AOTA Evidence Briefs

Attention Deficit/Hyperactivity Disorder

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

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Medication and behavior therapy, alone or together, improve the classroom behavior of children with ADHD

Carlson, C. L., Pelham, W. E., Jr., Milich, R., & Dixon, J. (1992). Single and combined effects of methylphenidate and behavior therapy on the classroom performance of children with attention-deficit hyperactivity disorder. *Journal of Abnormal Child Psychology, 20,* 213–232.

Level: IA1a

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

Why research this topic?

A review of studies investigating the effects of treating children with attention-deficit/hyperactivity disorder (ADHD) with a combination of medication and behavior therapy found that a majority showed the combination to be "superior to either treatment alone for at least one of the dependent variables examined. This superiority…was more likely to be found for classroom behavioral or social measures.…Thus, less is known about the effects of combined treaments on academic performance than on behavioral functioning" (p. 215). The reviewers concluded that additional research was needed because the samples had been small and the studies had methodological flaws.

What did the researchers do?

Carlson and her colleagues (1992), variously of the University of Texas at Austin, the Western Psychiatric Institute and Clinic (Pittsburgh, Pennsylvania), and the University of Kentucky (Lexington), designed a study that would allow for "a more thorough evaluation of single and combined effects" of medication and behavior therapy (p. 215).

The participants in the study were 24 boys selected from a group of 84 children participating in an 8-week summer treatment program at the Western Psychiatric Institute and Clinic. Children were excluded if they were girls, failed to meet the study's criteria (those of the *Diagnostic and Statistical Manual of Mental Disorders*, 3rd ed. rev.) for a diagnosis of ADHD, were not being assessed for medication, or were not present on any of the study days. The average age of the boys was 9.2 years.

Each day of the 8-week program, the boys attended a 60-minute class conducted by a developmental specialist and one or two teacher's aides. The boys were in six different classes, with each class consisting of 12 children, some of whom were not participants in the study. During the 6th and 7th weeks of the classes, the researchers compared two treatment conditions: behavior management and regular classroom. The boys in three classes received the behavior management condition for 1 week while the boys in the other three classes received the regular classroom condition. Then each group received the other condition for 1 week.

The behavior management condition involved social and token reinforcement, classroom structure, rules, feedback, time-out, an honor roll, and daily report cards. The regular classroom condition resembled a typical classroom setting; none of the behavior management components just identified was used.

The boys received medication under three conditions: “placebo” (a drug substitute, such as a sugar pill, that contains no active ingredients), 0.3 mg/kg of methylphenidate (Ritalin) (i.e., 0.3 milligrams per kilogram of body weight), and 0.6 mg/kg of methylphenidate. The medications were administered on Tuesday, Wednesday, and Thursday of each week, in random order.

The researchers were interested in the following outcome areas:

1. *Behavioral measures* of on-task and disruptive behaviors (e.g., physical aggression/intrusion, verbal abuse/teasing, and inappropriate use or destruction of property) (as observed and recorded daily by trained undergraduate research assistants using an adaptation of the COCADD Observational Scheme)
2. *Academic measures:* a timed arithmetic task, a timed reading task, and assigned seatwork, performed daily
3. *Self-ratings of classroom behavior and academic performance* (as measured by eight questions answered daily by the boys—for example, “How well did you do in class today?” and “How hard did you try in class today?”)

Measures were taken daily.

What did the researchers find?

On the behavioral measures, overall, medication had **significant** (see *Glossary*) effects on on-task behavior and disruptive behavior, increasing the former and diminishing the latter. The behavior modification condition showed a trend (near significance) toward an effect on on-task behavior and a significant effect on disruptive behavior.

In the behavior modification condition, the boys showed significantly lower rates of on-task behavior when they had taken the placebo than when they had taken either dosage of methylphenidate. Further, they showed significantly higher rates of disruptive behavior on the placebo than on 0.6 mg/kg and showed a trend (near significance) toward higher rates on the placebo than on 0.3 mg/kg. No differences were found between the two doses for on-task or disruptive behavior.

In the regular classroom condition, the boys showed significantly lower rates of on-task behavior and significantly higher rates of disruptive behavior on the placebo than on either 0.3 mg/kg or 0.6 mg/kg of methylphenidate. Further, they showed significantly higher rates of on-task behavior and lower rates of disruptive behavior on 0.6 mg/kg than on 0.3 mg/kg.

The boys showed significantly lower rates of on-task behavior and significantly higher rates of disruptive behavior in the behavior modification/placebo condition than in the regular classroom/0.6 mg/kg condition.

On the academic measures, medication had significant positive effects on the number of timed arithmetic problems the boys attempted, the number of timed reading questions they answered correctly, and the percentage of seatwork they completed. The effect of medication on the number of timed reading questions the boys attempted showed a trend toward significance. There was no difference in performance between the two doses of methylphenidate.

On the self-ratings, overall the boys perceived their teacher as significantly fairer in the regular classroom condition than in the behavior modification condition, and they showed a trend toward perceiving their work as more accurate in the regular classroom condition. When they were on medication, the boys rated themselves as following classroom rules significantly better. Further, they showed a trend toward doing better, trying harder, finishing more work, considering their pill more helpful, being more accurate, and considering the teacher fairer.

What do the findings mean?

For therapists and other providers, the findings suggest that both methylphenidate and behavior therapy improve the classroom behavior of children with ADHD, and the two treatments in combination are superior in this regard to either one alone (only when considering the low doses of methylphenidate). However, only methylphenidate seems to improve the children’s academic performance and self-ratings in the short term. A dose of 0.3 mg/kg appears to be sufficient to achieve these results.

What are the study's limitations?

One of the main factors examined in this study was classroom environment (regular versus behavioral management). However, all subjects had prior exposure to the behavior modification classroom in the 5 weeks prior to the observation weeks, potentially diluting the difference between the two classroom conditions. Nineteen of the 24 subjects also had one other psychiatric diagnosis (either conduct disorder [CD] or oppositional defiant disorder [ODD]), perhaps limiting the generalizability of the results to the ADHD population that is comorbid for CD or ODD.

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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