



AOTA Evidence Briefs

Attention Deficit/Hyperactivity Disorder

**A product of the American Occupational Therapy Association's Evidence-Based Literature Review Project*

A#11

Stimulant medication enhances the ability of children with ADHD to attend to a task

Solanto, M. V., Wender, E. H., & Bartell, S. S. (1997). Effects of methylphenidate and behavioral contingencies on sustained attention in attention-deficit hyperactivity disorder: A test of the reward dysfunction hypothesis. *Journal of Child and Adolescent Psychopharmacology*, 7, 123–136.

Level: IA1a

Randomized control trial, 20 or more participants per group, high internal validity, high external validity

Why research this topic?

Research on the effectiveness of either behavior therapy or stimulant medication on core symptoms of children with attention-deficit/hyperactivity disorder (ADHD) has been inconsistent in support of the theory that these children have an “elevated reward threshold” (p. 124)—that is, a need for frequent, immediate, and salient reinforcement to maintain appropriate responses. Core symptoms of ADHD include “shortened attention span, distractibility, failure to follow instructions, and failure to finish tasks” (p. 123).

What did the researchers do?

Solanto and her colleagues (1997), of Long Island Jewish Medical Center (New Hyde Park, New York) and Albert Einstein College of Medicine (Bronx, New York), designed a study to compare the effects of methylphenidate and behavioral contingencies on children’s ability to sustain attention to a task.

The researchers recruited participants for their study from children referred for evaluation of hyperactivity or inattentiveness by hospital-affiliated clinics and pediatricians in private practice. The first 22 who met the study’s criteria for participation were enrolled. The criteria included, among others, (1) between 6 and 10 years of age, (2) a diagnosis of ADHD according to the criteria of the *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed. rev.), (3) a score of 15 on the Hyperkinesia Index of both the Conners Parent Rating Scale and the Conners Teacher Rating Scale, and (4) an IQ of 80 or above on the Wechsler Intelligence Scale for Children–Revised. Nineteen of the participants were boys, 3 were girls. Their average age was 8.3 years.

The task presented to the children called for continuous performance. Ten letters in 10 different colors appeared consecutively on a computer screen for 130 milliseconds each. When a child saw a white S followed by a blue T, he or she was to press a button on the joystick. Each test session consisted of 10 trial blocks. In each block 10 target sequences were presented as well as 20 false target sequences (e.g., a white S followed by a blue letter not a T). A correct response elicited a high-pitched tone from the computer, an error a low-pitched tone.

Each child went through four test sessions, two on 0.6 mg/kg of methylphenidate (Ritalin) (i.e., 0.6 milligrams per kilogram of body weight) and two on a placebo (a drug substitute, such as a sugar pill, that contains no active ingredients).

A training session preceded the test sessions. In this session an examiner oriented the children to the task and adjusted the program to a presentation rate corresponding to the child’s ability.

Each test session began with an administration of the continuous performance task for 10 trial blocks, during which the child received auditory feedback only (as high- or low-pitched tones). The child then received methylphenidate or the placebo and played with toys and games for 1.5 hours while the medication took effect. When the test session resumed, the child took up the task again, now receiving auditory feedback only *or* auditory feedback and behavioral contingencies. The behavioral contingencies involved the child receiving a penny for every correct response, and losing a penny for every incorrect response. Depending on the amount of pennies the child had at the end of the session, he or she could “buy” the toy of his or her first choice, the toy of his or her second choice, or no toy.

The outcome areas of interest to the researchers were “*hit rate*” (number of correct responses divided by the total number of targets); “*false-alarm rate*” (number of responses to a false target divided by the total number of false targets); *ability to discriminate between a target and a false target*; and *response bias*.

What did the researchers find?

In the initial segment of each test session (no medication present, auditory feedback only), the children showed a **significant** (see *Glossary*) decline in performance across trials in hit rate, ability to discriminate, and response bias.

As measured by ability to discriminate, the children’s overall mean performance in the placebo-feedback condition was significantly worse than their performance in each of the other conditions (placebo-reward, methylphenidate-feedback, and methylphenidate-reward). As measured by hit rate, their performance in the placebo-feedback condition was significantly worse than their performance in two of the other conditions (methylphenidate-feedback, and methylphenidate-reward). Only methylphenidate prevented the decline in performance throughout the trials.

What do the findings mean?

For therapists and other providers, the findings suggest that methylphenidate exerts a positive influence on the ability of children with ADHD to discriminate between target and nontarget stimuli. They also suggest that behavioral contingencies that include positive and negative feedback have a positive influence on children’s ability to discriminate. The contingencies failed to sustain the children’s attention over time, however. They also failed to yield further improvement in performance when added to the methylphenidate condition.

What are the study’s limitations?

This study provides important information regarding the “elevated reward threshold” (p. 124) hypothesis of ADHD dysfunction. However, as the authors themselves point out, the absence of a non-ADHD group prevents statements about whether treatments act specifically on factors related to ADHD. The sample size was small (22), and participants were not assessed for comorbidity.

Glossary

significance (or significant)—A statistical term, this refers to the probability that the results obtained in the study are not due to chance, but to some other factor (such as the treatment of interest). A significant result is likely to be generalizable to populations outside the study.

Significance should not be confused with clinical effect. A study can be statistically significant without having a very large clinical effect on the sample. For example, a study that examines the effect of a treatment on a client’s ability to walk may report that the participants in the treatment group were able to walk significantly longer distances than the control group. However, if you read the study you may find that the treatment group was able to walk, on average, 6 feet, whereas the control group was able to walk, on average, 5 feet. Although the outcome may be statistically significant, a clinician may not believe that a 1-foot increase will improve his or her client’s function.

■ Terminology used in this document is based on two systems of classification current at the time the evidence-based literature reviews were completed: *Uniform Terminology for Occupational Therapy Practice—Third Edition* (AOTA, 1994) and *International Classification of Functioning, Disability and Health (ICIDH-2)* (World Health Organization [WHO], 1999). More recently, the *Uniform Terminology* document was replaced by *Occupational Therapy Practice Framework: Domain and Process* (AOTA, 2002), and modifications to *ICIDH-2* were finalized in the *International Classification of Functioning, Disability and Health* (WHO, 2001).

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For more information about the Evidence-Based Literature Review Project, contact the Practice Department at the American Occupational Therapy Association, 301-652-6611, x 2040.



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