



The Treatments for Attention-Deficit/Hyperactivity Disorder in Different Age Groups

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Abstract. Attention-deficit/hyperactivity disorder (ADHD), a mental disorder, is usually found in children and has the potential to persist throughout their lifespan. It negatively influences many dimensions of patients' life, including emotions, academics, occupation, and relationships. Today's medications and therapies offer patients many options, each with its own advantages and disadvantages. It can be difficult to find the best one. Since age may be a fundamental factor influencing treatment options, so this article mainly discusses common treatments and ideal treatments for all age groups. After summarizing the treatment options for different populations, it is necessary to continue to explore the effect of age on treatment efficacy to find the best treatment options. As age increases, the reaction to drugs becomes different. For example, estrogen has a dramatic effect on the most popular medication today, and women experience significant hormonal changes during menopause that cause the medicine to be ineffective. However, today's treatments do not differentiate for the changes that occur with aging, and it is likely that many medications do not achieve the desired response and effect. The current research on ADHD in older adults is far from adequate.

Keywords: Attention-deficit/hyperactivity disorder · ADHD · treatments · medication · age

1 Introduction

1.1 Background

1.1.1 Symptoms

Attention-Deficit/Hyperactivity Disorder (ADHD) can be found in all age groups, and its worldwide prevalence is 5.29% [1]. It is associated with comorbidity, negative social outcomes, and negative psychological outcomes [2]. The three core symptoms of ADHD are Inattention, Impulsivity, and Hyperactivity. Inattention manifests as difficulty maintaining attention to a task and its details, seemingly not listening when others are talking, and being easily distracted. Impulsivity presents difficulty in waiting, acting without consideration, and responding to questions in a single breath. Hyperactivity manifests in patients' irritability and hyperactivity in inappropriate situations.

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1.1.2 Diagnosis

The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) classified ADHD symptoms into two categories: inattentiveness and hyperactivity/impulsivity [3]. To be officially diagnosed with ADHD, children under 16 years old must have at least six symptoms of inattention and hyperactivity/impulsivity, respectively, for at least six months. However, adolescents and adults 17 years of age and older can be diagnosed with ADHD if they present with at least five symptoms of each of the two categories for at least six months. In addition to the presenting symptoms, the following requirements need to be considered:

1. Having several inattentive or hyperactive-impulsive symptoms before the age of 12.
2. Several symptoms appear in two or more settings, such as at school and with family members.
3. These symptoms interfere with or diminish the quality of social, school, or work functioning.

Based on the number of symptoms appearing in the two categories, there are three presentations of ADHD: combined presentation ADHD, predominantly inattentive presentation ADHD, and hyperactive/impulsive presentation ADHD. Patients designated as combined type will have six or more symptoms that appear in both categories. Inattentive type is defined as patients with six or more inattentive symptoms and fewer hyperactive/impulsive symptoms, while patients with six or more hyperactive/impulsive symptoms and fewer inattentive symptoms will be designated as impulsive/hyperactive.

The diagnosis of ADHD can be distinct based on age group. Children present more symptoms since children are usually more active compared to adults. Therefore, the diagnostic criteria for adults are distinguished from young patients. The diagnosis for older adults is challenging because there aren't age-appropriate diagnostic criteria for adult ADHD, and age-related health issues such as mild cognitive impairment could make diagnosis difficult. Moreover, ADHD was found to be more common on males than females, since males with ADHD are more observable than females.

1.1.3 Cause

The exact cause of ADHD is still unknown, but genetic and environmental the potential risk factors. From a study of 20 twins, the heritability of ADHD was 0.76, which means that 76% of ADHD cases are caused by genetics [4]. In addition, environmental factors such as premature birth, maternal use of drugs, alcohol, and tobacco during pregnancy, and exposure to environmental toxins.

1.2 Research Gap

Because ADHD is usually found during patients' childhood, recent and past studies have also focused on young patients. There is not much concluded research that thoroughly explains how to choose a treatment from various treatments based on patients' age group. Thus, this article will discuss which treatments are more suitable for the patient's age group.

