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TTENTION DEFICIT HYPERACTIVITY DISORDER

Introduction

Causes and Risk Factors

Assessment

Diagnostic Categories

Comorbidity

Evidence-based Treatments

Psychological Treatments

Pharmacological Treatments

Unproven Treatments

Cultural Considerations

Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is one of several childhood disorders brought into the public arena in recent years. It is found in an estimated 5 to 10 percent of children and adolescents. ADHD is characterized by multiple symptoms and persistent patterns of overactivity, impulsiveness, inattention and distractibility (Murphy, Cowan & Sederer, 2001).

A survey administered to a nationally representative sample of children ages eight to 15 in the United States found that close to nine percent reported meeting the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR)* (American Psychiatric Association [APA], 2000) criteria for ADHD (Froehlich, as cited by Busko, 2007). However, among children meeting the criteria, only 47 percent had been diagnosed and only 32 percent were receiving treatment (Froehlich, as cited by Busko).

ADHD is a chronic disorder. Contrary to previous theories, children with ADHD typically do not outgrow the disorder, although they may experience some reduction in symptoms of hyperactivity. Studies report that as many as 80 percent of children diagnosed with ADHD will continue to show symptoms of ADHD into adolescence and as many as 65 percent will remain symptomatic into adulthood (American Academy of Child & Adolescent Psychiatry [AACAP], 2007).

Numerous studies of youth with ADHD have documented chronic and serious impairment in social and emotional, family, and academic functioning (Anastopoulos, Guevremont, Shelton & DuPaul, 1992; Anastopoulos, Shelton, DuPaul & Guevremont, 1993; Barkley, Anastopoulos, Guevremont & Fletcher, 1992; Barkley, Edwards, Laneri, Fletcher & Metevia, 2001; Cunningham, Bennes & Siegel, 1988; Whalen, Jamner, Henker, Delfino & Lozano, 2002). Youth with ADHD are more likely than their non-ADHD peers to engage in risky behaviors, including tobacco and alcohol use (Barkley, Anastopoulos, Guevremont & Fletcher, 1991). Compared to their peers, these youth have more difficulty in school, are more likely to be retained a grade, and are less likely to graduate from high school (Barkley, Anastopoulos, Guevremont, & Fletcher, 1991). Moreover, these youth frequently experience peer rejection and academic and social difficulties which may have long-term effects.

Causes and Risk Factors

Mounting evidence has demonstrated a neurological and a genetic basis for ADHD (AACAP, 2007). Studies in the past 20 years involving twins, adoptions, and molecular investigations have confirmed this genetic link (MediFocus, 2002). A child diagnosed with ADHD is more likely than one without ADHD to have family members with the disorder. The heritability of ADHD averages approximately 80 percent, rivaling the heritability factor for the trait of height (Barkley, 2001).

Deficits in executive functioning in the frontal lobes of the brain are associated with the core features of ADHD (AACAP, 2007). Executive functions include planning, inhibition of behavior, and

selection of attention. Brain imaging studies have shown that many youth with ADHD show differences in brain function and structure in areas of the brain responsible for executive functions (Bush, Valera & Seidman, 2005; Castellanos et al., 2002; Sowell, Thompson, Welcome, Henkenius, Toga & Peterson, 2003).

A study conducted by the National Institute of Mental Health (NIMH) linked ADHD to changes in production of the brain's chemical dopamine (2007). Evidence from several previous studies led scientists to suspect involvement of a gene that codes for a receptor protein, which binds to the brain's chemical messenger dopamine. Children possessing a variant of this gene had an increased risk of having ADHD (NIMH). The report indicated that this version of the dopamine D4 receptor gene, called the 7-repeat variant, accounted for approximately 30 percent of the genetic risk for ADHD, making it by far the strongest candidate gene implicated in the disorder (NIMH). Traits linked to the 7-repeat version may include novelty-seeking and impulsiveness (NIMH). Researchers are following up with studies on the relationship between cortex thickness and the cognitive features present in ADHD (NIMH).

Assessment

Careful assessment is critical to meeting the needs of youth with ADHD. An appropriate and comprehensive assessment of ADHD includes gathering information from multiple sources, assessing functioning in multiple domains, ruling out alternative diagnoses, and assessing for comorbid conditions (AACAP, 2007). Diagnosis of ADHD should be made by a professional with training in ADHD or in the diagnosis of mental disorders (NIMH, 2007). Those most often trained in diagnosing ADHD are child psychiatrists, psychologists, developmental/behavioral pediatricians, behavioral neurologists and, in some cases, clinical social workers (NIMH).

