



Attention Deficit Hyperactivity Disorder in Children and Adolescents

Focus of Research for Clinicians

In response to a request from the public, a review was undertaken to evaluate the evidence regarding 1) the potential benefits and adverse effects associated with treatments for attention deficit hyperactivity disorder (ADHD) in preschoolers, 2) the long-term effectiveness of interventions for ADHD in individuals 6 years of age and older, and 3) the variability of prevalence, diagnosis, and treatment associated with potential moderating factors. The systematic review included 223 studies published from January 1980 through May 2010. The full report, listing all studies, is available at www.effectivehealthcare.ahrq.gov/adhd/treatment.cfm. This summary is provided to inform discussions with patients and caregivers of options and to assist in decisionmaking along with consideration of a patient or caregiver's values and preferences. However, reviews of evidence should not be construed to represent clinical recommendations or guidelines.

Background

ADHD affects children of all ages, and approximately 5 percent of children worldwide show impaired levels of attention and hyperactivity. There are three subtypes of ADHD: 1) predominantly inattentive, 2) predominantly hyperactive-impulsive, and 3) combined inattentive and hyperactive. Boys are classified with ADHD about twice as frequently as girls and young children about twice as frequently as adolescents. Clinically significant ADHD is often associated with concurrent defiant and disruptive behaviors, temper tantrums, anxiety, low self-esteem, and learning disabilities.

ADHD is most commonly identified and treated in elementary school (ages 7 to 9) but can begin before children enter school. There is an increasing interest in identifying children who show signs of ADHD at a very young age in order to treat them as early as possible and thereby diminish social and academic repercussions. Overall, levels of symptoms of hyperactivity and impulsiveness decrease with age; however, many children with ADHD continue to show impairment relative to same-age peers throughout adolescence and into adulthood.

Interventions for ADHD include a range of pharmacologic and nonpharmacologic options. Psychostimulants and nonstimulant medications are often prescribed. Children with ADHD and their families may also receive nonspecific psychosocial support, counseling, and advice or support through standardized programs for parents and children. Children with ADHD may receive academic tutoring and coaching, both within and outside of school settings. There is a need for a systematic evaluation, including long-term effectiveness, of both the pharmacologic and nonpharmacologic interventions.

Conclusion

The number of ADHD cases identified has increased over time. Children from lower socioeconomic status (SES) households are diagnosed with ADHD more often than

children from higher SES households. However, children from higher SES households are more likely to receive treatment than those from lower SES households.

High-strength evidence shows that parental behavior training is efficacious for preschoolers; however, parents often drop out. Evidence is insufficient to know if school-based interventions are effective for preschoolers, and there are very few data on the outcomes related to the use of ADHD medications other than methylphenidate (MPH). For children 6 years of age or older, evidence is insufficient to know if nonpharmacologic treatments alone are beneficial in the long term. Evidence shows that ADHD medications are safe and effective for children ages 6 and older. For both preschoolers and children over the age of 6, long-term effectiveness and adverse effects are not well studied. Which interventions are best for which children and which behavior training programs are most suitable for parents are unknown. Limited evidence suggests that some subgroups of children may benefit more from combined medication and behavioral interventions than from medication alone. It is unclear how long treatment may be required, of what type, and for which subgroups.

More adverse effects were reported in preschoolers than in elementary school children. Moodiness and irritability often lead to discontinuation of treatment with MPH. Although children taking ADHD medications appear to have diminished growth rates, some studies found that the children may eventually catch up on their growth over time.

Clinical Bottom Line

Effectiveness of Interventions for ADHD or Disruptive Behavior Disorder in Children Under 6 Years of Age

- Parental behavior training is an efficacious treatment option for preschoolers with disruptive behavior disorders or ADHD symptoms. Benefits for children with disruptive behavior disorders are maintained at least 6 months and up to 2 years in some studies. Parents who attend more parental behavior training sessions see more improvement in their child's behavior. ●●●

(Continued on next page)



Clinical Bottom Line (Continued)

Effectiveness of Interventions for ADHD or Disruptive Behavior Disorder in Children Under 6 Years of Age

- MPH* is efficacious and generally safe for treating ADHD symptoms, but there has been limited long-term followup in preschoolers beyond 12 months. ●○○
- Evidence is insufficient to know if there is an additional benefit to combining different treatments. ○○○
- It should be noted that where there is socioeconomic burden, a school-based intervention appears to be the primary beneficial intervention. Benefits, however, diminished over 2 years. This appears to be related to lack of parental engagement and attendance at sessions. ○○○

Long-term (>1 Year) Effectiveness of Interventions for ADHD in Individuals 6 Years of Age or Older

Pharmacologic

- Psychostimulants provide control of ADHD symptoms and are generally well tolerated for months to years at a time. The best evidence for benefits is for MPH* in the setting of careful medication monitoring for up to 14 months. ●○○
- Atomoxetine appears to be safe and effective for treating ADHD symptoms over a period of 12 months. ●○○
- Extended-release guanfacine may reduce ADHD symptoms, but evidence is insufficient to permit an evidence-based conclusion about its long-term effectiveness. ○○○

