Attention-Deficit Hyperactivity Disorder

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Introduction

Attention-Deficit Hyperactivity Disorder (ADHD) is one of the most common disorders of childhood. It is characterized by two dimensions of behavior: inattention and hyperactivity–impulsivity. The presence of significant elevations on one dimension or both determine the subtype of ADHD. Individuals with six or more symptoms of hyperactivity–impulsivity and fewer than six symptoms of inattention meet partial criteria for ADHD, Hyperactive–Impulsive Type. Individuals with six or more symptoms of inattention but fewer than six symptoms of hyperactivity–impulsivity meet partial criteria for ADHD, Inattentive Type. Individuals with six or more symptoms of both dimensions meet criteria for ADHD, Combined Type (American Psychiatric Association, 2000). In order to meet criteria for ADHD, it is also necessary to demonstrate that symptoms contribute to significant impairment in one or more domains, including social and academic or occupational and that there are impairments in multiple settings (home, school or work, and peer-related activities).

ADHD typically begins in early childhood but often persists into adolescence and adulthood. Research has demonstrated that hyperactive symptoms generally decrease with age, and that inattentive symptoms persist, and may even increase, across age (DuPaul, Power, Anastopoulos, & Reid, 1998; Monuteaux, Mick, Faraone, & Biederman, 2010). In adolescence, impairments due to inattention and impulsivity are particularly salient. Although the combined subtype of ADHD is most prevalent in childhood, the inattentive type is most common in adolescence (Hurtig et al., 2007).

The majority of the treatments for ADHD have been developed for elementary school children, the age when ADHD is most often first diagnosed. Research in adolescence is much less developed than it is for younger children. Furthermore, fewer interventions have been developed to target the functional challenges adolescents with ADHD often face. Now that the evidence has clearly indicated that ADHD persists into adolescence and adulthood, researchers have begun to fill this gap, investigating ADHD

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in adolescence and developing or adapting interventions to be used with teenagers with ADHD.

In this entry, we review the research on adolescents with ADHD. We evaluate the intervention research to differentiate effective, promising, and non-effective approaches. Further, we identify promising approaches to preventing the emergence of significant functional impairments among adolescents with ADHD.

DSM-V and Incidence/ Prevalence Rates

Changes in the diagnostic criteria for ADHD proposed by DSM-V are relatively subtle but significant, especially for the assessment of ADHD among adolescents and adults. First, the description of many of the ADHD symptoms has been modified to include examples that are relevant for adolescents and adults. For example, the symptom "often runs about or climbs in situations where it is inappropriate" has been modified to stipulate that for adolescents the behavior "may be limited to feeling restless." Second, the age of onset of the disorder has been proposed as 12 years, instead of 7 years, which had been stipulated in the DSM-IV. This change accounts for elevations in inattention and/or hyperactivity–impulsivity that sometimes occur later in childhood and may not become significant and impairing until the middle school years (Willcutt et al., 2012).

The prevalence of ADHD varies according to developmental level. Among elementary-age children, the prevalence is estimated to be about 8 % (American Academy of Pediatrics [AAP], 2011). The disorder is more prevalent among boys than girls with estimates of the gender ratio varying from 2:1 to 6:1 depending on whether estimates are based on community versus clinical samples. The disorder is chronic in nature, and it has been estimated that about 75 % of children with ADHD continue to have the disorder into their teenage years (Barkley, 2006), although a higher rate of youth continue to have some residual symptoms that could be somewhat problematic. ADHD often occurs along with other mental health conditions, the most common including oppositional defiant disorder, conduct disorder, anxiety disorders, and mood disorders. About 25 % of clinic-referred youth with ADHD demonstrate serious conduct problems, with somewhat higher rates for boys than girls. The risk of substance abuse among youth with ADHD is elevated among those who exhibit serious conduct problems by adolescence (Molina, 2011).

Biological/Genetic Factors

ADHD is a neurodevelopmental, neurobehavioral disorder. These descriptors emphasize the neurological basis of ADHD. The former emphasizes the fact that the symptoms of ADHD are displayed differently across the course of development, whereas the latter term refers to the fact that the symptoms of ADHD are primarily manifested as variations from typical behavior. Research has repeatedly found brain differences associated with ADHD.

Following Barkley's (2006) theory that executive functioning deficits underlie ADHD, many researchers have looked at areas of the brain associated with executive functioning, which refers to a set of brain processes that enable individuals to organize thoughts and activities, prioritize tasks, manage time efficiently, and make decisions. Castellanos, Sonuga-Barke, Milham, and Tannock (2006) have proposed that both "cool" executive functioning and "hot" executive functioning deficits may be associated with ADHD. Cool executive functioning deficits refer to those that are evident when children are completing a quiet, perhaps boring, task; whereas hot executive functioning deficits are those that are evident during completion of an emotionally exciting task.

Studies of children with ADHD have also found differences in corticostriatal loops that are related to reward processing, motivation, and learning (Kohls, Herpertz-Dahlmann, & Konrad, 2009). Adolescents with ADHD have also been found to have significant reductions in white matter relative to typically developing controls (Castellanos et al., 2002). More recently, studies in adolescents have found that ADHD is associated with less efficient connections between parts of the brain (Konrad & Eickhoff, 2010). Some

researchers have hypothesized that decreased efficiency of connections in the brains of youth with ADHD may be associated with a loss of long-range connections between distant sections of the brain (Wang et al., 2009).

Research has also found evidence that brain differences are associated with greater persistence of ADHD symptoms into adolescence and adulthood. For example, Schulz, Newcorn, Fan, Tang, and Halperin (2005) found that persistence of ADHD into adolescence after initial diagnosis during early childhood was associated with greater activation of the ventrolateral prefrontal cortex, an area of the brain associated with executive function. One study (Hermens, Kohn, Clarke, Gordon, & Williams, 2005) found differences in brain activation between adolescent boys and girls with ADHD, suggesting that different brain mechanisms may underlie the expression of ADHD symptoms in girls than boys.

