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Review Article

ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)-CAUSES, DIAGNOSIS AND MANAGEMENT

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ABSTRACT

Attention deficit hyperactivity disorder (ADHD), is a psychiatric disorder of the neuro developmental type in which there are significant problems of attention, hyperactivity, or acting impulsively that are not appropriate for a person's age.Despite being the most commonly studied and diagnosed psychiatric disorder in children and adolescents, the cause in the majority of cases is unknown. It affects about 6–7% of children when diagnosed via the DSM-IV (Diagnostic and Statistical Manual of Mental Disorders) criteria and 1–2% when diagnosed via the ICD-10(International classification of diseases) criteria. Rates are similar between countries and depend mostly on how it is diagnosed. ADHD is diagnosed approximately three times more in boys than in girls. About 30–50% of people diagnosed in childhood continue to have symptoms into adulthood and between 2–5% of adults have the condition. ADHD management usually involves some combination of counseling, lifestyle changes, and medications. Medications are only recommended as a first-line treatment in children who have severe symptoms and may be considered for those with moderate symptoms who either refuse or fail to improve with counseling. Most healthcare providers accept ADHD as a genuine disorder with debate in the scientific community mainly around how it is diagnosed and treated.

INTRODUCTION

Attention-Deficit/Hyperactivity Disorder (ADHD) is a childhood-onset neurobehavioral syndrome characterized primarily by disorders in attention, concentration, and impulse control. These dysfunctions can lead to behavioral problems in home, school, work, and social settings. Children with ADHD may have difficulty with learning in school, developing appropriate social skills, and managing frustration and aggression.[1]

ADHD is also a developmental disorder whose presentation may change with maturation. There is often a decrease in **overt hyperactivity and impulsivity** with age, while **attention problems** are more likely to persist.[2]

Epidemiology

ADHD is estimated to affect about 6–7% of people aged 18 and under when diagnosed via the DSM-IV criteria.[3] When diagnosed via the ICD-10 criteria rates in this age group are estimated at 1–2%.[4] Children in North America appear to have a higher rate of ADHD than children in Africa and the Middle East; this is believed to be due to differing methods of diagnosis rather than a difference in underlying frequency.[5] If the same diagnostic methods are used rates are more or less the same between countries.[6] It is diagnosed approximately three times more often in boys than in girls.[7,8] This difference between sexes may reflect either a difference in susceptibility or that females with ADHD are less likely to be diagnosed than males.[9]

Rates of diagnosis and treatment have increased in both the United Kingdom and the United States since the 1970s. This is believed to be primarily due to changes in how the condition is diagnosed [10] and how readily people are willing to treat it with medications rather than a true change in how common the condition is.[4] It is believed that changes to the diagnostic criteria in 2013 with the release of the DSM V will increase the percentage of people with ADHD especially among adults.[11]

Causes[12]

Scientists are not sure what causes ADHD, although many studies suggest that genes play a large role. Like many other illnesses, ADHD probably results from a combination of factors. In addition to genetics, researchers are looking at possible environmental factors, and are studying how brain injuries, nutrition, and the social environment might contribute to ADHD.

Results from several international studies of twins show that ADHD often runs in families. **Genes**

Researchers are looking at several genes that may make people more likely to develop the disorder. Knowing the genes involved may one day help researchers prevent the disorder before symptoms develop. Learning about specific genes could also lead to better treatments.

Children with ADHD who carry a particular version of a certain gene have thinner brain tissue in the areas of the brain associated with attention. This NIMH research showed that the difference was not permanent, however, and as children with this gene grew up, the brain developed to a normal level of thickness. Their ADHD symptoms also improved.

Environmental factors

Studies suggest a potential link between cigarette smoking and alcohol use during pregnancy and ADHD in children. In addition, preschoolers who are exposed to high levels of lead, which can sometimes be found in plumbing fixtures or paint in old buildings, may have a higher risk of developing ADHD.

Brain injuries

Children who have suffered a brain injury may show some behaviors similar to those of ADHD. However, only a small percentage of children with ADHD have suffered a traumatic brain injury.

