



NASET ADHD SERIES

Part # 1 - Overview of ADHD

Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a neurological condition that involves problems with inattention and hyperactivity-impulsivity that are developmentally inconsistent with the age of the child. We are now learning that ADHD is not a disorder of attention, as had long been assumed. Rather, it is a function of developmental failure in the brain circuitry that monitors inhibition and self-control. This loss of self-regulation impairs other important brain functions crucial for maintaining attention, including the ability to defer immediate rewards for later gain (Barkley, 1998a).

Behavior of children with ADHD can also include excessive motor activity. The high energy level and subsequent behavior are often misperceived as purposeful noncompliance when, in fact, they may be a manifestation of the disorder and require specific interventions. Children with ADHD exhibit a range of symptoms and levels of severity. In addition, many children with ADHD often are of at least average intelligence and have a range of personality characteristics and individual strengths.

ADHD was first described by Dr. Heinrich Hoffman in 1845. A physician who wrote books on medicine and psychiatry, Dr. Hoffman was also a poet who became interested in writing for children when he couldn't find suitable materials to read to his 3-year-old son. The result was a book of poems, complete with illustrations, about children and their characteristics. "The Story of Fidgety Philip" was an accurate description of a little boy who had attention deficit hyperactivity disorder. Yet it was not until 1902 that Sir George F. Still published a series of lectures to the Royal College of Physicians in England in which he described a group of impulsive children with significant behavioral problems, caused by a genetic dysfunction and not by poor child rearing children who today would be easily recognized as having ADHD. Since then, several thousand scientific papers on the disorder have been published, providing information on its nature, course, causes, impairments, and treatments.

Inattention, hyperactivity, and impulsivity are the core symptoms of Attention Deficit Hyperactivity Disorder (ADHD). A child's academic success is often dependent on his or her ability to attend to tasks and teacher and classroom expectations with minimal distraction. Such skill enables a student to acquire necessary information, complete assignments, and participate in classroom activities and discussions (Forness & Kavale, 2001). When a child exhibits behaviors associated with ADHD, consequences may include difficulties with academics and with forming relationships with his or her peers if appropriate instructional methodologies and interventions are not implemented. A child with ADHD faces a difficult but not insurmountable task ahead. In

order to achieve his or her full potential, he or she should receive help, guidance, and understanding from parents, guidance counselors, and the public education system.

Prevalence of ADHD

ADHD is one of the most commonly diagnosed behavioral disorders of childhood. The disorder is estimated to affect between 3 to 7 out of every 100 school-aged children (American Psychiatric Association, 2000). In the United States, an estimated 1.46 to 2.46 million children (3 percent to 5 percent of the student population) have ADHD (American Psychiatric Association, 1994; Anderson, et al., 1987; Bird, et al., 1988; Esser, Schmidt, & Woemer, 1990; Pastor & Reuben, 2002; Pelham, Gnagy, Greenslade, & Milich, 1992; Shaffer, et al., 1996; Wolraich, Hannah, Pinock, Baumgaertel, & Brown, 1996).

Although for years it was assumed to be a childhood disorder that became visible as early as age 3 and then disappeared with the advent of adolescence, the condition is not limited to children. It is now known that while the symptoms of the disorders may change as a child ages, many children with ADHD do not grow out of it (Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1998). Boys are four to nine times more likely to be diagnosed, and the disorder is found in all cultures, although prevalence figures differ.

Causes of ADHD

ADHD is a very complex, neurobiochemical disorder. Researchers do not know ADHD's exact causes, as is the case with many mental and physical health conditions. Where ADHD is concerned, there are a few individuals who do not believe ADHD really exists. As researchers continue to learn more about ADHD, this controversy will be put to rest. Meanwhile, scientists are making great strides in unlocking the mysteries of the brain.

Recent technological advances in brain study are providing strong clues as to both the presence of ADHD and its causes. In people with the disorder, these studies show that certain brain areas have less activity and blood flow and that certain brain structures are slightly smaller. These differences in brain activity and structure are mainly evident in the prefrontal cortex, the basal ganglia, and the cerebellum (Castellanos & Swanson, 2002).