Nonpharmacologic

- Evidence is insufficient to know if behavioral or psychosocial treatment alone is an effective long-term treatment option for children ages 6 years or older with ADHD. ○○○
- There are not enough studies to know if parental behavior training or school-based interventions are effective as long-term treatment options for children ages 6 years or older with ADHD. However, one good-quality study and its extension showed that school-based programs to enhance academic skills are effective in improving achievement scores in multiple domains. ○○○

Combined Treatments

- Both psychostimulant medication alone and a combination of medication and behavioral treatment are effective in treating ADHD plus ODD symptoms in children. Results are most applicable to elementary school-age boys of normal intelligence with the combined subtype of ADHD. ●○○

*Note: MPH is not approved by the U.S. Food and Drug Administration (FDA) for children under the age of 6.

ODD = oppositional defiant disorder

Strength of Evidence Scale

- High: ●●● There are consistent results from good-quality studies. Further research is very unlikely to change the conclusions.
- Moderate: ●●○ Findings are supported, but further research could change the conclusions.
- Low: ●○○ There are very few studies, or existing studies are flawed.
- Insufficient: ○○○ Research is either unavailable or does not permit estimation of a treatment effect.

Adverse Effects

Although not critically evaluated within the report, general research on adverse effects associated with ADHD treatments suggests the following:

- Psychostimulants and atomoxetine may cause insomnia, appetite loss, tiredness, social withdrawal, and abdominal pain.
- Psychostimulants and atomoxetine may also cause a modest increase in average blood pressure and average heart rate in some children and adolescents.
- Children or adolescents taking atomoxetine may be more likely to think about suicide than children who do not take it.
- More adverse effects were reported in preschoolers than in elementary school children.
- Moodiness and irritability often led to discontinuation of treatment with MPH.
- ADHD medications appear to have a small but distinct dose-related impact on growth rates in children. Some studies found that although children taking ADHD medications appear to have diminished growth rates, they may eventually catch up on their growth over time.
- Extended-release guanfacine was not well tolerated, with less than 20 percent of study participants completing the treatment at 12 months. Adverse effects include somnolence or sedation, fatigue, headache, and possible weight gain. Abnormal or worsening electrocardiographic changes judged clinically significant in 1 percent of patients suggest that monitoring of cardiac status is indicated.
- Safety investigations from observational studies and administrative databases did not provide conclusive evidence for cardiovascular or cerebrovascular adverse effects.

ADHD Medications

| Medication | Brand Name |
|--|------------------------------------|
| Stimulants | |
| Mixed amphetamine salts | Adderall®, Adderall XR® |
| Dextroamphetamine | Dexedrine® |
| Lisdexamfetamine* | Vyvanse®* |
| Methylphenidate | Concerta® |
| | Daytrana® |
| | Focalin®,* Focalin XR®* |
| | Metadate ER®, Metadate CD® |
| | Methylin®, Methylin ER® |
| | Ritalin®, Ritalin LA®, Ritalin SR® |
| Nonstimulants | |
| Atomoxetine | Strattera® |
| Clonidine hydrochloride* | Kapvay®* |
| Guanfacine ER | Intuniv® |
| *These medications were not included in this report. | |
| CD = continuous dose; ER = extended release; LA = long acting; SR = sustained release; XR = extended release | |

Variability in Prevalence, Clinical Identification, and Treatment of ADHD in Children

The table below lists conclusions on the variability in prevalence, diagnosis, and treatment of ADHD in children associated with potential moderating factors. For these conclusions, the literature was searched using the methodology of a systematic review; however, the selection of papers for inclusion was not subject to

the same constraints as the rest of the report. Other relevant papers were added via peer review feedback. These findings were included to provide context, and any studies considered pertinent to the topic of variability in ADHD prevalence, diagnosis, and treatment were included.

