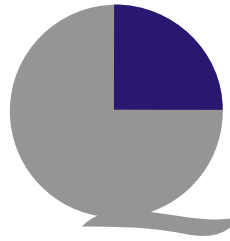


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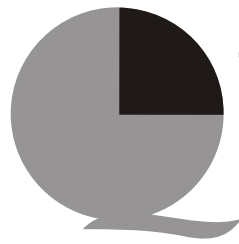
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Review: Understanding ADHD



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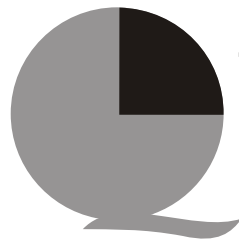
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Understanding ADHD

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Understanding ADHD

Contents

Topics	Page No.
1) What is ADHD?	1
2) What are the symptoms of ADHD in children?	2
3) What causes ADHD?	3
4) How is ADHD diagnosed?	4
5) How is ADHD treated?	6
6) What conditions can coexist with ADHD?	10
7) Do teens with ADHD have special needs?	11
8) Can adults have ADHD?	12
9) Citations	13

What is Attention Deficit Hyperactivity Disorder (ADHD)?

Attention deficit hyperactivity disorder (ADHD) is one of the most common childhood brain disorders. Worldwide prevalence is 5.29%. More in boys (5.3%) against girls (1.5%). Although it begins in childhood, 40% continue to meet the criteria in teenage years through to adulthood. include difficulty staying focused and paying attention, difficulty controlling behavior, and hyperactivity (over-activity). These symptoms can make it difficult for a child with ADHD to succeed in school, get along with other children or adults, or finish tasks at home.

**Worldwide prevalence is 5.29%.
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Although it begins in childhood,
40% continue to meet the criteria in
teenage years through to adulthood.**

There are 5 main diagnostic criteria:

1. Onset before age 7 yrs
2. Duration greater than 6 months
3. An item symptom list of inattention and hyperactive/impulsive symptoms which have persisted to a degree that is maladaptive and inconsistent with development level.
4. Some impairment in two or more settings.
5. Symptoms that do not occur exclusively during the course of pervasive developmental disorder, schizophrenia or other psychotic disorder.

Brain imaging studies have revealed that, in youth with ADHD, the brain matures in a normal pattern but is delayed, on average, by about 3 years.¹The delay is most pronounced in brain regions involved in thinking, paying attention, and planning. More recent studies have found that the outermost layer of the brain, the cortex, shows delayed maturation overall,²and a brain structure important for proper communications between the two halves of the brain shows an abnormal growth pattern.³These delays and abnormalities may underlie the hallmark symptoms of ADHD and help to explain how the disorder may develop.

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Treatments can relieve many symptoms of ADHD, but there is currently no cure for the disorder. With treatment, most people with ADHD can be successful in school and lead productive lives. Researchers are developing more effective treatments and interventions, and using new tools such as brain imaging, to better understand ADHD and to find more effective ways to treat and prevent it.

What are the symptoms of ADHD in children?

Inattention, hyperactivity, and impulsivity are the key behaviors of ADHD. It is normal for all children to be inattentive, hyperactive, or impulsive sometimes, but for children with ADHD, these behaviors are more severe and occur more often. To be diagnosed with the disorder, a child must have symptoms for 6 or more months and to a degree that is greater than other children of the same age.

Inattention, hyperactivity, and impulsivity are the key behaviors of ADHD

Children who have symptoms of **inattention** may:

- Be easily distracted, miss details, forget things, and frequently switch from one activity to another
- Have difficulty focusing on one thing
- Become bored with a task after only a few minutes, unless they are doing something enjoyable
- Have difficulty focusing attention on organizing and completing a task or learning something new
- Have trouble completing or turning in homework assignments, often losing things (e.g., pencils, toys, assignments) needed to complete tasks or activities
- Not seem to listen when spoken to
- Daydream, become easily confused, and move slowly
- Have difficulty processing information as quickly and accurately as others
- Struggle to follow instructions.