ADHD is increasingly understood to have a remarkably complex etiology. Genetics research has found that there is a genetic contribution to this disorder. Greater risk for ADHD has been reported among first and second degree family members of individuals with ADHD. Further, a higher risk for ADHD has been reported in biological parents, but not in adoptive parents, of individuals with ADHD (Sprich, Biederman, Crawford, Mundy, & Faraone, 2000). Twin studies have provided estimates of heritability, which is the proportion of a trait that can be accounted for by genetic factors. In younger cohorts (2 years of age or less) the heritability of ADHD has been estimated to be 76 %, whereas lower rates, around 30 %, have been reported in older cohorts (Ehringer, Rhee, Young, Corley, & Hewitt, 2006; Price et al., 2005; Schultz, Rabi, Faraone, Kremen, & Lyons, 2006).

Family studies suggest that genetic influences related to ADHD are less important in cases that remit before adolescence compared to persistent cases (Faraone, 2000). Twin studies also indicate that hyperactive symptoms are more stable in early and middle childhood, whereas attention problems are more stable in late childhood and adolescence (Larsson, Larsson, & Lichtenstein, 2004). These results highlight the importance of genetically influenced developmental changes in ADHD symptoms from childhood to adolescence.

Research to date has failed to identify a specific gene or set of genes associated with ADHD. Instead, the research evidence suggests that several distinct clusters of genes may underlie the development of ADHD, and clusters of genes may differ across families (Elia et al., 2010). Furthermore, research suggests that several identifiable environmental factors mediate the expression of these genes in such a way as to increase the severity of clinical symptoms among susceptible individuals (Seeger, Schloss, Schmidt, Rüter-Jungfleisch, & Henn, 2004).

Individual Factors Influencing Risk and Resiliency

Various factors, including childhood severity of ADHD and psychiatric comorbidity have been found to predict persistence of ADHD into adolescence among clinic-referred children (Biederman & Faraone, 2002). Children in a community sample who had major depressive disorder or oppositional defiant disorder were more likely than children without these disorders to meet criteria for ADHD when they became adolescents. The presence of specific inattentive symptoms in childhood (e.g., being forgetful, losing things, difficulty following instructions, difficulty organizing tasks, avoiding tasks) was also associated with the persistence of ADHD into adolescence (Biederman et al., 1996). Although ADHD is more common in boys than in girls, findings regarding its persistence were similar for both boys and girls (Hurtig et al., 2007).

Research has shown that ADHD subtype often changes from childhood to adolescence (Hurtig et al., 2007). Children who met criteria for the combined subtype of ADHD in childhood most often meet criteria for the inattentive subtype in adolescence. Individuals who continue to meet criteria for the combined subtype in adolescence are more likely to have comorbid oppositional defiant disorder or conduct disorder than

adolescents with other subtypes of ADHD. Females with ADHD and anxiety in childhood appear to be more likely to have a comorbid anxiety disorder in adolescence, whereas the presence of a childhood anxiety disorder in boys with ADHD did not predict the presence of an anxiety disorder in adolescence.

A number of individual factors have been associated with impairments in adolescents with ADHD. Both male and female adolescents with a history of ADHD were more likely than their peers without ADHD to also have another psychiatric condition (Monuteaux et al., 2010). Adolescents with ADHD who also had a comorbid psychiatric condition showed significantly greater impairments in functioning than their peers who had ADHD without comorbidity.

ADHD is associated with an increased likelihood of unsafe driving behaviors, including receiving citations, being involved in motor vehicle crashes, and being involved in accidents resulting in injuries and fatalities (Barkley & Cox, 2007). Potential mechanisms of action have been proposed, including poor ability to anticipate driving hazards, willingness to engage in risky driving behaviors, inadequate self-assessment of skills in relation to challenging driving situations, and vulnerability to influence from peers (Pollatsek, Fisher, & Pradhan, 2006).

Research identifying protective factors has been limited. One study found that greater self-perceived sense of control and meaningfulness about life among youth with ADHD predicted higher reductions in ADHD symptoms from childhood to adolescence, especially for teens with severe symptoms (Edbom, Malmberg, Lichtenstein, Granlund, & Larsson, 2010).

Family Factors Influencing Risk and Resiliency

ADHD has a significant effect on children and adolescents and their families. Youth with ADHD require greater supervision and encouragement than their peers without this disorder (Barkley, 2006). Parents of children with ADHD typically feel more frustrated and stressed and they are more likely to feel helpless than parents of children without ADHD (Deault, 2010).

Parent–child communication is essential to sustaining strong relationships and enabling parents to be involved in a useful way in their child's decision making regarding peers and community activities (Robin, 2009). Communication problems are common among families of teens with ADHD and are associated with negative outcomes. For example, when a child has ADHD, parent–child communication difficulties during childhood have been shown to predict tobacco use in early adolescence (Burke, Loeber, & Lahey, 2001). Resilience factors have been identified with novice drivers that likely have applicability to those with ADHD include strong parent–child communication, increased parental surveillance, and use of an accountability system based on parent–teen negotiation, contracting, and positive reinforcement for goal attainment (Fabiano et al., 2011).

Parental surveillance is essential for preventing youth from engaging in harmful activities in the community and promoting adaptive peer functioning. Working out the right level of parental supervision can be challenging in families in which there is a teen with ADHD. Once again, strong communication between parent and child lays the foundation for success in negotiating a system of accountability that acknowledges the teen's emerging need for greater autonomy and is effective in protecting the teen from harm (Barkley, Edwards, & Robin, 1999).

Social and Community Factors Influencing Risk and Resiliency

The presence of ADHD poses serious risks to adolescents with ADHD in school and community contexts. This section describes the risks as well as factors that promote resilience and successful coping in school and community settings for these individuals.

School factors. Students with ADHD are at high risk for poor school performance, including more homework problems, lower rates of class work

completion, lower grades, poorer performance on standardized achievement tests, higher rates of classification in special education, and higher rates of grade retention (DuPaul & Stoner, 2003). A pattern of poor school performance often becomes established early in schooling, persists through the elementary and middle school years, and results in increased risk of dropout in high school. School dropout, in turn, has been shown to be a serious risk factor for poor outcomes later in life, including chronic health conditions, alcohol and substance abuse, serious mental illness, unemployment, and incarceration (National Research Council, 2001).