Sugar

The idea that refined sugar causes ADHD or makes symptoms worse is popular, but more research discounts this theory than supports it.

Food additives

Recent British research indicates a possible link between consumption of certain food additives like artificial colors or preservatives, and an increase in activity. Research is under way to confirm the findings and to learn more about how food additives may affect hyperactivity.

Society

The diagnosis of ADHD can represent family dysfunction or a poor educational system rather than an individual problem.[13] Some cases may be explained by increasing academic expectations; with a diagnosis being a method for parents in some countries to get extra financial and educational support for their child.[14] The youngest children in a class have been found to be more likely to be diagnosed as having ADHD possibly due to their being developmentally behind their older classmates.[15,16] Behavior typical of ADHD occur more commonly in children who have experienced violence and emotional abuse.[17]

The three primary characteristics of ADD (Attention deficit disorders)/ADHD[18]

The three primary characteristics of ADD/ADHD are inattention, hyperactivity, and impulsivity. The signs and symptoms of child with attention deficit disorder has depends on which characteristics predominate.

Children with ADD/ADHD may be:

1. Inattentive, but not hyperactive or impulsive.
2. Hyperactive and impulsive, but able to pay attention.
3. Inattentive, hyperactive, and impulsive (the most common form of ADD/ADHD)

Diagnosis

Diagnostic systems and criteria

The most commonly used criteria for the diagnosis of both children and adults are those provided in DSM-IV-TR and in ICD-10.

The DSM criteria break down symptoms into two groups: inattentive and hyperactive-impulsive. Six of the nine symptoms in each section must be present for a 'combined type' diagnosis of ADHD. (Table I) If there are insufficient symptoms for a combined diagnosis then predominantly inattentive (ADHD-I) and hyperactive (ADHD-H) diagnoses are available. Additionally, symptoms must be: chronic (present for 6 months), maladaptive, functionally impairing across two or more contexts, inconsistent with developmental level and differentiated from other mental disorders.

The ICD uses a different nomenclature; the same symptoms are described as part of a group of hyperkinetic disorders of childhood, and inattention, hyperactivity and impulsivity must all be present; so only 'combined-type' ADHD qualifies (Table II). In addition, the research diagnostic criteria of the ICD provide an even more restricted set of requirements: the symptom counts must all be met in more than one context.[17]

Table I: DSM (Diagnostic and Statistical Manual of Mental Disorders): -IV-TR criteria for Attention deficit hyperactivity disorder[19]

1. Either A or B.	
A. **Inattention** – Six or more symptoms persisting for at least 6 months to a degree that is maladaptive and inconsistent with developmental level.	
	Often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities
	Often has difficulty sustaining attention in tasks or play activities
	Often does not seem to listen when spoken to directly
	Often does not follow through on instructions; fails to finish schoolwork, chores or workplace duties (not due to oppositional behaviour or failure to understand instructions
	Often has difficulty organising tasks and activities
	Often avoids, dislikes, or is reluctant to do tasks requiring sustained mental effort
	Often loses things necessary for tasks or activities
	Is often easily distracted by extraneous stimuli
	Is often forgetful in daily activities
B. **Hyperactivity-impulsivity** – Six or more symptoms persisting for at least 6 months to a degree that is maladaptive and inconsistent with developmental level.	
Hyperactivity	Often fidgets with hands or feet or squirms in seat
	Often leaves seat in classroom or in other situations where remaining seated is expected
	Often runs or climbs excessively where inappropriate (feelings of restlessness in young people or adults)
	Often runs or climbs excessively where inappropriate (feelings of restlessness in young people or adults)
	Is often 'on the go' or often acts as if 'driven by a motor'
	Often talks excessively
Impulsivity	Often blurts out answers before questions have been completed
	Often has difficulty awaiting turn
	Often interrupts or intrudes on others (for example, butts into conversations or games)
2. Some hyperactive-impulsive or inattentive symptoms that caused impairment were present before age 7 years.	
3. Some impairment from symptoms is present in two or more settings (for example, at school or work and at home).	

