Neuroimaging the neural correlates of increased risk for substance use disorders in attention-deficit/hyperactivity disorder—A systematic review

Vitria Adisetiyo and Kevin M. Gray

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Abstract

Background/Objectives
Children with attention-deficit/hyperactivity disorder (ADHD) are nearly three times more likely to develop substance use disorders (SUD) than their typically developing peers. Our objective was to review the existing neuroimaging research on high-risk ADHD (ie, ADHD with disruptive behaviour disorders, familial SUD and/or early substance use), focusing on impulsivity as one possible mechanism underlying SUD risk.

Methods
A PubMed literature search was conducted using combinations of the keywords “ADHD,” “substance use,” “substance use disorder,” “SUD,” “addiction,” “dependence,” “abuse,” “risk,” “brain” “MRI,” “imaging” and “neuroimaging.” Studies had to include cohorts that met diagnostic criteria for ADHD; studies of individuals with ADHD who all met criteria for SUD were excluded. Eight studies met the search criteria.

Results
Individuals with high-risk ADHD have hyperactivation in the motivation-reward processing brain network during tasks of impulsive choice, emotion processing, and risky decision-making. During response inhibition tasks, they have hypoactivation in the inhibitory control brain network. However, studies focusing on this latter circuit found hypoactivation during inhibitory control tasks, decreased white matter microstructure coherence and reduced cortical thickness in ADHD independent of substance use history.

Discussion/Conclusions
An exaggerated imbalance between the inhibitory control network and the motivation-reward processing network is theorised to distinguish individuals with high-risk ADHD. Preliminary findings suggest that an exaggerated aberrant reward processing network may be the driving neural correlate of increased SUD risk in ADHD.