Children who have symptoms of **hyperactivity** may:

- Fidget and squirm in their seats
- Talk nonstop
- Dash around, touching or playing with anything and everything in sight



- Have trouble sitting still during dinner, school, and story time
- Be constantly in motion
- Have difficulty doing quiet tasks or activities.

Children who have symptoms of **impulsivity** may:

- Be very impatient
- Blurt out inappropriate comments, show their emotions without restraint, and act without regard for consequences
- Have difficulty waiting for things they want or waiting their turns in games
- Often interrupt conversations or others' activities.



What causes ADHD?

ADHD involves functional and anatomical dysfunction in the brain's frontal cortex and basal ganglia segment of the cortico-basal ganglia-thalamo-cortical circuitry. These areas support the regulation of attentional resources.

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.

ADHD can possibly be caused by

- Genes
- Neurotransmitters
- Environmental factors
- Brain injuries
- Food additives

Genes: Inherited from our parents, genes are the "blueprints" for who we are. Results from several international studies of twins show that ADHD often runs in families. Researchers are looking at several genes that may make people more likely to develop the disorder.^{4,5} 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.

Mode of inheritance: Symptoms of ADHD may be caused by several interacting genes of modest effect. This hypothesis is consistent with high concordance in monozygotic twins but modest recurrence risk for first degree relatives.

A study of children with ADHD found that those who carry a particular version of a certain gene have thinner brain tissue in the areas of the brain associated with

attention. This 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.⁶

Researchers are also studying genetic variations that may or may not be inherited, such as duplications or deletions of a segment of DNA. These "copy number variations" (CNVs) can include many genes. Some CNVs occur more frequently among people with ADHD than in unaffected people, suggesting a possible role in the development of the disorder.^{7,8}

Neurotransmitters: Dopamine and Epinephrine-Norepinephrine are said to play a role.

Serotonin may not be relevant.

Environmental factors: Studies suggest a potential link between cigarette smoking and alcohol use during pregnancy and ADHD in children.^{9,10} Medical history should include prenatal, perinatal, toddler and preschool phases of life. Enquiries about maternal smoking, alcohol, drug abuse, eclampsia-preeclampsia, diabetes, delivery problems, prematurity, jaundice and low birth weight have to be gone into. Developmental milestones, illnesses injuries need to be reviewed.

In addition, preschoolers who are exposed to high levels of lead, which can sometimes be found in plumbing fixtures or paint in old buildings, have a higher risk of developing ADHD.¹¹

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.

Food additives: There is a small number of children with ADHD sensitive to food dyes, artificial flavors, preservatives, or other food additives. They may experience fewer ADHD symptoms on a diet without additives, but such diets are often difficult to maintain.^{12,16}

How is ADHD diagnosed?

Children mature at different rates and have different personalities, temperaments, and energy levels. Most children get distracted, act impulsively, and struggle to concentrate at one time or another. Sometimes, these normal factors may be mistaken for ADHD. ADHD symptoms usually appear early in life, often between the ages of 3 and 6, and because symptoms vary from person to person, the disorder can be hard to diagnose. Parents may first notice that their child loses interest in things sooner than other children, or seems constantly "unfocused" or "out of control." Often, teachers notice the symptoms first, when a child has trouble following rules, or

No single objective test can diagnose a child as having ADHD

frequently "spaces out" in the classroom or on the playground.

No single objective test can diagnose a child as having ADHD.

Instead, a licensed health professional needs to gather information about the child, and his or her behavior and environment. A family may want to first talk with the child's pediatrician. Some pediatricians can assess the child themselves, but many will refer the family to a mental health specialist with experience in childhood brain disorders such as ADHD.