A multimodal strategy should be used to assess for the presence of ADHD. A diagnosis of ADHD requires that the symptoms be present and affect multiple domains of the youth's life (APA, 2000). Therefore, assessment should involve the youth, the parents/caregivers, and the teachers. Accordingly, it is important to assess the youth's functioning at home, school, day care or in other settings (AACAP, 2007). Structured clinical interviews should be used to determine the presence, duration and age of onset for each symptom. Validated behavior rating scales should also be completed by parents and teachers to compare the youth's behavior to established normative behavior (AACAP). Onset should be before age seven and follow a chronic course (APA, 1994). Although most parents notice inattention, hyperactivity, and impulsivity before their child is school age, these symptoms may go unnoticed until the child runs into problems at school (NIMH, 2003). An alternative diagnosis should be considered if the majority of symptoms began after age seven, there are patterns of remission, or symptoms are present in only one setting (e.g., at home or at school).

Before diagnosing a child with ADHD, the clinician should rule out other potential reasons for the child's behavior. Behaviors which mimic ADHD may be the result of a sudden change in the child's life, undetected seizures, a middle ear infection causing hearing problems, medical disorders affecting brain functioning, a learning disability, communication disorders, anxiety or depression (NIMH, 2003). Children should be referred to a specialist for additional testing if seizures or other medical disorders are suspected (AACAP, 2007). A qualified professional should administer tests of intelligence and learning achievement to rule out whether a cognitive impairment is contributing to the symptoms or a learning disability is present (AACAP).

Comorbid conditions should also be assessed during an evaluation for ADHD. The presence of a comorbid disorder will influence treatment planning, especially pharmacological interventions. The diagnosis that is the most impairing to the child is usually the initial focus of treatment. In instances of disruptive behavior, the clinician must determine whether the disruptive behavior is the primary diagnosis or is secondary to ADHD (AACAP, 1994). If ADHD is the primary cause, it must be diagnosed and treated in most instances so that the secondary disruptive behavioral disorder can also be successfully addressed (AACAP). In other cases, the disruptive behaviors can be treated first. Similarly, other comorbid disorders, such as anxiety and depression, can be treated successfully either concurrently or before or after the treatment of ADHD.

Table 1 outlines evidence-based assessment tools for ADHD.

Table 1

Evidence-based Assessment Tools for ADHD

Structured Diagnostic Interviews

- NIMH Diagnostic Interview Schedule for Children-IV (NIMH DISC-IV, 1997).
- Schedule of Affective Disorders and Schizophrenia for School-Aged Children, Present and Lifetime Version (K-SADS-PL; Kaufman et al., 1996).
- Anxiety Disorders Interview Schedule (ADIS C/P; Jarrett, Wolff & Ollendick, 2007).

Behavior Rating Scales

- ADHD Rating Scale-IV (DuPaul, Power, Anastopoulos & Reid, 1998).
- Child Behavior Checklist/Teacher Report Form (www.aseba.org/index.html).
- Conners Rating Scale (Parent, Teacher, and Adolescent Self Report Scales; Conners 1997; Conners & Wells, 1997).
- Disruptive Behavior Disorders Rating Scale (Parent, Teacher, Youth Report Scales; Barkley, 1997).
- Home Situations Questionnaire-Revised (School and Home Situations Questionnaire-Revised; available: Barkley, 1990).

Sources: Commission on Youth Graphic of citations provided in table.

Diagnostic Categories

The three subtypes of ADHD are Hyperactive-Impulsive Type, Predominantly Inattentive Type and Combined Type (APA, 2000):

- Hyperactive-Impulsive Type is used to describe children who present with a greater number of symptoms (six or more) of hyperactivity (excessive talking, restlessness, excessive climbing) and impulsivity (blurting, difficulty waiting turns), but have fewer than six symptoms of inattention.
- Predominantly Inattentive Type is used when the child shows greater number of symptoms (six or more) of inattention (difficulty maintaining attention, easily distracted, poor organization). (Predominantly Inattentive Type is sometimes referred to as ADD, although the preferred term is ADHD, Predominately Inattentive Type.)
- Combined Type is the most common form of ADHD (Kids Health, 2005). This subtype should be used to describe children who present six or more symptoms of both inattention and hyperactive-impulse and these symptoms of hyperactivity-impulsivity have persisted for at least six months.

