Structural and functional connectivity in children and adolescents with and without attention-deficit/hyperactivity disorder

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Abstract

Background
Attention deficit/hyperactivity disorder (ADHD) has frequently been associated with changes in resting-state functional connectivity and decreased white matter (WM) integrity. In the current study, we investigated functional connectivity within Default Mode and frontal control resting-state networks (RSNs) in children with and without ADHD. We hypothesised the RSNs of interest would show a pattern of impaired functional integration and segregation and corresponding changes in WM structure.

Methods
Resting-state fMRI and diffusion-weighted imaging data were acquired from 35 participants with ADHD and 36 matched typically developing peers, aged 6 through 18 years. Functional connectivity was assessed using independent component analysis. Network topology and WM connectivity were further investigated using graph theoretical measures and tract-based spatial statistics (TBSS).

Results
Resting-state fMRI analyses showed increased functional connectivity in right inferior frontal gyrus (IFG), and bilateral medial prefrontal cortex (mPFC) within the Default Mode and frontal control networks. Furthermore, a more diffuse spatial pattern of functional connectivity was found in children with ADHD. We found no group differences in structural connectivity as assessed with TBSS or graph theoretical measures.

Conclusions
Resting-state networks show a more diffuse pattern of connectivity in children with ADHD. The increases in functional connectivity in right IFG and bilateral mPFC in children with ADHD may reflect reduced or delayed functional segregation of prefrontal brain regions. As these functional changes were not accompanied by changes in WM, they may precede the development of the frequently reported changes in WM structure.