Between them, the referring pediatrician and specialist will determine if a child:

- Is experiencing undetected seizures that could be associated with other medical conditions
- Has a middle ear infection that is causing hearing problems
- Has any undetected hearing or vision problems
- Has any medical problems that affect thinking and behavior
- Has any learning disabilities
- Has anxiety or depression, or other psychiatric problems that might cause ADHD-like symptoms
- Has been affected by a significant and sudden change, such as the death of a family member, a divorce, or parent's job loss.

A specialist will also check school and medical records for clues, to see if the child's home or school settings appear unusually stressful or disrupted, and gather information from the child's parents and teachers. Coaches, babysitters, and other adults who know the child well also may be consulted.

The specialist also will ask:

- Are the behaviors excessive, and do they affect all aspects of the child's life?
- Do they happen more often in this child compared with the child's peers?
- Are the behaviors a continuous problem or a response to a temporary situation?
- Do the behaviors occur in several settings or only in one place, such as the playground, classroom, or home?

The specialist pays close attention to the child's behavior during different situations. Some situations are highly structured, some have less structure. Others would require the child to keep paying attention. Most children with ADHD are better able to control their behaviors in situations where they are getting individual attention and when they are free to focus on enjoyable activities. These types of situations are less important in the assessment. A child also may be evaluated to see how he or she acts in social situations, and may be given tests of intellectual ability and academic

achievement to see if he or she has a learning disability.

Finally, after gathering all this information, if the child meets the criteria for ADHD, he or she will be diagnosed with the disorder.

How is ADHD treated?

Currently available treatments aim at reducing the symptoms of ADHD and improving functioning. Treatments include medication, various types of psychotherapy, education and training, or a combination of treatments.

Medications

Stimulants such as Methylphenidate and amphetamines are the most common type of medication used for treating ADHD. In addition, a few non-stimulant medications, such as atomoxetine and clonidine, are also available. For many children, ADHD medications reduce hyperactivity and impulsivity and improve their ability to focus, work, and learn. Medications also may improve physical coordination.

- Medications used in ADHD include:**
- Stimulants such as Methylphenidate and amphetamines
 - Atomoxetine
 - Tricyclic antidepressants
 - Bupropion
 - Clonidine

However, a one-size-fits-all approach does not apply for all children with ADHD. Several different medications or dosages must be tried before finding one that works for a particular child. Any child taking medications must be monitored closely and carefully by caregivers and doctors.

Stimulant medications come in different forms, such as a pill, capsule, liquid, or skin patch. Some medications also come in short-acting, long-acting, or extended release varieties. In each of these varieties, the active ingredient is the same, but it is released differently in the body. Long-acting or extended release forms often allow a child to take the medication just once a day before school.

Medication	Forms	Dose	Peak effect	Duration of action
1. Desmethylphenidate	2.5/5/10mg tabs	2.5-10mg bid	1-4 hrs	5-6 hrs
2. Dextroamphetamine	5/10 mg tabs	5-10 mg bid	1-3 hrs	4-6 hrs
3. Methylphenidate Short acting Long acting	5/10/20mg tabs 10/20/30mg tabs	5 mg bid / 10mg tid 10-30 mg AM	1-3 hrs 5 hrs	3-5 hrs 8-12 hrs

Efficacy: 77% responders

Cognitive effects: stimulants have been shown to improve vigilance and reaction time, short term memory and learning of verbal and non-verbal material and reduce

variability in children with ADHD.

Behavioral effects: reduce gross motor over activity, out of seat behaviour, calling out behaviour in the classroom, disruptiveness, impulsive behavior, and noncompliance. Improves mother-child interactions.

Atomoxetine: Norepinephrine reuptake inhibitor

0.5-1 mgm/kgm body weight. Once or twice daily dosing.

Adverse effects: abdominal discomfort, nausea, decreased appetite, sedation, daytime drowsiness, vertigo, irritability, mood swings

Tricyclic antidepressants: imipramine, nortryptiline use is associated with significant reduction of ADHD symptoms

Bupropion, clonidine have also been used for ADHD

What are the side effects of stimulant medications?