Research has identified student engagement as a key factor in preventing dropout and promoting successful school performance. Student engagement has multiple dimensions (Betts, Appleton, Reschly, Christenson, & Huebner, 2010). Behavioral engagement, the extent to which a student is in a position to participate in school, is measured by attendance, suspensions, and participation in extracurricular activities. Academic engagement, the extent to which students are involved in instruction and practice activities, is differentiated into active responding (asking questions, working on class work) and passive responding (looking at teacher during instruction). Cognitive engagement refers to internal factors related to learning, including self-regulation, academic motivation, goal directedness, and use of learning strategies. Finally, psychological engagement refers to a student's connectedness with school, including perceived support from teachers and classmates and a sense of belonging.

Research on student engagement has identified multiple factors that have relevance to promoting resilience for students with ADHD who are at risk for school failure (see National Research Council and Institute of Medicine, 2004). One factor is ensuring that instructional and practice activities include the appropriate ratios of familiar to unfamiliar material and are meaningful and interesting to students (Burns, 2004). A critical factor is to establish and maintain a strong relationship between student and teacher, which has been related to academic and social success in school (Pianta, 1999). Although the manner in which families are involved changes in secondary school in response to emerging student autonomy and changes in school structure, it is critical for parents to actively participate in their child's education and remain closely connected with the school (Grolnick, Kurowski, Dunlap, & Hevey, 2000). In addition, connecting students to a mentoring program promotes a sense of student belonging to the school, provides ongoing monitoring of academic performance and behavior, and coordinates the efforts of school personnel to assist the student (Sinclair, Christenson, & Thurlow, 2005).

Community factors. Adolescence is marked by a heightened desire for autonomy from parents and other adults, an increased interest in forming relationships with peers, greater involvement in activities outside of home and school, and increasing access to privileges (e.g., driving, intimate relationships). Adolescence poses substantial challenges and risks to youth and their families, but the presence of ADHD often confers additional risk, such as engaging in potentially harmful sexual behavior (Barkley & Gordon, 2002), using tobacco (Molina, 2011), and engaging in dangerous driving behavior (Barkley, 2004).

Psychosocial adversity, such as lower socioeconomic status, single parenting, and parental psychopathology, predicts the persistence of ADHD into adolescence (Biederman & Faraone, 2002). Several factors that promote resilience among adolescents have relevance for youth with ADHD. Involvement in meaningful community activities (e.g., afterschool programs) has been identified as a key factor in promoting positive youth development (Lerner & Benson, 2003). In these contexts, it is important for youth to have the opportunity to form meaningful relationships with adults outside the home, engage in supportive peer relationships, and pursue activities that have intrinsic value to them; however, youth with ADHD face unique challenges in becoming involved in meaningful extracurricular activities at school and in the community.

Evidence-Based Treatment Interventions for ADHD

Unlike research regarding psychosocial interventions for children with ADHD, psychosocial treatment development for adolescents with ADHD is in its infancy. Nonetheless, there are many promising approaches to psychosocial intervention for youth with this disorder.

What Works

A review of the literature to date indicates that no treatment has met the criteria of being tested in three randomized controlled trials and shown to be successful. As a result, a work group of the AAP concluded that there is not sufficient research support for the effectiveness of psychosocial treatments for adolescents with ADHD (American Academy of Pediatrics, 2011). A meta-analysis of behavior modification treatments for ADHD (parent behavioral therapy, classroom consultation, and summer treatment programs) found moderate to large effect sizes, but few of the reviewed studies examined the effectiveness of such treatments with adolescents (Fabiano, Pelham, Coles, Gnagy, & Chronis-Tuscano, 2009).

What Might Work

Researchers have begun to address the need for effective psychosocial treatments for adolescents with ADHD that address teenagers' functioning at home, school, and elsewhere.

Family-based interventions. Table 9.1 lists the six studies investigating the effectiveness of a family-based intervention for adolescents with ADHD. Two large-scale studies conducted by Barkley, Guevremont, Anastopoulos, and Fletcher (1992), Barkley, Edwards, Laneri, Fletcher, and Metevia (2001) found significant improvements as a result of Behavior Management Training (BMT) and Problem-Solving Communication Training (PSCT). BMT provided in this study was an adapted version of the program developed by Barkley to train parents in behavioral management techniques. It was found effective in reducing parent–child conflict and child noncompliance in children with ADHD and disruptive behavior disorders. PSCT teaches family members behavioral skills (e.g., problem solving, communication strategies, contingency management), uses family therapy approaches to address family structure and communication patterns, and uses cognitive therapy approaches to reframe irrational beliefs. These studies found that adolescents in both treatment groups improved significantly from pre-treatment to post-treatment, although neither study included a treatment as usual group to control for non-treatment effects. However, less than one third of teenagers showed significant improvements and less than one fifth of teenagers improved to the point of being in the normal range, suggesting that the effectiveness of these treatments was somewhat limited.

Additional studies have found improvements in response to structural family therapy (Barkley et al., 1992) and a summer treatment program with parent training intervention (Sibley et al., 2011, 2012, Sibley, Smith, Evans, Pelham, & Gnagy, 2012) suggesting that these interventions also show promise in treating adolescents with ADHD. For two studies, parent involvement was limited to parent psychoeducation and did not include behavioral parent training. One of these studies found positive improvements (McCleary & Ridley, 1999), whereas the other study (Antshel, Faraone, & Gordon, 2012), which combined parent education with adolescent cognitive-behavioral therapy, failed to find positive results. These mixed results suggest that further research is needed to determine the effectiveness of parent education.

