

# A multicohort, longitudinal study of cerebellar development in attention deficit hyperactivity disorder.

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Abstract

## BACKGROUND:

The cerebellum supports many cognitive functions disrupted in attention deficit hyperactivity disorder (ADHD). Prior neuroanatomic studies have been often limited by small sample sizes, inconsistent findings, and a reliance on cross-sectional data, limiting inferences about cerebellar development. Here, we conduct a multicohort study using longitudinal data, to characterize cerebellar development.

## METHODS:

Growth trajectories of the cerebellar vermis, hemispheres and white matter were estimated using piecewise linear regression from 1,656 youth; of whom 63% had longitudinal data, totaling 2,914 scans. Four cohorts participated, all contained childhood data (age 4-12 years); two had adolescent data (12-25 years). Growth parameters were combined using random-effects meta-analysis.

## RESULTS:

Diagnostic differences in growth were confined to the corpus medullare (cerebellar white matter). Here, the ADHD group showed slower growth in early childhood compared to the typically developing group (left corpus medullare  $z = 2.49$ ,  $p = .01$ ; right  $z = 2.03$ ,  $p = .04$ ). This reversed in late childhood, with faster growth in ADHD in the left corpus medullare ( $z = 2.06$ ,  $p = .04$ ). Findings held when gender, intelligence, comorbidity, and psychostimulant medication were considered.

## DISCUSSION:

Across four independent cohorts, containing predominately longitudinal data, we found diagnostic differences in the growth of cerebellar white matter. In ADHD, slower white matter growth in early childhood was followed by faster growth in late childhood. The findings are consistent with the concept of ADHD as a disorder of the brain's structural connections, formed partly by developing cortico-cerebellar white matter tracts.