NIH Award from the National Institute of Mental Health

Principal investigator: James Booth, communication science and disorders
School of Communication

- Project: Multiple pathway models of attention deficit hyperactivity disorder (ADHD)
- Start Date: June 19, 2009
- Total Award Amount: $437,091

How the results of this project will benefit society:
Attention deficit hyperactivity disorder, ADHD, is one of the most common mental disorders that develop in children. Children with ADHD have impaired functioning in multiple settings, including home, school, and in relationships with peers. If untreated, the disorder can have long-term adverse effects into adolescence and adulthood. No studies have yet examined the neural correlates of ADHD subtypes that have been neuropsychologically defined based on their behavior, so the results of this grant will have implications for the objective diagnosis of subtypes of ADHD children. This grant potentially will lead to further studies that examine the effect of medical intervention on the neural correlates of executive functioning and reward processing in ADHD subtypes.

The problem the project is trying to solve:
The goal of this grant is to examine brain differences during executive functioning and reward processing among children with ADHD and between control and ADHD children. The central goal of this grant is to determine if the underlying brain abnormalities in ADHD children are characterized by a dichotomous or continuous behavioral distribution. If brain abnormalities are characterized by a dichotomous behavioral distribution (i.e., deficit versus no deficit), we expect that a subset of ADHD children will have brain abnormalities restricted to the executive functioning circuit (including ventro-lateral prefrontal cortex and dorsal striatum) and a subset of ADHD children will have brain abnormalities restricted to the reward processing circuit (including orbito-frontal cortex and ventral striatum). We further expect that a subset of ADHD children will have a behavioral deficit in both domains and they may have especially pronounced brain abnormalities in both circuits. Although limited behavioral research on the ADHD combined type suggests that approximately equal numbers of children fall into these neuropsychologically defined categories, it is possible that there is a more continuous behavioral distribution of executive functioning and reward processing ability. In order to test this hypothesis, we will directly compare a dichotomous to a continuous model using multiple regression. If the dichotomous behavioral model does not explain brain abnormalities, but the continuous model does, then we can conclude that the underlying deficit is characterized by a continuous distribution. If both models explain variance, but the continuous model explains significantly more variance than the dichotomous model, then we can conclude that the underlying deficit has both a continuous and dichotomous component.

How this project will work:
We will examine medication-naive 8- to 9-year-old boys with the combined type of ADHD, because research has shown medication, age-related, sex and subtype effects in ADHD in terms of behavioral performance and brain activation. Response inhibition as measured by a go no-go task will be used to index executive functioning because this cognitive process may be the most common deficit in ADHD children. The executive functioning task will be given under immediate and delayed reinforcement conditions because studies have suggested that ADHD children may have a different delay-of-reinforcement gradient. We will also perform exploratory analyses using dynamic causal modeling (DCM) to examine patterns of effective connectivity between regions of interest in these circuits.

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