

# Brain development is delayed in attention-deficit/hyperactivity disorder

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Is attention-deficit/hyperactivity disorder (ADHD) due to a delay in brain development or the result of complete deviation from typical development? In the current issue of *Biological Psychiatry*, Dr. Philip Shaw and colleagues present evidence for delay based on a study by the National Institutes of Health.

The [cerebral cortex](#) is the folded gray tissue that makes up the outermost portion of the brain, covering the brain's inner structures. This tissue has left and right hemispheres and is divided into lobes. Each lobe performs specific and vitally important functions, including attention, thought, language, and sensory processing.

Two dimensions of this structure are cortical thickness and cortical surface area, both of which mature during childhood as part of the normal developmental process. This group of scientists had previously found that the thickening process is delayed in children diagnosed with ADHD. So in this study, they set out to measure whether surface area development is similarly delayed.

They recruited 234 children with ADHD and 231 typically developing children and scanned each up to 4 times. The first scan was taken at about age 10, and the final scan was around age 17. Using advanced neuroimaging technology, they were able to map the trajectories of [surface area](#) development at over 80,000 points across the brain.

They found that the development of the cortical surface is delayed in

frontal brain regions in children with ADHD. For example, the typically developing children attained 50% peak area in the right [prefrontal cortex](#) at a mean age of 12.7 years, whereas the ADHD children didn't reach this peak until 14.6 years of age.

"As other components of [cortical development](#) are also delayed, this suggests there is a global delay in ADHD in [brain regions](#) important for the control of action and attention," said Dr. Shaw, a clinician studying ADHD at the National Institute of Mental Health and first author of this study.

"These data highlight the importance of longitudinal approaches to brain structure," commented Dr. John Krystal, Editor of [Biological Psychiatry](#). "Seeing a lag in [brain development](#), we now need to try to understand the causes of this developmental delay in ADHD."

Dr Shaw agrees, adding that this finding "guides us to search for genes that control the timing of brain development in the disorder, opening up new targets for treatment."

Additional work expanding these measures into adulthood will also be important. Such data would help determine whether or when a degree of normalization occurs, or if these delays translate into long-lasting cortical deficits.

**More information:** The article is "Development of Cortical Surface Area and Gyrfication in Attention-Deficit/Hyperactivity Disorder" by Philip Shaw, Meaghan Malek, Bethany Watson, Wendy Sharp, Alan Evans, and Deanna Greenstein ( [doi: 10.1016/j.biopsych.2012.01.031](https://doi.org/10.1016/j.biopsych.2012.01.031) ). The article appears in *Biological Psychiatry*, Volume 72, Issue 3 (August 1, 2012).

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