Comorbidity

According to the NIMH (2000), ADHD is not typically an isolated disorder and comorbidities may complicate research studies. ADHD can occur with learning disabilities (15 to 25 percent), language disorders (30 to 35 percent), conduct disorder (15 to 20 percent), oppositional defiant disorder (up to 40 percent), mood disorders (15 to 20 percent) and anxiety disorders (20 to 25 percent). Up to 60 percent of children with tic disorders also have ADHD. There is research which also estimates that 16 percent of youth with ADHD show signs of mania (Jensen, 2001). The estimates of comorbidity of ADHD and bipolar disorder are controversial due to some overlap in symptoms (Biederman, 1998).

Evidence-based Treatments

ADHD is a chronic disorder; therefore, management of symptoms is the goal of treatment. Treatment must be provided over long periods to assist those with ADHD in the on-going management of their disorder. A wide variety of treatments have been used to treat ADHD. Foremost is education of the family and school staff about ADHD and its management. A comprehensive treatment plan involving the youth, parents, and school personnel should be implemented to address all relevant areas of impairment. Current research suggests that a combination of behavioral and pharmacological treatments is the most effective (AACAP, 2007; Pelham & Fabiano, 2008).

Effective treatment includes the development and utilization of an appropriate educational program, behavior modification, parent, child and teacher education, counseling, and medication (Children and Adults with Attention Deficit Disorders [CHADD], 2001). Caregivers need to advocate for their children in academic settings. Children with ADHD may be eligible for special educational services in the public schools under both the Individuals with Disabilities in Education Act (IDEA: Public Law 101-476) and Section 504 of the Rehabilitation Act of 1973 (Public Law 93-112) (Barkley, 2001). IDEA governs special education requirements and Section 504 provides for reasonable accommodations for children with disabilities (Gephart, 2002). Caregiver involvement, under these laws, can help to optimize positive outcomes.

For this review, evidence-based treatments are divided into two categories: What Works and What Does Not Work. These treatments are outlined in Table 2 and in the paragraphs which follow.

Psychological Treatments

Behavior therapy is the psychological treatment of choice for ADHD (Pelham & Fabiano, 2008; AACAP, 2007). One behavior therapy which has consistently worked is classroom management. Another behavior therapy treatment approach that also has research support is behavioral parent training (Pelham & Fabiano).

Behavior therapy uses contingency management strategies (e.g., point/token reward systems, timeout, response cost) to reinforce appropriate behavior and reduce unwanted behaviors. Contingency management strategies employ reward systems which are designed to provide reinforcements to increase desired behaviors, including following directions, attentiveness or turn-taking. Rewards systems can take many forms including, but not limited to, points, stickers, poker chips or other tokens that can be traded for small prizes or special privileges. Careful consideration must be taken to ensure that rewards are age appropriate and salient to the youth. Young children may benefit more from tangible rewards, while adolescents may appreciate point systems to earn special privileges. Response-cost programs remove a reinforcer, or desired object or activity, when an undesirable behavior occurs in order to reduce that behavior. This can include loss of points or tokens from a reward system, loss of privilege or time-out. Time-outs—also called “time out from reinforcement”—are a form of response-cost used to decrease undesirable behaviors. For time-outs to be effective, they must remove children from a desirable activity (television, video games, contact with other children) and place them in a neutral location. Behavioral intervention systems can be put in place both in the classroom and at home (Evans, Langberg, Raggi, Allen & Buvinger, 2005; Barkley, 2000).

Table 2

Summary of Treatments for ADHD

What Works – Psychological	Description
Behavioral Classroom Management (BCM)	BCM uses contingency management strategies, including teacher-implemented reward programs, token systems, time-out procedures and Daily Report Cards (DRCs). Clinicians or parents may work in consultation with teachers to develop a classroom treatment plan.
Behavioral Parent Training (BPT)	BPT teaches the parent to implement contingency management strategies similar to BCM techniques at home.
Intensive Behavioral Peer Intervention (BPI)	Intensive BPI is conducted in recreational settings, such as Summer Treatment Programs (STPs) (Pelham & Hoza, 1996) have demonstrated effectiveness and are considered well-established. However, STPs are less feasible to implement than other evidence-based practices (Pelham & Fabiano, 2008).
What Works – Pharmacological	Description
Stimulant: d-Amphetamine	Short-acting: Adderall, Dexedrine, DextroStat Long-acting: Dexedrine Spansule, Adderall XR, Lisdexamfetamine
Stimulant: Methylphenidate	Short-acting: Focaline, Methylin, Ritalin Intermediate-acting: Metadate ER, Methylin ER, Ritalin SR, Metadate CD, Ritalin LA Long-acting: Concerta, Daytrana patch, Focalin XR
Serotonin and Norepinephrine Reuptake	Atomoxetine is unique in its ability to act on the brain's