Similarities among the interventions that appear promising consist of elements of behavior therapy, goal setting, contingency management, and frequent use of positive reinforcement. In addition, these interventions include components to make the treatment developmentally appropriate for adolescents, such as communication and negotiation training. Each of these treatments needs additional randomized controlled trials in order to conclusively determine that they are effective for teenagers with ADHD. Furthermore,

Table 9.1 Family interventions for adolescents with ADHD adapted by authors

Tx	Study authors (*N*, age range)	Design	(Gender) ethnicity	Outcome measures	Findings
CBT + Family Ed	Antshel et al. (2012) (*N* = 68, 14–18)	Within-subjects	(66 % Male) 81 % Caucasian 13 % Af. Am. 3 % Latino	GPA, attendance, BASC-2 (P&T), IRS, ADHD-RS (P&T), med adherence, med dose	• No statistically significant findings • Larger *ES* for school absences/tardiness, parent and teacher ratings of inattention, and parent ratings of externalizing problems
PSCT, BMT, SFT	Barkley et al. (1992) (*N* = 61, 12–17)	Randomized control trial	(Gender NR) 100 % Caucasian	CBCL (P&Y), Conflict Behavior Questionnaire, Issues Checklist, Locke-Wallace Marital Adjustment Test, Family Beliefs Inventory, BDI, PAICS-R	• Statistically significant improvements for all three Tx groups on parent- and youth-report of communication, # conflicts, anger intensity; and parent ratings of school adjustment, internalizing and externalizing problems • Only 5–30 % reliably improved from treatment, only 5–20 % recovered following treatment
PSCT, BMT	Barkley et al. (2001) (*N* = 97, 12–18)	Pre-/Post-	(90 % Male) 86 % Caucasian 9 % Latino 3 % Asian 2 % Af. Am.	Conflict Behavior Questionnaire, Issues Checklist, Parent–Teen Conflict Tactics Scale, Conflict Rating System, DBD	• Statistically significant improvements for both Tx groups (PSCT, BMT + PSCT) on parent, teacher, adolescent, and direct observation ratings
STP-A + Parent Train.	Sibley et al. (2011) (*N* = 19, 11–16)	Within-subjects + Single Case Ex.	(68 % Male) 58 % Caucasian 21 % Latino 11 % Af. Am. 11 % Other	Program-specific ratings of target behaviors	• Parent, youth, and counselor reported improvements in target behaviors • Moderate treatment effects for case study
STP-A + Parent Train.	Sibley et al. (2012) (*N* = 34, *M* = 13.9)	Within-subjects	(88 % Male) 82 % Caucasian	Improvement Rating Scale	• Parent ratings show some improvement across target behavior from baseline
Parent education and skills training	McCleary and Ridley (1999) (*N* = 103, 12–17)	Pre-/Post-	(77 % Male) Ethnicity NR	Conflict Behavior Questionnaire, Issues Checklist	• Statistically significant improvements in parent–youth conflict and child problem behavior

Abbreviations: *BMT* Behavior Management Training, *CBT* Cognitive-Behavioral Therapy, *PSCT* Problem-Solving Communication Training, *SFT* Structured Family Therapy; *STP-A* Summer Treatment Program for Adolescents

the relatively low response rate to intervention in the Barkley studies suggests that modifications may be needed to increase the effectiveness of family treatments for adolescents.

It is important to note that each of the previously mentioned interventions has been designed for and applied in an outpatient setting. When adolescents experience significant impairment, requiring more intensive intervention than can be provided in an outpatient setting, similar family interventions can be applied in an inpatient, residential, or day treatment setting, although additional research is needed in these settings.

School interventions. Table 9.2 lists the 28 studies that have investigated the effectiveness of school-based intervention for adolescents with ADHD. Six studies investigated the *Challenging Horizons Program* (CHP; Evans, Schultz, DeMars, & Davis, 2011). CHP is an afterschool program developed for middle school students with ADHD, which was adapted and is currently being evaluated for use with high school students with ADHD. This program addresses students' academic, behavioral, and social functioning through a variety of after-school intervention, parent education, and teacher consultation activities that include elements of behavioral parent training and teacher consultation, as well as the application of behavioral interventions to teach organization and social skills. The middle school version of CHP has been found to have medium to large effect sizes on a variety of outcome measures and to move 38–60 % of middle school students with ADHD into the average range on a measure of impairment. CHP has been evaluated in multiple studies and could be considered an efficacious treatment for middle school students with ADHD. However, it is classified as a program that "might work" for adolescents given that there have not been any outcome studies determining the effectiveness of this program with high school students.

Five studies investigated interventions to address academic skill deficits in adolescents with ADHD. Each found significant treatment effects on measures of academic performance and/or on-task behavior. Two interventions were examined in two separate studies, the *Thinking Before Reading*, *While Reading*, *After Reading* intervention (TWA) and the *Self-Regulated Strategy Development* intervention (SRSD). The other interventions were only evaluated in one study. An additional five studies investigated the effectiveness of interventions targeting disruptive behavior. Similar behavioral techniques were used in each of these studies, but approaches were not standardized across studies. Improvements were found in all five studies, although each study used a single case design and therefore the results are limited with regard to generalizability to adolescents with ADHD.

Nine studies have investigated interventions addressing organizational skills and homework problems. The sample sizes for all of these studies were small, with four of them including fewer than five participants. All of these studies found positive improvements in response to intervention, although only one study assessed the statistical significance of results. All of the studies used behaviorally based techniques but differed in their specific interventions, with the exception of two studies that used self-monitoring of class preparation behavior. An additional three studies examined social skills interventions applied in the school setting and found positive improvements on some measures of social behavior.

Overall, a review of these studies reveals that the effective interventions shared some common elements, specifically the application of behavioral principles to address school problems and the involvement of both students and teachers in the implementation of interventions. Interventions differed in the extent to which students were the primary treatment agent (e.g., self-monitoring interventions) versus teachers or other school personnel (e.g., group contingency management). With the exception of the CHP, the generalizability of study results is limited by the failure of studies to standardize their interventions so that results can be compared across studies.