The most commonly reported side effects are:

- Decreased appetite and weight loss
- Sleep problems: delayed sleep onset
- Anxiety, and irritability
- Increase blood pressure and palpitations
- Mild stomachaches or headaches
- Less common side effects: A few children develop sudden, repetitive movements or sounds called tics, visual hallucinations, choreiform movements, automatisms. Changing the medication dosage may make tics go away. Some children also may have a personality change, such as appearing "flat" or without emotion.
- Long term side effects are growth retardation, substance abuse

Common side effects of stimulant drugs:

- Decreased appetite and weight loss
- Sleep problems: delayed sleep onset
- Anxiety, and irritability
- Increase blood pressure and palpitations
- Mild stomachaches or headaches
- Growth retardation, substance abuse

Most side effects are minor and disappear over time or if the dosage level is lowered.

Are stimulant medications safe?

Preschoolers are more sensitive to the side effects of methylphenidate, and some may experience slower than average growth rates. Very young children should be closely monitored while taking ADHD medications.^{17,18,19}

Rare side effects

Cardiovascular (heart and blood) or psychiatric problems: ADHD patients with existing heart conditions had a slightly higher risk of strokes, heart attacks, and/or sudden death when taking the medications.^{20,21}

A slight increased risk, about 1 in 1,000, for medication- related psychiatric problems, such as hearing voices, having hallucinations, becoming suspicious for no reason, or becoming manic (an overly high mood), even in patients without a history of psychiatric problems.

On Atomoxetine children and teenagers are more likely to have suicidal thoughts than children and teenagers with ADHD who do not take it.²²

Do medications cure ADHD?

Current medications do not cure ADHD. Rather, they control the symptoms for as long as they are taken. Medications can help a child pay attention and complete schoolwork.²³

Role of diet in ADHD

In a recent review, the effects of various nutritional factors on ADHD were examined. It was noted that children with ADHD had significantly lower levels of iron, zinc, manganese, iodine as well as long chained poly unsaturated fatty acids, especially DHA, which led to deepening of symptoms. The authors concluded that having a balanced diet with sufficient amounts of micronutrients, vitamins and minerals in pregnant and lactating mothers as well as children is advisable. It would also have beneficial effects in patients with ADHD.²⁴

Children with ADHD had significantly lower levels of iron, zinc, manganese, iodine as well as long chained poly unsaturated fatty acids, especially DHA, which led to deepening of symptoms

Several studies have demonstrated low levels of omega-3 fatty acid composition in plasma and in erythrocyte membranes in patients with ADHD compared to unaffected controls. Omega-3 fatty acids have anti-inflammatory properties and can alter central nervous system, cell membrane fluidity and phospholipid composition. Cell membrane fluidity can alter serotonin and dopamine neurotransmission. In a recent meta-analysis, 10 randomized, placebo controlled trials with a total of 699 children was reported.

Omega-3 fatty acid supplementation demonstrated a small, but significant effect in improving ADHD symptoms. The relative efficacy of omega-3 fatty acid supplementation was modest compared to currently available pharmacotherapies for ADHD such as psychostimulants, atomoxetine or alpha-2 agonists. However, given its relatively benign side effect profile and evidence of modest efficacy, it may be reasonable to use omega-3 fatty acid supplementation to augment traditional pharmacological interventions or for families who decline other psychopharmacological options.²⁵

In another randomized control trial, effects of omega-3 fatty acids in the form of DHA oil or EPA oil were compared with Omega-6 fatty acids in form of Safflower oil. The

effect of supplementation on cognition, literacy, and parent-rated behaviour was assessed in children with ADHD symptoms for 4 months.

There were no significant differences between the supplement groups in the primary outcomes after 4 months. However, the erythrocyte fatty acid profiles indicated that an increased proportion of DHA was associated with improved word reading and lower parent ratings of oppositional behavior. These effects were more evident in a subgroup of 17 children with learning difficulties: an increased erythrocyte DHA was associated with improved word reading, improved spelling, an improved ability to divide attention, and lower parent ratings of oppositional behavior, hyperactivity, restlessness, and overall ADHD symptoms.