These areas are known to help us inhibit behavior, sustain attention, and control mood. ADHD has traditionally been viewed as a problem related to attention, stemming from an inability of the brain to filter competing sensory inputs such as sight and sound. Recent research, however, has shown that children with ADHD do not have difficulty in that area. Instead, researchers now believe that children with ADHD are unable to inhibit their impulsive motor responses to such input (Barkley, 1997; 1998a).

It is still unclear what the direct and immediate causes of ADHD are, although scientific and technological advances in the field of neurological imaging techniques and genetics promise to clarify this issue in the near future. Most researchers suspect that the cause of ADHD is genetic or biological, although they acknowledge that the child's environment helps determine specific behaviors.

There is also strong evidence to suggest that certain chemicals in the brain-called neurotransmitters-play a large role in ADHD-type behaviors. Neurotransmitters help brain cells

communicate with each other. The neurotransmitter that seems to be most involved with ADHD is called dopamine. Dopamine is widely used throughout the brain.

Scientists have discovered a genetic basis for part of the dopamine problem that exists in some individuals with ADHD. Scientists also think that the neurotransmitter called norepinephrine is involved to some extent. Other neurotransmitters are being studied as well (Castellanos & Swanson, 2002).

Imaging studies conducted during the past decade have indicated which brain regions may malfunction in patients with ADHD, and thus account for symptoms of the condition (Barkley, 1998a). A 1996 study conducted at the National Institutes for Mental Health (NIMH) found that the right prefrontal cortex (part of the cerebellum) and at least two of the clusters of nerve cells known collectively as the basal ganglia are significantly smaller in children with ADHD (as cited in Barkley, 1998a). It appears that these areas of the brain relate to the regulation of attention. Why these areas of the brain are smaller for some children is yet unknown, but researchers have suggested mutations in several genes that are active in the prefrontal cortex and basal ganglia may play a significant role (Barkley, 1998a). In addition, some nongenetic factors have been linked to ADHD including premature birth, maternal alcohol and tobacco use, high levels of exposure to lead, and prenatal neurological damage. Although some people claim that food additives, sugar, yeast, or poor child rearing methods lead to ADHD, there is no conclusive evidence to support these beliefs (Barkley, 1998a; Neuwirth, 1994; NIMH, 1999).

Over the last few decades, scientists have come up with possible theories about what causes ADHD. Some of these theories have led to dead ends, some to exciting new avenues of investigation. Below is a summary of the possible causes of ADHD

Environmental Agents

Studies have shown a possible correlation between the use of cigarettes and alcohol during pregnancy and risk for ADHD in the offspring of that pregnancy. As a precaution, it is best during pregnancy to refrain from both cigarette and alcohol use.

Another environmental agent that may be associated with a higher risk of ADHD is high levels of lead in the bodies of young preschool children. Since lead is no longer allowed in paint and is usually found only in older buildings, exposure to toxic levels is not as prevalent as it once was. Children who live in old buildings in which lead still exists in the plumbing or in lead paint that has been painted over may be at risk.

Brain Injury

One early theory was that attention disorders were caused by brain injury. Some children who have suffered accidents leading to brain injury may show some signs of behavior similar to that of ADHD, but only a small percentage of children with ADHD have been found to have suffered a traumatic brain injury.

Food Additives and Sugar

It has been suggested that attention disorders are caused by refined sugar or food additives, or that symptoms of ADHD are exacerbated by sugar or food additives. In 1982, the National

Institutes of Health held a scientific consensus conference to discuss this issue. It was found that diet restrictions helped about 5 percent of children with ADHD, mostly young children who had food allergies. A more recent study on the effect of sugar on children, using sugar one day and a sugar substitute on alternate days, without parents, staff, or children knowing which substance was being used, showed no significant effects of the sugar on behavior or learning.

In another study, children whose mothers felt they were sugar-sensitive were given aspartame as a substitute for sugar. Half the mothers were told their children were given sugar, half that their children were given aspartame. The mothers who thought their children had received sugar rated them as more hyperactive than the other children and were more critical of their behavior.

Genetics

Attention disorders often run in families, so there are likely to be genetic influences. Studies indicate that 25 percent of the close relatives in the families of ADHD children also have ADHD, whereas the rate is about 5 percent in the general population. Many studies of twins now show that a strong genetic influence exists in the disorder. Researchers continue to study the genetic contribution to ADHD and to identify the genes that cause a person to be susceptible to ADHD. Since its inception in 1999, the Attention Deficit Hyperactivity Disorder Molecular Genetics Network has served as a way for researchers to share findings regarding possible genetic influences on ADHD.

