Acute Stimulant Treatment and Reinforcement Increase the Speed of Information Accumulation in Children with ADHD.

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Abstract

The current studies utilized drift diffusion modeling (DDM) to examine how reinforcement and stimulant medication affect cognitive task performance in children with ADHD. In Study 1, children with (n = 25; 88 % male) and without ADHD (n = 33; 82 % male) completed a 2-choice discrimination task at baseline (100 trials) and again a week later under alternating reinforcement and no-reinforcement contingencies (400 trials total). In Study 2, participants with ADHD (n = 29; 72 % male) completed a double-blind, placebo-controlled trial of 0.3 and 0.6 mg/kg methylphenidate and completed the same task utilized in Study 1 at baseline (100 trials). Children with ADHD accumulated information at a much slower rate than controls, as evidenced by a lower drift rate. Groups were similar in nondecision time and boundary separation. Both reinforcement and stimulant medication markedly improved drift rate in children with ADHD (ds = 0.70 and 0.95 for reinforcement and methylphenidate, respectively); both treatments also reduced boundary separation (ds = 0.70 and 0.39). Reinforcement, which emphasized speeded accuracy, reduced nondecision time (d = 0.37), whereas stimulant medication increased nondecision time (d = 0.38). These studies provide initial evidence that frontline treatments for ADHD primarily impact cognitive performance in youth with ADHD by improving the speed/efficiency of information accumulation. Treatment effects on other DDM parameters may vary between treatments or interact with task parameters (number of trials, task difficulty). DDM, in conjunction with other approaches, may be helpful in clarifying the specific cognitive processes that are disrupted in ADHD, as well as the basic mechanisms that underlie the efficacy of ADHD treatments.