best addressed proactively for consortium study. Lessons learned from the National Consortium on Alcohol and NeuroDevelopment in Adolescence (NCANDA) experience can provide valuable direction for others.

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