Inhibitor (SNRI): Atomoxetine	norepinephrine transporters without carrying the same risk for addiction as other medications.
What Does Not Work (Psychological/Pharmacological/Other)	Description
Cognitive, psychodynamic, client-centered therapies	Traditional talk therapies and play therapy have been demonstrated to have little to no effect on ADHD symptoms. ADHD is best treated with intensive behavioral interventions in the youth's natural environments.
Office-based social skills training	Neither once-weekly individual nor group office-based training have demonstrated significant improvement in social skills. (However, intensive group social skills training that use behavioral interventions, such as STPs, are considered well-established.)
Dietary Interventions	Interventions include elimination of food additives, elimination of allergens/sensitivities, and use of nutritional supplements.
Antidepressants	These include Bupropion (Wellbutrin), Imipramine (Tofranil), Nortriptyline (Pamelor, Aventil), Clonidine (Catapres) and Guanfacine (Tenex).

Sources: AACAP, 2007; Pelham & Fabiano, 2008.

Behavioral classroom management (BCM) has received the most support of any psychological treatment for youth with ADHD (Pelham & Fabiano, 2008). BCM are teacher implemented behavior modification strategies. Effective classroom management strategies include reward programs, point systems and time-outs. The Daily Report Card (DRC) (Jurbergs & Kelley, 2008) is another effective classroom management strategy included in many of the studies of BCM reviewed (Pelham & Fabiano; Pelham, Wheeler & Chronis, 1998). The DRC provides feedback to youth, parents, and/or the therapist about target behaviors occurring in the classroom, and bridges BCM and home-based interventions. Behavioral parent training (BPT) teaches parents behavior management and discipline skills to extend treatment from the therapist's office to the home in order to address a wide array of problematic behaviors. The behavioral techniques used in parent training programs include positive reinforcement, time-out from reinforcement and/or response cost techniques. BPT takes many different forms, ranging from brief problem-focused programs to more extensive programs lasting 18 sessions or more in individual or group settings. The most frequent training method involves providing verbal instruction through one-on-one discussion with parents, followed by educational reading materials, such as pamphlets or manuals (Moreland, Schwebel, Beck & Wells, 1982). BPT has been shown to be effective in improving problematic child behavior and negative parent-child interactions.

Pharmacological Treatments

Pediatricians, family physicians, specialized psychiatrists or child psychiatrists most frequently prescribe stimulant medications for the treatment of ADHD. Studies have found a significant majority of children with ADHD derive benefits from these medications and that they are effective at reducing ADHD symptoms in the short-term (AACAP, 2007). Medications for ADHD act on dopaminergic pathways in the prefrontal cortex, striatum and nucleus accumbens (Sauer, Ring & Witcher, 2005) and increase the availability of dopamine in the brain.

The two most frequently prescribed medications for ADHD are methylphenidate and dexamphetamines (National Institute of Drug Abuse [NIDA], 2008), i.e., Adderall, Adderall XR. The tolerability and safety of stimulant medications are comparable, with all medications demonstrating similar side effects, including effects on cardiovascular functioning, sleep disturbance, appetite suppression, and anxiety (Wernicke & Kratochvil, 2002). The major drawback of stimulant medications is the lack of selectivity on the subcortical regions upon which they act. There is a marked potential for abuse of stimulant medications due to their effects on the brain (Bymaster et al., 2002; Wee & Woolverton, 2004). As a result, methylphenidate and dexamphetamine are listed as Schedule II drugs with the U.S. Food and Drug Administration (FDA).

Recently, the FDA approved a medication for treating ADHD that is not a stimulant (NIMH, 2003). Atomoxetine acts specifically on the prefrontal cortex to increase levels of dopamine and norepinephrine and leads to improved executive functioning and reduced ADHD symptoms.

Atomoxetine is unique in its ability to act on norepinephrine transporters in the prefrontal cortex without acting on striatum or nucleus accumbens regions of the brain (Bymaster et al., 2002; Wee & Woolverton, 2004). The side effects of atomoxetine are similar to those of stimulant medications. Despite side effects, atomoxetine is considered well-tolerated in most children and adults (Spencer et al., 1998). An examination of four clinical trials reported to the FDA showed the percentage of overall discontinuation of use due to adverse events was 3.8 percent (Wernicke & Kratochvil, 2002). Other medications for ADHD, such as methylphenidate and dexamphetamine, act on the entire norepinephrine and dopamine regions, including the striatum and nucleus accumbens. Increases in dopamine in these regions of the brain are implicated in the reward system of the brain and heighten the potential for abuse. Because atomoxetine does not act on these regions, it does not carry the same risk of addiction and is not a scheduled drug (Sauer, Ring & Witcher, 2005).