The authors concluded that increases in erythrocyte omega-3 polyunsaturated fatty acids, specifically DHA, may improve literacy and behaviour in children with ADHD.²⁶

Psychotherapy

Different types of psychotherapy are used for ADHD. Behavioral therapy aims to help a child change his or her behavior. It might involve practical assistance, such as help organizing tasks or completing schoolwork, or working through emotionally difficult events. Behavioral therapy also teaches a child how to monitor his or her own behavior. Learning to give oneself praise or rewards for acting in a desired way, such as controlling anger or thinking before acting, is another goal of behavioral therapy. Clear rules, chore lists, and other structured routines can help a child control his or her behavior.

Therapists may teach children social skills, such as how to wait their turn, share toys, ask for help, or respond to teasing. Learning to read facial expressions and the tone of voice in others, and how to respond appropriately can also be part of social skills training.

How can parents help?

Children with ADHD need guidance and understanding from their parents and teachers to reach their full potential and to succeed in school. Before a child is diagnosed, frustration, blame, and anger may have built up within a family. Parents and children may need special help to overcome bad feelings. Mental health professionals can educate parents about ADHD and how it impacts a family. They also will help the child and his or her parents develop new skills, attitudes, and ways of relating to each other.

Parenting skills training helps parents learn how to use a system of rewards and consequences to change a child's behavior. Parents are taught to give immediate and positive feedback for behaviors they want to encourage, and ignore or redirect behaviors they want to discourage. In some cases, the use of "time-outs" may be used when the child's behavior gets out of control. In a time-out, the child is removed from the upsetting situation and sits alone for a short time to calm down.

Parents are also encouraged to share a pleasant or relaxing activity with the child, to notice and point out what the child does well, and to praise the child's strengths and abilities. They may also learn to structure situations in more positive ways. For example, they may restrict the number of playmates to one or two, so that their child does not become overstimulated. Or, if the child has trouble completing tasks, parents can help their child divide large tasks into smaller, more manageable steps. Also, parents may benefit from learning stress-management techniques to increase their own ability to deal with frustration, so that they can respond calmly to their child's behavior.

Sometimes, the whole family may need therapy. Therapists can help family members find better ways to handle disruptive behaviors and to encourage behavior changes. Finally, support groups help parents and families connect with others who have similar problems and concerns. Groups typically meet regularly to share frustrations and successes, to exchange information about recommended specialists and strategies, and to talk with experts.

Tips to help kids stay organized and follow directions

Schedule

Keep the same routine every day, from wake-up time to bedtime. Include time for homework, outdoor play, and indoor activities. Keep the schedule on the refrigerator or on a bulletin board in the kitchen. Write changes on the schedule as far in advance as possible.

Organize everyday items

Have a place for everything, and keep everything in its place. This includes clothing, backpacks, and toys.

Use homework and notebook organizers

Use organizers for school material and supplies. Stress to your child the importance of writing down assignments and bringing home the necessary books.

Be clear and consistent

Children with ADHD need consistent rules they can understand and follow.

Give praise or rewards when rules are followed

Children with ADHD often receive and expect criticism. Look for good behavior, and praise it.

What conditions can coexist with ADHD?

A learning disability

A child in preschool with a learning disability may have difficulty understanding certain sounds or words or have problems expressing himself or herself in words. A school-aged child may struggle with reading, spelling, writing, and math.

Oppositional defiant disorder

Kids with this condition, in which a child is overly stubborn or rebellious, often argue with adults and refuse to obey rules.

Conduct disorder

This condition includes behaviors in which the child may lie, steal, fight, or bully others. He or she may destroy property, break into homes, or carry or use weapons. These children or teens are also at a higher risk of using illegal substances. Kids with conduct disorder are at risk of getting into trouble at school or with the police.