4. There must be clear evidence of significant impairment in social, school or work functioning.
5. The symptoms do not happen only during the course of a pervasive developmental disorder, schizophrenia or other psychotic disorder. The symptoms are not better accounted for by another mental disorder (for example, mood disorder, anxiety disorder, dissociative disorder, or a personality disorder).

Table II: ICD-10 criteria for hyperkinetic disorder[20]

1. **Inattention** – At least six symptoms of attention have persisted for at least 6 months, to a degree that is maladaptive and inconsistent with the developmental level of the child:	
	Often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities
	Often has difficulty sustaining attention in tasks or play activities
	Often appears not to listen to what is being said to him or her
	Often fails to follow through on instructions or to finish school work, chores or duties in the workplace (not because of oppositional behaviour or failure to understand instructions)
	Is often impaired in organising tasks and activities
	Often avoids or strongly dislikes tasks, such as homework, that require sustained mental effort
	Often loses things necessary for certain tasks and activities, such as school assignments, pencils, books, toys or tools
	Is often easily distracted by external stimuli
	Is often forgetful in the course of daily activities
2 Hyperactivity – At least three symptoms of hyperactivity have persisted for at least 6 months, to a degree that is maladaptive and inconsistent with the developmental level of the child:	
	Often fidgets with hands or feet or squirms on seat
	Often leaves seat in classroom or in other situations in which remaining seated is expected
	Often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, only feelings of restlessness may be present)
	Is often unduly noisy in playing or has difficulty in engaging quietly in leisure activities
	Often exhibits a persistent pattern of excessive motor activity that is not substantially modified by social context or demands
3. Impulsivity – At least one of the following symptoms of impulsivity has persisted for at least 6 months, to a degree that is maladaptive and inconsistent with the developmental level of the child:	
	Often blurts out answers before questions have been completed
	Often fails to wait in lines or await turns in games or group situations
	Often interrupts or intrudes on others (for example, butts into others' conversations or games)
	Often talks excessively without appropriate response to social Constraints
4. Onset of the disorder is no later than the age of 7 years.	
5. Pervasiveness – The criteria should be met for more than a single situation, for example, the combination of inattention and hyperactivity should be present both at home and at school, or at both school and another setting where children are observed, such as a clinic. (Evidence for cross-situationality will ordinarily require information from more than one source; parental reports about classroom behaviour, for instance, are unlikely to be sufficient.)	
6. The symptoms in 1 and 3 cause clinically significant distress or impairment in social, academic or occupational functioning.	

Hyperkinetic disorder (ICD-10) therefore describes a group that forms a severe sub-group of the DSM-IV-TR combined subtype of ADHD. Hyperkinetic disorder is further divided into hyperkinetic disorder with and without conduct disorder.[17]

With regard to adults, strict usage of the full diagnostic criteria may be inappropriate, because the criteria focus on childhood problems and do not take full account of the developmental changes mentioned above. Recommendations for identification in adult life have therefore included lowering of diagnostic thresholds and providing age-appropriate adjustment of the symptoms. Issues such as self-awareness and motivation in adult patients reinforce the importance of taking a thorough developmental and psychiatric history and mental state – though this should be a key feature of any diagnostic process. DSM-IV-TR allows a category of 'ADHD in partial remission' for individuals who no longer meet the full criteria; this criterion is particularly relevant for adults where some of the symptoms may have declined with age but where significant impairments related to the symptoms remain.[17]

Common problems associated with ADHD in children[17]

It is very common for the core problems of ADHD in children to present together with other developmental impairments and/or mental health problems. There are many rather non-specific problems that are very common in ADHD, and can even be used – incorrectly – as grounds for the diagnosis.

Non-compliant behaviour	Motor tics
Sleep disturbance	Mood swings
Aggression	Temper tantrums
Unpopularity with peers	Clumsiness
Immature language	Literacy and other learning problems

Everyday life for Children with ADHD[21]

Children with ADHD often have academic difficulties and/or problems at school, including learning disabilities, language impairment and movement difficulties .Sleep problems, such as having trouble falling asleep and staying asleep overnight, can often make school even more difficult. Child might have social difficulties – for example, he can't concentrate or sit still long enough to enjoy a game with other children. Other mental health difficulties might also develop, including oppositional defiance disorder and conduct disorder, anxiety in the younger years, anxiety in teenagers and/or depression in teenagers.