Recent Studies on Causes of ADHD

Some knowledge of the structure of the brain is helpful in understanding the research scientists are doing in searching for a physical basis for attention deficit hyperactivity disorder. One part of the brain that scientists have focused on in their search is the frontal lobes of the cerebrum. The frontal lobes allow us to solve problems, plan ahead, understand the behavior of others, and restrain our impulses. The two frontal lobes, the right and the left, communicate with each other through the corpus callosum, (nerve fibers that connect the right and left frontal lobes). The basal ganglia are the interconnected gray masses deep in the cerebral hemisphere that serve as the connection between the cerebrum and the cerebellum and, with the cerebellum, are responsible for motor coordination. The cerebellum is divided into three parts. The middle part is called the vermis.

All of these parts of the brain have been studied through the use of various methods for seeing into or imaging the brain. These methods include functional magnetic resonance imaging (fMRI) positron emission tomography (PET), and single photon emission computed tomography (SPECT). The main or central psychological deficits in those with ADHD have been linked through these studies. By 2002 the researchers in the NIMH Child Psychiatry Branch had studied 152 boys and girls with ADHD, matched with 139 age- and gender-matched controls without ADHD. The children were scanned at least twice, some as many as four times over a decade. As a group, the ADHD children showed 3-4 percent smaller brain volumes in all regions the frontal lobes, temporal gray matter, caudate nucleus, and cerebellum.

This study also showed that the ADHD children who were on medication had a white matter volume that did not differ from that of controls. Those never-medicated patients had an abnormally small volume of white matter. The white matter consists of fibers that establish long-distance connections between brain regions. It normally thickens as a child grows older and the brain matures. Although this long-term study used MRI to scan the children's brains, the

researchers stressed that MRI remains a research tool and cannot be used to diagnose ADHD in any given child. This is true for other neurological methods of evaluating the brain, such as PET and SPECT.

School Performance and ADHD

The school experience can be challenging for students with ADHD. Students usually are identified only after consistently demonstrating a failure to understand or follow rules or to complete required tasks. Other common reasons for referral include frequent classroom disruptions and poor academic performance.

Studies found that students with ADHD, compared to students without ADHD, had persistent academic difficulties that resulted in the following: lower average marks, more failed grades, more expulsions, increased dropout rates, and a lower rate of college undergraduate completion (Weiss & Hechtman as cited in Johnston, 2002; Ingersoll, 1988). The disruptive behavior sometimes associated with the disorder may make students with ADHD more susceptible to suspensions and expulsions. A study by Barkley and colleagues (1990b) found that 46 percent of their student study group with ADHD had been suspended and 11 percent had been expelled. ADHD's core symptoms inattention, hyperactivity, and impulsivity make meeting the daily rigors of school challenging (Zentall, 1993). Difficulty sustaining attention to a task may contribute to missing important details in assignments, daydreaming during lectures and other activities, and difficulty organizing assignments. Hyperactivity may be expressed in either verbal or physical disruptions in class. Impulsivity may lead to careless errors, responding to questions without fully formulating the best answers, and only attending to activities that are entertaining or novel. Overall, students with ADHD may experience more problems with school performance than their nondisabled peers.

In the elementary years, ADHD usually causes these problems:

- off-task behavior
- incomplete or lost assignments
- disorganization
- sloppy work or messy handwriting
- not following directions
- errors in accuracy
- inconsistent performance
- disruptive behavior or spacey, daydreaming behavior
- social interaction difficulties.

Around middle school and into high school and beyond, most of these problems continue.

However, additional ones arise. That is because adolescents are expected to be much more independent and self-directed. They receive less supervision. Demands for concentration and more sophisticated thinking and problem solving increase. ADHD makes it hard to meet those demands. Given the additional problems that seem to arise in middle school and beyond, it's not unusual to see a student who's gotten by in earlier grades dive bomb academically around puberty.