It is important to note that each of the previously mentioned interventions have been designed for and applied in a regular education classroom placement setting. When adolescents

Table 9.2 School interventions for adolescents with ADHD adapted by authors

Tx	Authors (*N*, age range)	Design	(Gender) Ethnicity	Outcome measures	Findings
Multimodal Interventions					
CHP	Evans et al. (2004) (*N*=7, 6–8)	Within subjects	(71 % Male) Ethnicity NR	Grades, GPA slope, ADHD-RS, CIS	• Large effect sizes for parent- and teacher-rated inattention, academics, teacher-rated hyperactivity and classroom behavior
CHP	Evans et al. (2005) (*N*=27, 11–14)	Pre-/Post-	(78 % Male) 100 % Cauc.	GPA, IRS	• Maintenance of GPA in Tx group vs. decline in comparison group • Improvement to "normal range" on IRS for 38–60 % of Tx group
CHP	Evans et al. (2005) (*N*=35, 11–14)	Within subjects	(83 % Male) 100 % Cauc.	IRS, ADHD-RS	• Average effect size across raters indicates overall improvement • Raters agreed on only 27 % of kids
CHP-C	Evans et al. (2007) (*N*=79, 10–14)	Between group	(77 % Male) 94 % Cauc.	BASC, DBD, IRS, SSRS, Grades	• Improvements in parent ratings of ADHD symptoms and social functioning • Trends suggested benefits for Tx group grades
CHP	Evans et al. (2011) (*N*=49, 10–13)		(71 % Male) 70 % Cauc. 14 % Af. Am. 12 % Hisp. 4 % Asian	DBD, IRS, CPS, Grades	• Improved teacher ratings of academic impairment for Tx group • Improved teacher-reported language arts and social studies progress for Tx group • Better grades in math for Tx group • Unspecified site-specific contextual factors may have contributed to differences for some outcome measures
CHP	Molina et al. (2008) (*N*=20, 6–8)		(Gender NR) Ethnicity NR	BASC, IRS, Grades, Aggression and Conduct Problems Scale	• Medium *ES* for parent ratings of internalizing, and adolescent-reported school adjustment • Prevention effect on grades and conduct problems • Small *ES* for parent-reported externalizing problems
Academic Skills Interventions					
SSIC	Diliberto et al. (2008) (*N*=83 [7 ADHD], 6–8 grade)	Pre-/Post-	(65 % Male) 61 % Cauc. 27 % Af. Am. 12 % Hisp.	WJ-III Reading Subtests, Reading Fluency	• Statistically significant effects on WJ-III subtests, favoring Tx group • Interaction effect for reading fluency approached significance (p=.06)
Planning strategy instruction	Iseman and Naglieri (2011) (*N*=29, 10–15)	Pre-/Post-	(72 % Male) 89.7 % Cauc.	WJ-III Math Fluency, WIAT-II Numerical Operations, Math scores	• Gains for Tx group on all three measures • Maintained at 1-year follow-up
TWA & SRSD	Johnson et al. (2012) (*N*=3, 14–15)	Mult. BL	(100 % Male) 100 % Cauc.	Recall of main ideas and details	• PND main ideas >80 % • PND details >60 %

(continued)

Table 9.2 (continued)

Tx	Authors (*N*, age range)	Design	(Gender) Ethnicity	Outcome measures	Findings
TWA-WS & SRSD	Rogevich and Perin (2008) (*N*=63, [31 ADHD], 13–16)	Pre-/Post-	(100 % Male) 35 % Cauc. 41 % Af. Am. 24 % Hisp.	Summarization of main ideas	• Improvements on post-test, near and far transfer tasks, and follow-up
Self-monitor+reward	Shimabukuro et al. (1999) (*N*=3, 12–13)	Mult. BL	(100 % Male) Ethnicity NR	Academic accuracy, Productivity, On-task behavior	• Stronger improvements for productivity and accuracy in reading and math classes vs. writing class • On-task behavior showed similar pattern across subject areas
Behavioral Interventions					
Func. Assess. & Int.	Ervin et al. (1998) (*N*=2, 13–14)	Single subj.	(100 % Male) 50 % Cauc. 50 % Hisp.	On-task behavior	• % intervals of on-task behavior increased to >88 % for both participants
Self-monitor	Graham-Day et al. (2010) (*N*=3, 16)	.	(67 % Male) 100 % Cauc.	On-task behavior, Grades	• On-task behavior increased across all 3 participants to >90 % • Grades showed little change
Group contingency	Jones et al. (2008) (*N*=7, 6–8)		(Gender NR) Ethnicity NR	Disrespectful verbal behavior	• Reductions in verbally disrespectful behavior across participants
Func. Assess. & Int.	Majeika et al (2011) (*N*=1, 17)		(100 % Male) 100 % Cauc.	On-task behavior	• % intervals of on-task behavior increased to roughly 80 %
Self-monitor+reward	Shapiro et al. (1998) (*N*=2, 12)		(100 % Male) Ethnicity NR	ADHD-RS, CTRS-R, Classroom behavior ratings, On-task behavior	• Improved classroom behavior ratings • Improved levels of on-task behavior • Some improvements on CTRS-R and ADHD-RS
Organizational Skills and Homework Interventions					
Self-monitor	Creel et al. (2006) (*N*=4, 11–12)	Mult. BL	(75 % Male) 50 % Af. Am. 25 % Cauc. 25 % Hisp.	Class preparation behaviors	• Improvements in teacher ratings of classroom preparedness • PND of 0 % for all participants
PDAs for HW	Currie et al. (2005) (*N*=4, 12–14)	Mult. BL	(100 % Male) Ethnicity NR	Homework completion	• Average % of homework completed met or exceeded criterion of 80 % for 3 of 4 students
Org. Checklist	Evans et al., (2009) (*N*=28, 11–15)	With-in-subjects	(77 % Male) 70 % Cauc. 14 % Af. Am. 12 % Hisp. 4 % Asian	Mastery of organizational checklist, Grades	• 71 % of the sample met a mastery criterion of 90 % over three weeks • Performance on specific organizational skills correlated with student math and English grades