Anxiety and depression

Treating ADHD may help to decrease anxiety or some forms of depression.

Bipolar disorder

Some children with ADHD may also have this condition in which extreme mood swings go from mania (an extremely high elevated mood) to depression in short periods of time.

Tourette syndrome

Very few children have this brain disorder, but, among those who do, many also have ADHD. People with Tourette syndrome have nervous tics, which can be evident as repetitive, involuntary movements, such as eye blinks, facial twitches, or grimacing, and/or as vocalizations, such as throat-clearing, snorting, sniffing, or barking out words inappropriately. These behaviors can be controlled with medication, behavioral interventions, or both.

ADHD also may coexist with a sleep disorder, bed-wetting, substance abuse.

Do teens with ADHD have special needs?

Most children with ADHD continue to have symptoms as they enter adolescence. Some children are not diagnosed with ADHD until they reach adolescence. This is more common among children with predominantly inattentive symptoms because they are not necessarily disruptive at home or in school. In these children, the disorder becomes more apparent as academic demands increase and responsibilities mount. For all teens, these years are challenging. But for teens with ADHD, these years may be especially difficult.

Although hyperactivity tends to decrease as a child ages, teens who continue to be hyperactive may feel restless and try to do too many things at once. They may choose tasks or activities that have a quick payoff, rather than those that take more effort, but provide bigger, delayed rewards. Teens with primarily attention deficits struggle with school and other activities in which they are expected to be more self-reliant.

What about teens and driving?

Teens with ADHD take more risks and are involved in four times as many car accidents as those who do not have ADHD. They are also more likely to cause injury in accidents, and they get three times as many speeding tickets as their peers.^{27,28}

Can adults have ADHD?

Some children with ADHD continue to have it as adults. And many adults who have the disorder don't know it. They may feel that it is impossible to get organized, stick to a job, or remember and keep appointments. Daily tasks such as getting up in the morning, preparing to leave the house for work, arriving at work on time, and being productive on the job can be especially challenging for adults with ADHD.

These adults may have a history of failure at school, problems at work, or difficult or failed relationships. Many have had multiple traffic accidents. Like teens, adults with ADHD may seem restless and may try to do several things at once, most of them unsuccessfully. They also tend to prefer "quick fixes," rather than taking the steps needed to achieve greater rewards.

How is ADHD diagnosed in adults?

To be diagnosed with the condition, an adult must have ADHD symptoms that began in childhood and continued throughout adulthood.²⁹

the person's history of childhood behavior and school experiences is important.

For some adults, a diagnosis of ADHD can bring a sense of relief. Adults who have had the disorder since childhood, but who have not been diagnosed, may have developed negative feelings about themselves over the years. Receiving a diagnosis allows them to understand the reasons for their problems, and treatment will allow them to deal with their problems more effectively.

How is ADHD treated in adults?

Much like children with the disorder, adults with ADHD are treated with medication, psychotherapy, or a combination of treatments.

Medications. ADHD medications, including extended-release forms, often are prescribed for adults with ADHD.³⁰

Antidepressant bupropion (Wellbutrin), which affects the brain chemical dopamine, showed benefits for adults with ADHD.³¹ Older antidepressants, called tricyclics, sometimes are used because they, like stimulants or atomoxetine, affect the brain chemical norepinephrine.

Education and psychotherapy. A professional counselor or therapist can help an adult with ADHD learn how to organize his or her life with tools such as a large calendar or date book, lists, reminder notes, and by assigning a special place for keys, bills, and paperwork. Large tasks can be broken down into smaller, more manageable steps so that completing each part of the task provides a sense of accomplishment.

Psychotherapy, including cognitive behavioral therapy, also can help change one's poor self-image by examining the experiences that produced it. The therapist encourages the adult with ADHD to adjust to the life changes that come with treatment, such as thinking before acting, or resisting the urge to take unnecessary risks.

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