

# Altered Neural Substrates of Cognitive Control in Childhood ADHD: Evidence from Functional Magnetic Resonance Imaging

Chandan J. Vaidya, Ph.D., Silvia A. Bunge, Ph.D., Nicole M. Dudukovic, B.A., Christine A. Zalecki, M.A., Glen R. Elliott, M.D., Ph.D., and John D.E. Gabrieli, Ph.D.

**OBJECTIVE:** The study compared the neural bases of two cognitive control operations, interference suppression and response inhibition, between children with and children without attention deficit hyperactivity disorder (ADHD). **METHOD:** Ten children (7–11 years of age) with combined-type ADHD and 10 comparison subjects matched for age and gender underwent rapid event-related functional magnetic resonance imaging (fMRI) during performance of a modified flanker task. Functional maps were generated through group averaging and performance-based correlational analyses. **RESULTS:** Interference suppression in ADHD subjects was characterized by reduced engagement of a frontal-striatal-temporal-parietal network that subserved healthy performance. In contrast, response inhibition performance relied upon different regions in the two groups, frontal-striatal in comparison subjects but right superior temporal in ADHD children. **CONCLUSIONS:** Alteration in the neural basis of two cognitive control operations in childhood ADHD was characterized by distinct, rather than unitary, patterns of functional abnormality. Greater between-group overlap in the neural network activated for interference suppression than in response inhibition suggests that components of cognitive control are differentially sensitive to ADHD. The ADHD children's inability to activate the caudate nucleus constitutes a core abnormality in ADHD. Observed functional abnormalities did not result from prolonged stimulant exposure, since most children were medication naive.