| Factor | Conclusions |
|--|---|
| Location | <ul style="list-style-type: none"> ■ Cultural differences influence how ADHD is understood and treated in different countries. ■ After accounting for differences in research methodologies between countries, the underlying prevalence does not appear to vary much among countries. ■ Rates of diagnosis vary considerably due to cultural context, access to local health care services, and providers available in the area. ■ There are significant regional variations in clinical identification across the United States. ■ Rates of treatment vary considerably due to location and access to health care providers—internationally, regionally, and even within the same community. |
| Service Provider | <ul style="list-style-type: none"> ■ Providers vary in their level of expertise in diagnosing ADHD. |
| Informant | <ul style="list-style-type: none"> ■ Rates of diagnosis vary considerably due to cultural context. Some ethnicities are more likely to seek help or accept the diagnosis than others. ■ The sociocultural experience of the parent or teacher informant may influence the interpretation and reporting of behaviors, willingness and persistence in seeking professional help, and/or acceptance of treatment modalities. |
| Time Period | <ul style="list-style-type: none"> ■ Since being identified as a clinical entity in 1902, the prevalence of identified ADHD cases has increased. <ul style="list-style-type: none"> □ This is partially due to increased knowledge about ADHD. It is also partially due to changes in the definition of who can identify a child as having ADHD (parents and teachers are becoming informants), changes in screening tests, and changes in diagnostic categories and classification systems over time. ■ The use of MPH and other drug treatments for ADHD has increased steadily since the early 1980s. ■ As an indicator of trends in treatment, the International Narcotics Control Board reported that medical use of MPH in the United States increased 77 percent from 2004 to 2008. |
| SES | <ul style="list-style-type: none"> ■ Some studies found that children of lower SES have a higher prevalence of ADHD. ■ Children of lower SES are identified as having ADHD more often than children of higher SES; however, the latter are more likely to be receiving treatment. ■ Lower SES and minority ethnicity are associated with shorter duration of medication use. ■ Insurance status may influence access to specialist providers in the United States. |
| Sex | <ul style="list-style-type: none"> ■ Most studies found the prevalence of ADHD is greater in boys than in girls. ■ There are few comparative data examining rates of treatment by sex in children diagnosed with ADHD. |
| Age | <ul style="list-style-type: none"> ■ Children ages 5 to 10 years appear to have the highest prevalence of ADHD. ■ Elementary school children are identified as having ADHD more frequently than older children. ■ Medication treatment prevalence is higher for elementary school children than for adolescents or adults. |
| ADHD = attention deficit hyperactivity disorder; MPH = methylphenidate; SES = socioeconomic status | |

Gaps in Knowledge

- Data regarding the long-term effectiveness or possible adverse effects for all ADHD treatments are scarce. The few long-term studies that are available are mostly of medications.
- Studies are needed to compare the effectiveness of diagnosis and treatment approaches for girls, as the current evidence is based predominantly on boys.
- Other populations that need further research include ethnic minorities and families of low SES.
- Little specific information is available about outcomes for children with comorbid learning disabilities, language impairments, and reading or mathematics disorders.
- Investigations of parental preferences regarding behavior training are needed to determine if parental completion rates for training can be improved.
- Very few studies examined psychostimulant use for preschoolers.
- Very few randomized clinical trials offer information about parental training interventions designed specifically for preschoolers with ADHD.

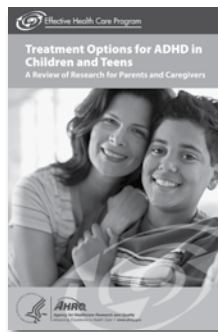
What To Discuss With Your Patients and Their Caregivers

- How ADHD affects children or adolescents and their families.
- Potential benefits associated with nonpharmacologic interventions such as parental behavior therapy programs.
- Potential benefits and adverse effects associated with psychostimulants and nonstimulants. In choosing medications, it is useful to discuss dose timing and monitoring in order to make choices most compatible with treatment goals and patient schedules and lifestyle.
- Patient and parental preferences regarding diagnosis and treatment options, including pharmacologic and nonpharmacologic interventions.
- How they can access information from the National Resource Center on ADHD about diagnosis and treatment, educational programs, public benefits, and other issues. The Center is supported with funding from the Federal Government through the Centers for Disease Control and Prevention (CDC). ADHD information can be accessed online at www.help4adhd.org or by phone at 800-233-4050.

Resource for Patients

Treatment Options for ADHD in Children and Teens, A Review of the Research for Parents and Caregivers is a free companion to this clinician research summary. It can help patients, parents, and caregivers talk with their health care professionals about the many options for diagnosis and treatment. It provides:

- A description of ADHD and its symptoms
- Descriptions of the types of treatments and potential side effects
- Simplified summaries of the research on the effectiveness of each treatment option
- Questions to guide a discussion about treatment options between parents or caregivers and their child's doctor



Ordering Information

For electronic copies of *Treatment Options for ADHD in Children and Teens, A Review of the Research for Parents and Caregivers*, this clinician research summary, and the full systematic review, visit www.effectivehealthcare.ahrq.gov/adhdreatment.cfm. To order free print copies, call the AHRQ Publications Clearinghouse at 800-358-9295.

Source

The information in this summary is based on *Attention Deficit Hyperactivity Disorder: Effectiveness of Treatment in At-Risk Preschoolers; Long-term Effectiveness in All Ages; and Variability in Prevalence, Diagnosis, and Treatment*, Comparative Effectiveness Review No. 44, prepared by the McMaster University Evidence-based Practice Center under Contract No. MME 2202-290-02-0020 for the Agency for Healthcare Research and Quality, October 2011. Available at www.effectivehealthcare.ahrq.gov/adhdreatment.cfm. This summary was prepared by the John M. Eisenberg Center for Clinical Decisions and Communications Science at Baylor College of Medicine, Houston, TX.