ADHD symptoms might put a strain on day-to-day family life, particularly if other family members also have ADHD or other learning difficulties. Children with ADHD can be highly creative and can spend a long time doing activities they love. Some children might enjoy using their energy on sport or dancing. They might also be more open to trying new things than other children. Finding positive ways for your child to use his energy can be good for his self-esteem and help protect him against mental health problems.

Management

Psychosocial

There is good evidence for the use of behavioral therapies in ADHD[22] and they are the recommended first line treatment in those who have mild symptoms or are preschool-aged.[23] Psychological therapies used include: psychoeducational input, behavior therapy, cognitive behavioral therapy (CBT), interpersonal psychotherapy, family therapy, school-based interventions, social skills

training, parent management training[17], and neurofeedback.[24] Parent training and education have been found to have short-term benefits.[25] There is little high quality research on the effectiveness of family therapy for ADHD, but the evidence that exists shows that it's similar to community care and better than a placebo.[26] Several ADHD specific support groups exist as informational sources and may help families cope with ADHD.[27]

Diet[8]

Dietary interventions in the treatment of ADHD have been widely used and take the form of supplementation with substances thought to be deficient or exclusion of substances thought to be harmful. Research, however, has encountered many difficulties of methodology and feasibility: changes in food and drink are subject to many confounding influences, are difficult to disguise in controlled trials and may be hard to comply with.

Elimination Diets

Elimination diets were introduced with the 'Feingold theory' that implicated artificial colourings, preservatives and cross-reacting natural salicylates in a variety of illnesses including ADHD (Feingold, 1985). Public concern led to several trials being conducted. At present the Feingold diet is not part of conventional management of ADHD. Multiple idiosyncratic reactions to food and drink have been alleged to lead to hyperactive behaviour.[13] The notion is that susceptible children can each be affected by one or more substances triggering adverse reactions. Therefore the intervention aims to discover and eliminate from the diet the substances individually implicated for each child.

Elimination of tartrazine and other artificial colourants and preservatives[8]

Several trials have addressed multiple idiosyncratic reactions to food, focusing either on tartrazine, or on mixed additives, or on a range of potentially harmful substances that can vary from child to child. Conners and colleagues[14] found a significant difference between a 'Feingold diet' (excluding artificial additives and natural salicylates) and a 'placebo' diet; but the generalisability was limited by unexplained order effects and by doubts over whether there was adequate disguise of the treatment allocation measures to preserve the disguise, and found no consistent effects.

Supplementation Diets

After a preliminary review of studies on supplementation diets, those using fatty acids were selected as the most promising.

Fatty acids

Long-chain polyunsaturated fatty acids (PUFA) are used for many purposes, including the development of nerve cells and their membranes (see Chapter 2). A deficiency could result either from a restricted diet or from an increased metabolic need. More recent investigations have considered omega-3 PUFA more specifically. Some trials have described behavioural improvements with PUFA supplements in children with other learning difficulties[15] developmental coordination disorder[16], but are not considered further here as they were not carried out on children with diagnosed ADHD. Other trials on ADHD have not yet reported their results.

Common medications[17]

- Amphetamines
- Adderal
- Dexedrine
- Methylphenidate
- Ritalin
- Ritalin LA
- Methylin
- Focalin
- Focalin XR
- Metadate CD
- Atomoxetine HCI (Strattera)
- Bupropion (Wellbutrin XL)
- Benzphetamine
- Clonidine
- Provigil

Physical exercise can significantly improve ADHD symptoms Twenty-minute exercise sessions can significantly improve focus in children with ADHD, researchers from Michigan State University reported in the Journal of Pediatrics, October 2012 issue. Team leader, Prof. Matthew Pontifex, added that the children became much less distracted during classroom tasks after the physical activity. This could be significant, because the greatest problem children with ADHD have to struggle with is "inhibitory control". After the work out, the kids had much better results in reading comprehension and math tests. Pontifex believes children should have more physical activity incorporated into their daily school schedule.

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