Self-monitor	Gureasko-Moore et al (2006) (*N*=3, 12)	Mult. BL	(100 % Male) Ethnicity NR	Class preparation behaviors	Overall improvements across all three participants, with gains maintained
Org. Strategies	Langberg et al. (2008) (*N*=37, 4–7)		(84 % Male) 70 % Cauc. 30 % Af. Am.	APRS, HPC, Grades, Organization Checklist, Homework Management Checklist	• Improvements to >90 % on Organization Checklist • Improvements to 72 % on Homework Checklist • Statistically significant improvements for Tx group on HPC • Some improvement of GPA for Tx group
Goal setting and coaching	Merriman and Codding (2008) (*N*=3, 9–10)	Mult. BL	(67 % Male) Ethnicity NR	Homework completion and accuracy	• Stable improvements in both completion and accuracy for 2 of 3 students
Self- and parent-monitoring, SQ4R	Meyer and Kelley (2008) (*N*=42, 11–14)		(86 % Male) 93 % Cauc.	HPC, CPS, Homework Grades	• Self- and parent-monitoring groups both increased % homework turned in and reduced homework problems on HPC
HIP	Raggi et al. (2009) (*N*=11, 11–13)	Mult. BL	(91 % Male) 36 % Cauc. 45 % Af. Am. 9 % Hisp. 9 % Bi-racial	APRS, BIRS, DBD, Grades, HPC, Homework Process Questionnaire	• 8 of 11 participants improved on HPC; 6 maintained improvements • 7 of 8 students with grades showed improvement • 7 of 11 kids improved on parent DBD ratings • 6 of 10 students were rated improved on the Academic Productivity subscale of the APRS
Daily Planner & Org. Checklist	Sadler et al. (2011) (*N*=36, 13-17) STUDY 1	Pre-/Post-	(86 % Male) 92 % Cauc. 6 % Biracial 3 % Hisp.	Mastery of planner and checklist	• 62 % of kids mastered checklist • Mixed findings for planner • Positive correlations found between adherence to checklist/planner and GPA
Social Skills Interventions					
Social rules and group prob. solving	Kuester and Zentall (2012) (*N*=34, 10–14)		(47 % Male) 94 % Cauc. 6 % Af. Am.	% problems cooperatively solved Pro-social behavior	• Fewer problems solved in no-rule condition • Some increases in pro-social behavior under rules condition
ISG	Sadler et al. (2011) (*N*=15 , 13–17) STUDY 2	Pre-/Post-	(Gender NR) Ethnicity NR	IRS, SSRS, ISG Cards	• 33 % of student mastered social goals • Mastery was associated with greater decreases in IRS social impairment • All students improved on SSRS ratings
Peer scaffolding	Watkins and Wentzel (2008) (*N*=24, 9–13)	Pre-/Post-	(100 % Male) Ethnicity NR	Behavioral observation of a problem-solving task	• Joint participation increased through scaffolding • Solitary participation decreased • Passive behaviors remained stable

Abbreviations: *NR* Not Reported, *CHP* Challenging Horizons Program, *CHP-C* CHP with Consultation, *ADHD-RS* ADHD-Rating Scale, *BASC* Behavior Assessment System for Children, *CIS* Children's Impairment Scale, *CPS* Classroom Performance Survey, *DBD* Disruptive Behavior Disorders Rating Scale, *IRS* Impairment Rating Scale, *SSRS* Social Skills Rating Scale, *SSIC* Syllable Skills Instruction Curriculum, *TWA* Thinking Before Reading, While Reading, After Reading, *SRSD* Self-Regulated Strategy Development, *TWA-WS* TWA-with Written Summarization, *CTRS-R* Connors Teacher's Rating Scale-Revised, *SQ4R* Survey, Question, Read, Write, Recite study strategy, *HIP* Homework Intervention Program, *ISG* Interpersonal Skills Group, *APRS* Academic Performance Rating Scale, *BIRS* Behavior Intervention Rating Scale, *CPS* Classroom Performance Survey, *HPC* Homework Problems Checklist

Table 9.3 Other interventions for adolescents with ADHD adapted by authors

Tx	Study authors (*N*, age range)	(Gender) Ethnicity	Design	Outcome measures	Findings
STEER	Fabiano et al. (2011) (*N*=7, 16–17)	(43 % Male) 100 % Caucasian	Mixed Methods/ Multiple-baseline	Electronically monitored driving behaviors (CarChip Pro), Driving Behavior Questionnaire (P&Y), IRS	• Hard braking, top weekly speed improved • Ratings on DBQ and IRS suggestive of positive effects, though not tested for significance

Abbreviation: *STEER* Supporting a Teen's Effective Entry to the Roadway

experience more significant impairment, so that they cannot be effectively and safely taught in a regular education classroom setting, they typically receive similar interventions at a greater intensity in a special education classroom placement. As such, there remains a need for additional research regarding the effectiveness of school interventions in more restrictive academic settings for students with ADHD.

Other interventions. The majority of interventions have been focused on improving youth functioning at home and/or school. However, the following intervention approaches also have promise and deserve mention.

Driving. Fabiano et al. (2011) have developed the STEER program as an intervention for adolescents with ADHD who are learning to drive. This program incorporates components of cognitive-behavior therapy (CBT) that have been shown to be promising in the treatment of teens with ADHD, including negotiating, goal setting, contracting, monitoring of behavior, and contingency management. In a pilot study, Fabiano and colleagues demonstrated that STEER is feasible to implement and promising for improving driving performance.

Working memory. Studies of working memory training have included both children and adolescents, so it is not possible to pinpoint the effects of such programs on adolescents with ADHD. Working memory training programs have found some intriguing initial results, primarily demonstrating that they can improve performance on working memory tasks in the lab. However, studies that have investigated their effect on ADHD symptoms via blind parent and teacher reports have failed to demonstrate treatment effects (Shipstead, Redick, & Engle, 2012).

Biofeedback. Some initial studies of biofeedback as a treatment for ADHD have found promising results for children. One study found that biofeedback had positive results compared to controls on independent clinician ratings of diagnostic status (e.g., Bakhshayesh, Esser, & Wyschkon, 2010), suggesting that this treatment shows promise. However, studies with adolescents that look specifically at the beneficial effects of this treatment on behavior at home and school are needed to determine whether biofeedback "works" as a treatment strategy for ADHD in adolescence.

What Doesn't Work

Although no intervention has been sufficiently studied with adolescents with ADHD to conclude that it does not work for certain, ADHD treatment research with younger children suggests approaches that are not likely to work. Specifically, treatments targeting youth that do not include behavioral management strategies applied by parents and teachers have not been found to be effective for children with ADHD. Consistent with this, Antshel et al. (2012) studied the effectiveness of cognitive-behavioral therapy combined with parental education (rather than behavioral parent training) for adolescents with ADHD and failed to find any significant improvements as a result of the treatment (see Table 9.1 for further information). Numerous

alternative treatments have been developed and have proponents who claim that the approaches are effective for treating ADHD. However, in general, these alternative treatments either have not been researched sufficiently or research has failed to find beneficial results when the treatment was subjected to a double-blind study. For further information regarding alternative treatments for ADHD, see the review by Hurt, Lofthouse, and Arhold (2011).