The thinking difficulties associated with ADHD do not have to do with intellectual ability. Instead, they arise out of problems with concentration, memory, and cognitive organization. Typically, ADHD-related memory problems arise in two areas:

- working memory-which helps the student keep one thing in mind while working on another
- retrieval-being able to locate on demand information that has been learned and stored in memory.

Many students also show problems in:

- time management
- prioritizing work
- reading comprehension
- note taking
- study skills, and completing multi-step tasks.

Clearly, a student with ADHD can have difficulty in any number of academic areas and with critical academic skills. Thus, it is extremely important that the school and parents work together to design an appropriate educational program for the student. This program needs to include the accommodations, modifications, and other services necessary to support the student academically and promote successful learning and appropriate behavior.

Special Education and Students with ADHD

The process by which a child is found eligible for special education services is described within the federal law known as the Individuals with Disabilities Education Act, or IDEA. The IDEA is the federal law under which schools:

- evaluate children for the presence of a disability and their need for special services
- provide special education and related services to students who meet eligibility requirements.

Eligibility decisions about a child's need for special education and related services are made on a case-by-case basis. School districts may not arbitrarily refuse to either evaluate or offer services to students with ADHD.

In order for a child to be eligible for special education services, he or she must have a disability according to the criteria set forth in the Individuals with Disabilities Education Act (IDEA) or under state law (state law is based on the IDEA). The disability must adversely affect his or her educational performance. Thus, a medical diagnosis of ADHD alone is not enough to make your child eligible for services. Educational performance, which consists of social, emotional, behavioral, or academic performance, must be adversely affected.

Presently, the IDEA lists 13 categories of disability under which a child may be found eligible for special education. ADHD is specifically mentioned in the IDEA as part of its definition of "Other Health Impairment."

IDEA's Definition of "Other Health Impairment"

In order to be eligible for special education, a student must meet the definition criteria for at least 1 of 13 disability categories listed in the federal regulations. Some students may meet more than

one definition. Many students with ADHD now may qualify for special education services under the "Other Health Impairment" category within the Individuals with Disabilities Education Act (IDEA). IDEA defines "other health impairment" as...

"...having limited strength, vitality or alertness, including a heightened alertness to environmental stimuli, that results in limited alertness with respect to the educational environment, that is due to chronic or acute health problems such as asthma, attention deficit disorder or attention deficit hyperactivity disorder, diabetes, epilepsy, a heart condition, hemophilia, lead poisoning, leukemia, nephritis, rheumatic fever, and sickle cell anemia; and adversely affects a child's educational performance."

Conclusion

The core symptoms of ADHD are developmentally inappropriate levels of inattention, hyperactivity, and impulsivity. These problems are persistent and usually cause difficulties in one or more major life areas: home, school, work, or social relationships. Clinicians base their diagnosis on the presence of the core characteristics and the problems they cause.

Children with ADHD typically exhibit behavior that is classified into two main categories: poor sustained attention and hyperactivity-impulsiveness. As a result, three subtypes of the disorder have been proposed by the American Psychiatric Association in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSMIV): predominantly inattentive, predominantly hyperactive-impulsive, and combined types (Barkley, 1997). A child expressing hyperactivity commonly will appear fidgety, have difficulty staying seated or playing quietly, and act as if driven by a motor. Children displaying impulsivity often have difficulty participating in tasks that require taking turns. Other common behaviors may include blurting out answers to questions instead of waiting to be called and flitting from one task to another without finishing. The inattention component of ADHD affects the educational experience of these children because ADHD causes them to have difficulty in attending to detail in directions, sustaining attention for the duration of the task, and misplacing needed items. These children often fail to give close attention to details, make careless mistakes, and avoid or dislike tasks requiring sustained mental effort.

These characteristics affect not only the academic lives of students with ADHD, they may affect their social lives as well. Children with ADHD of the predominantly hyperactive-impulsive type may show aggressive behaviors, while children of the predominantly inattentive type may be more withdrawn. Also, because they are less disruptive than children with ADHD who are hyperactive or impulsive, many children who have the inattentive type of ADHD go unrecognized and unassisted. Both types of children with ADHD may be less cooperative with others and less willing to wait their turn or play by the rules (NIMH, 1999; Swanson, 1992; Waslick & Greenhill, 1997). Their inability to control their own behavior may lead to social isolation. Consequently, the children's self-esteem may suffer (Barkley, 1990a).