Unproven Treatments

There is a long list of other interventions for the treatment of ADHD including: dietary replacement, exclusion or supplementation; various vitamin, mineral or verbal regimens; and perceptual stimulation. Other treatment approaches that were tested and found to have no support in recent studies include client-centered therapy, self-control training, skill development, and the combination of parent management training and self-verbalization (AACAP, 2007). It is important, however, to note that some of these treatments may offer benefits to the accompanying symptoms of ADHD, so further study is needed (Chorpita & Daleiden, 2007).

Anecdotal evidence of the effects of diet on ADHD abounds. Unfortunately, many studies on diet lack the rigorous scientific methods necessary to draw conclusions about their efficacy. Several foods are mentioned, particularly casein (derived from milk). More recently, gliadin (derived from wheat gluten) has been frequently cited (Lilienfeld, 2005). There are studies linking ADHD to certain food sensitivities. Some of the dietary elimination strategies showed intriguing results, suggesting the need for future research. One dietary study determined that food additives might have an impact on a child's hyperactivity level (Warner, 2004). Treatments focusing on mineral supplementation merit further study, but current data suggest that mineral supplementation is useful only when true deficiency has been demonstrated. Although these approaches have generated considerable interest and there are studies exploring various treatment strategies, the research does not currently support their use.

Antidepressant medications are sometimes prescribed "off-label" for the treatment of ADHD, meaning they have not been approved by the FDA for the treatment of ADHD. These include Bupropion, Imipramine, and Nortriptyline. Another class of medications prescribed off-label is α_2 -Adrenergic agonists, which include Clonidine and Guanfacine. These medications have not been researched sufficiently to determine their efficacy for the treatment of ADHD. Despite this, they are frequently used when either the symptoms do not respond to approved medications (stimulants or atomoxetine) or the side effects of other medications are intolerable (e.g., the increased risk of tics associated with stimulants) (AACAP, 2007).

Cultural Considerations

Research suggests that the prevalence of ADHD is similar in all youth, regardless of ethnicity. Caucasian youth, however, are significantly more likely to be diagnosed and receive treatment for ADHD (Eiraldi, Mazzuca, Clarke & Power, 2006). A combination of factors may impact the likelihood that minority youth are identified as having ADHD, including cultural perceptions of child behavior, the stigma of mental health problems and mistrust of mental health professionals. The lack of culturally sensitive assessment tools and the prevalence of stereotypes play a role in under-diagnosis or misdiagnosis (Eiraldi et al.). Further, there are prevailing barriers to treatment when families, regardless of ethnicity, are living below the poverty line. (Eiraldi et al.). As a result, it is critical that health care professionals receive training in multicultural mental health issues to ensure proper diagnosis and treatment of youth with ADHD. Recommendations include understanding how minority families perceive the youth's behavior, the use of culturally sensitive assessment methods, and education about the causes and treatment of ADHD, while maintaining respect for cultural beliefs.

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Additional Resources

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National Organizations

American Academy of Child & Adolescent Psychiatry (AACAP)

Children Who Can't Pay Attention/Attention-Deficit/Hyperactivity Disorder

http://www.aacap.org/cs/root/facts_for_families/children_who_cant_pay_attention/attention_deficit_hyperactivity_disorder

American Psychiatric Association (APA)

<http://www.parentsmedguide.org>

Attention Deficit Disorder Resources

<http://www.addresources.org>

Centers for Disease Control and Prevention (CDC)

Attention-Deficit/Hyperactivity Disorder

<http://www.cdc.gov/ncbddd/adhd/index.html>

Children and Adults with Attention Deficit Disorders (CHADD)

8181 Professional Place, Suite 201 – Landover, MD 20785

National Resource Center on ADHD

<http://www.help4adhd.org>

National Call Center – 800-233-4050

<http://www.chadd.org>

Virginia Resources

Children and Adults with Attention Deficit Disorders (CHADD) Virginia

<http://www.chadd.org/Support/Directory.aspx?state=279640059>

Virginia's Parental and Information Resource Center at PEATC

<http://www.peatc.org>