Psychopharmacology and ADHD

There is strong evidence that pharmacological treatment is effective with adolescents and adults (Barkley, 2006; Wolraich, 2011) and equally effective with males and females. The most effective class of medications for treating ADHD is the stimulants (AAP, 2011). There are two broad classes of stimulants: methylphenidate and amphetamine compounds. Both classes of medication are essentially equally effective, although some individuals respond more favorably to one class as opposed to the other. Experts generally recommend that prescribing providers offer a trial of both types of stimulants before advancing to non-stimulant alternatives (Wolraich, 2011). Several additional medications have been approved by the Food and Drug Administration for the treatment of ADHD; these include atomoxetine, extended release guanfacine, and extended release clonidine. In general, effect sizes achieved by the stimulants are larger than those exhibited by these alternative drugs (AAP, 2011).

A major concern with the pharmacological treatment of ADHD is non-adherence (Molina et al., 2009). Non-adherence is often related to ambivalence on the part of adolescents about the benefits and usefulness of medication, as well as concerns about unwanted side effects (e.g., seriousness, lack of spontaneity). For this reason, approaches to treatment planning that involve full participation by adolescents as well as their parents and health providers are strongly recommended (Power, Soffer, Cassano, Tresco, & Mautone, 2011). Another concern when treating adolescents with medicine is the potential for diversion, that is, unauthorized use of medication involving the giving, selling, or trading of prescribed medication by youth with ADHD to another youth (Wilens et al., 2008). This concern has led to recommendations that prescribing clinicians monitor carefully refill requests and use medications that have low abuse potential (AAP, 2011).

Prevention for Youth with ADHD

Prevention for youth with ADHD refers to reducing educational and social impairments and minimizing risks associated with poor outcomes later in life. Research focused on the prevention of impairments and risk among adolescents with ADHD is limited, but public health models have been developed that have relevance and promise for youth with ADHD.

What Works

Although research on adolescents with ADHD has increased substantially over the past several years, no prevention programs for these individuals have been demonstrated to be effective. However, many prevention approaches are promising and likely to be effective.

What Might Work

Schools are a logical venue for the delivery of prevention services, given that the mission of schools is to promote youth development and given that they serve a very high percentage of youth. Since 2000, there has been a widespread effort to implement a public health, prevention framework in public schools throughout the USA. The most commonly used and most widely studied approach is School-wide Positive Behavior Support (SWPBS; Sugai & Horner, 2006). This approach is characterized by the use of multi-tier models of prevention and intervention. Applying a public health approach to programming for youth with ADHD has significant utility and potential effectiveness (Evans

et al., 2014). Most multi-tier models developed for schools have three or four levels. Recently, Tresco, Lefler, and Power (2010) have described a four-tier model that has applicability for youth with ADHD.

Multi-tier models. The first tier refers to universal strategies for all students that can be beneficial to the subset of youth with ADHD. These approaches include instructional strategies that maximize student attention and productivity. For example, research indicates that instruction incorporating novel material and teaching methods that provide students with frequent opportunities for active responding (e.g., participation in class, brief written assignments, opportunities to work on educational computer games) can promote concentration and work productivity (DuPaul & Power, 2009). Further, instruction in organizational strategies, such as note taking, organization of school work and homework, and time management, can be useful in promoting school success for all children, especially those with ADHD.

Universal strategies have also been developed to promote adaptive behavior and social interaction. For example, it is important for teachers to identify a limited number of critical rules for students to follow, to post these rules in a prominent location, and to provide frequent instruction and reminders about the rules. In addition, it is important for teachers to observe students on a continual basis with regard to how well they are following the rules and provide frequent positive reinforcement for rule-governed behavior. Corrective feedback can be offered to students in the class, but the ratio of positive reinforcement to corrective feedback to the class as a whole and to each student should be at least four to one (DuPaul & Stoner, 2010). Promoting family involvement in education is another important universal strategy, given the clear link between family involvement and student outcomes (Christenson & Sheridan, 2001). Teachers can provide parents and youth with clear guidelines about how to address common homework challenges and how to seek help when problems arise. In addition, teachers can educate parents about other ways to support students, such as communicating high and realistic expectations to students and identifying useful websites.

The second tier refers to selective strategies for the subgroup of students who do not respond sufficiently to universal approaches. Peer tutoring is an approach that has received some research attention for students with ADHD (DuPaul, Ervin, Hook, & McGoey, 1998). Peer tutoring is typically provided by pairing students and requesting them to work in a reciprocal manner (i.e., exchange of tutor/tutee roles). This strategy provides opportunities for students to receive individualized instruction using a pace that matches the style of the learner. Also, peer tutoring typically includes frequent prompts for attention and frequent positive reinforcement for effort and accurate responding. In addition, peer coaching is a useful approach and has the potential to improve both academic and social performance (Dawson & Guare, 1998). Peer coaching typically incorporates goal-setting techniques and monitoring to evaluate goal attainment. The success of both peer tutoring and peer coaching requires careful planning with the teacher and ongoing adult supervision. Another Tier 2 strategy is identifying a school-based mentor, who could be a teacher, counselor, or coach. The role of the mentor is to provide support and guidance to the student, coordinate communications among teachers, and promote family–school collaboration. Various models of school mentoring have been developed. The Check and Connect program, developed to promote school engagement and prevent dropout, uses an approach to mentoring that is relatively intensive and more consistent with a Tier 3 intervention (Sinclair et al., 2005), but components of this program can be adapted for use at the Tier 2 level.

Multi-tier models for youth with ADHD typically include two additional tiers that involve intervention as opposed to prevention. Tier 3 includes interventions such as self-management, organizational skills training, and social skills programming, which are described in the treatment section. Tier 4 refers to highly intensive intervention that might include placement in special education for most of the school day or partial hospitalization programming.

