

# New study finds younger aged children with symptoms of ADHD have reduced brain size

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Children with ADHD find it more difficult to focus and to complete their schoolwork. Credit: public domain image

Children as young as four years old with symptoms of Attention-Deficit/Hyperactivity Disorder (ADHD) showed reduced brain volumes in regions essential for behavioral control, according to a study published today in the *Journal of the International Neuropsychological Society*. The

study, funded by the National Institutes of Health (NIH), represents the first comprehensive examination of cortical brain volume in preschool children with ADHD and provides an indication that anomalous brain structure is evident in the early stages of development.

Using high-resolution anatomical MRI scans along with cognitive and behavioral measures, researchers from Kennedy Krieger Institute studied the [brain](#) development of 90 medication-naïve preschoolers between the ages of 4 and 5 years. The study, funded by the Eunice Kennedy Shriver National Institute of Child Health and Human Development, found that preschoolers with ADHD showed significantly reduced brain volume across multiple regions of the cerebral cortex, including the frontal, temporal, and parietal lobes. The brain regions showing greatest ADHD-related reductions included those known to be critical for cognitive and [behavioral control](#) and predictability of behavioral symptoms.

"These findings confirm what parents have known for a while—even in very [young children](#), ADHD is a real biological condition with pronounced physical and cognitive manifestations," said E. Mark Mahone, Ph.D., ABPP, lead study author and research scientist at the Kennedy Krieger Institute.

ADHD is the most commonly diagnosed form of psychopathology during the preschool years, and during early childhood, it is associated with significant long-term health and economic costs. To date, studies assessing structural brain development in children with ADHD have examined school-aged samples, despite most children with the disorder showing symptoms early in the preschool years. This study carefully identified children with symptoms of ADHD closer to their onset, allowing for better understanding of the brain mechanisms associated with the onset of the condition.

"MRI research in children can be challenging—particularly so for young

children with ADHD—as it requires them to lie still for periods up to 30-40 minutes," said Dr. Mahone. "To address this challenge, we employed an individualized behavioral desensitization procedure using a mock scanner to help prepare the children for the scans, leading to a nearly 90 percent success rate."

These findings represent the first phase of a study that will follow a preschool age cohort into adolescence, in hopes of identifying early biological signs in preschool years that can help predict which children are most at risk for developing ADHD.

"Our hope is that by following these children from early on in life, we will be able to determine which early brain and behavioral signs are most associated with later difficulties, or even better, which aspects of early development can predict better outcome and recovery from the condition," said Dr. Mahone. "By understanding the brains of children who grow into the disorder as well as those who grow out of it, we can begin to implement targeted, preventative interventions in young [children](#) with the goal of reducing adverse outcomes or even reversing the course of this condition."

Provided by Kennedy Krieger Institute

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