Progress monitoring. A key component of prevention programming is monitoring of progress on critical outcome variables. There are two broad classes of outcome variables that are relevant for students with ADHD: academic and social-behavioral. A useful strategy for monitoring progress with regard to academic functioning is curriculum-based measurement (CBM), which involves the frequent, ongoing assessment of materials directly linked to the curriculum using brief (1- or 2-min) probes (Shapiro & Gebhardt, 2012). A noteworthy advantage of CBM methods is that they yield useful data about rate (slope) of progress in addition to level of functioning, which is highly useful in assessing whether rate of progress is adequate.

A highly useful strategy for monitoring social and behavioral functioning is direct behavior ratings (DBRs). This method involves frequent (daily or multiple times per day) ratings of student behavior by a teacher on one or more targeted behaviors (Gresham et al., 2010; Volpe & Gadow, 2010). These methods demonstrate adequate psychometric properties for progress monitoring and generally are sensitive to the effects of evidence-based interventions.

Assessment of integrity and engagement. Integrity refers to the extent to which interventions are delivered as intended, and engagement refers to the extent to which participants are actively involved in the process of intervention. The importance of assessing integrity and engagement is highlighted by the reality that lack of intervention (or prevention) effectiveness could be due to use inadequate clinician implementation and/or participant engagement (Glover & DiPerna, 2007).

Implementing intervention strategies with integrity means adhering to or following the steps of the intervention and doing so competently. Integrity is most accurately assessed by having external reviewers observe the intervention and code for adherence and competence. Engagement is a multi-dimensional construct that includes session attendance, active attending during sessions, and completion of between-session assignments to parents or youth to practice skills. Engagement can be measured by clinician ratings of intervention involvement, participant response to clinician attempts to contact, or permanent products generated by homework assigned to participants (Power et al., 2005).

Response to intervention. A key feature of multi-tier models of prevention is that movement up and down the tiers is based on response to intervention, which is determined by progress monitoring of targeted outcome variables and a consideration of integrity and engagement (Glover & DiPerna, 2007). For example, in the context of a public health or prevention framework, all students with ADHD will receive universal strategies of instruction and behavior management and their progress will be monitored based on empirical findings regarding the student's academic, behavioral, and social functioning. If the student is struggling based on progress monitoring data, then integrity and engagement data should be reviewed to determine whether adjustments in implementation by the teacher are needed. If outcomes are inadequate despite acceptable implementation, then transitioning to Tier 2 prevention strategies likely is needed. Subsequent applications of prevention strategies and collection of outcome, integrity, and engagement data are then used to determine whether movement to higher tiers (Tier 3 and 4) are required.

As a general rule, prevention programming for students begins with Tier 1 and proceeds in a gradual, step-by-step (one tier at time) manner. However, for some children with ADHD, data available at baseline may indicate that universal programming will not be adequate and more intensive strategies are needed. In these cases, starting treatment at Tier 2 or 3 may be warranted. Also, the use of medication may have an effect on the tier that is most appropriate for students. For example, use of medication may enable a student with ADHD to be treated effectively in the general education setting using Tier 3 strategies, thereby averting the needed for intensive special education or partial hospitalization (Tresco et al., 2010).

What Doesn't Work

In general, elimination diets and vitamin and mineral supplementation are limited in their effectiveness. Elimination diets generally are not effective unless they target foods for which an individual has been shown to have heightened sensitivity. However, these approaches can have adverse effects, such as parent–child conflict related to efforts to maintain adherence and nutrition imbalance associated with unintended elimination of important vitamins and minerals. Further, the application of elimination diets may result in delayed use of treatments that are much more likely to be effective (Arnold et al., 2011).

Diets involving nutritional supplementation have been examined in numerous studies (e.g., Hirayama et al., 2004; Raz et al., 2009; Voigt et al., 2001) There is little support for amino acid supplementation but some evidence that essential fatty acid supplementation may be a safe and sensible approach for improving inattention (Arnold et al., 2011; Chalon, 2009). Also, administering recommended daily allowances of multivitamins may promote nutrition and general health, but there is essentially no evidence to support the use of megadoses of vitamins (Arnold et al., 2011). Research generally supports the practice of prescribing mineral supplements when there are identified deficiencies of these substances. Further, thyroid treatment may be indicated when there is evidence of thyroid dysfunction (Arnold et al., 2011).

Recommended Best Practice

ADHD is a neurodevelopmental disorder that usually starts in early childhood and often continues through adolescence. Currently, there is no cure for the biopsychosocial underpinnings of ADHD. When working with adolescents with ADHD, the goal is to help them develop strategies to manage the symptoms and address associated functional challenges, as well as to prevent the emergence of additional problems. Research regarding the treatment and prevention of functional impairments in teenagers with ADHD is in its infancy. As a result, no specific psychosocial treatment has been shown to work in at least three randomized controlled trials.

However, research conducted to date with adolescents who have ADHD supports the following practices:

- Interventions applied at home and school should be based on principles of behavioral psychology and include youth, their parents and teachers in goal setting and contingency management involving the frequent use of positive reinforcement.
- Training youth and their parents in communication and negotiation skills is critical in strengthening parent–child relationships and developing strategies that are developmentally appropriate and acceptable to youth.
- Organizational skills training and peer relations training that involve youth as well as their parents and teachers are promising approaches to improving academic and social functioning.
- Public health models incorporating multi-tier models of prevention, ongoing monitoring of integrity and outcomes, and adjustments in level of support based on response to intervention are promising in preventing the emergence of serious impairments among youth with ADHD.
- Pharmacological treatment, in particular the stimulants, is an evidence-based treatment for adolescents with ADHD. Medication can be effective when youth view this treatment as acceptable and consistently adhere to the regimen. Also, there is evidence to suggest that medication may facilitate response to psychosocial interventions.

Research suggests that the response rate to existing interventions is variable and lower than that for younger children. Therefore, additional treatment development research is needed to adapt current treatments to increase their effectiveness and to develop new methods of intervention. Working memory training and neurofeedback are promising approaches, but additional research is needed to demonstrate their effectiveness and determine the conditions under which they may

be beneficial in augmenting approaches that are more likely to be effective, that is, behavioral and cognitive-behavioral strategies applied at home and school and medication, when indicated.

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