1.3 Research Objective

Age is a factor that affects treatment options. Firstly, of all a person's body responds differently to medications at different ages. Secondly, the life issues that a person faces at each age are different. All of these factors affect the feasibility and applicability of therapies used by patients. This article will discuss different therapies and their effectiveness for different age groups and what is the most effective treatment or the combination for different patient groups.

2 Treatments

The treatments for ADHD include medications to reduce the symptoms of the patient and also therapies that help patients to control themselves and adapt to society. There are many treatments for ADHD, and some of the commonly used treatments today include medications, behavioral therapy, cognitive-behavioral therapy, and behavioral parent/classroom/peer intervention for ADHD.

2.1 Medications

There are many medications available to treat ADHD, they can be classified by stimulants and nonstimulants.

Psychostimulants, such as Amphetamine and methylphenidates, can stimulate the cells to release neurotransmitters: dopamine and norepinephrine. It is the most effective treatment for ADHD, which can immediately take effect. There are 70% to 80% of cases show it works well with patients [5]. However, since the dosage of medication is dependent on the individual but not body weight, usually, patients will start taking it in small amounts. Then the doctor will recommend a change in medication or dosage depending on individual cases. If the medication works in the starting dosage, the patient will continue taking it. The common side effects of stimulants are trouble sleeping, loss of appetite, headaches, and stomach aches. Some of the less common adverse effects are emotional instability and developmental delays [6]. Although there isn't a significant statistical correlation between taking stimulants and the risk of heart attack, patients who have a personal or family history of heart disease are also recommended to have an electrocardiogram before taking the psychostimulants. Patients with comorbidities that cause tics, such as Tourette's, should avoid stimulants, as they can intensify the symptoms of tics [6]. Moreover, psychostimulants for ADHD have the risk of abuse. Some people without ADHD might exaggerate their symptoms in order to get the medications.

Nonstimulant medications are an alternative option for patients if the side effects of stimulants are unbearable or they don't work. It is very common for doctors to change the medication for patients because the choice of medications is based on the individual. Atomoxetine is a selective norepinephrine reuptake inhibitor [7]. It is different from psychostimulants in that it limits the increase of concentration of the norepinephrine and dopamine can only happen in the prefrontal cortex of the brain. The concentration of the substance in other areas of the brain would not increase, so it doesn't have the potential for abuse, and there are fewer side effects compared to psychostimulants. Other

than that, there are some medications that have an off-label effect on ADHD. Alpha2-Agonists are non-stimulants that are used as adjuncts to cope with ADHD-related sleep disturbance [8].

2.2 Psychotherapy

Unlike medications which directly change the chemical release in the brain, psychotherapy helps patients to develop coping skills and manage their behavior. There are many psychotherapies for treating ADHD, and behavioral therapy, cognitive behavioral therapy (CBT), is the most commonly used. Behavioral therapy teaches patients to manage their symptoms by using reward and punishment to enhance and reduce patients' specific actions. It focuses on replacing negative behavior with a positive one. Cognitive behavioral therapy for ADHD aims to help patients modify maladaptive thinking and to increase engagement in positive activities by providing a sense of accomplishment and pleasure [9].

2.3 Interventions

Since ADHD can happen in different settings such as school, family, and workplace during patients' lifespan, behavioral parent training (BPT), behavioral classroom management (BCT), and behavioral peer intervention (BPI) are accepted interventions for different settings [10]. BPT involves training parents to help in improving patients behavior problems by using positive reinforcement methods [11], whereas BCT involves training teachers to manage patients' behavior. Pelham and Fabiano [12] classified BPI into BPI-C, and BPI-R. BPI-C is provided in a clinic with traditional, weekly, social skills training groups and BPI-R targets peer relationships and functioning in recreational settings. Steven et al. concluded that there is insufficient evidence that BPI-C is mature or potentially effective while BPI-R matches the criteria to serve as a well-established treatment [10].

3 Age Difference

Age is a factor that influences treatment options. First, individual usually have different goals at different ages. Children focus on physical development and learning, adults focus on employment and relationships, and older adults focus on avoiding and coping with illness. Second, the human mind and body also differ at different ages, such as the side effects of medication, resistance to medication, the ability to cope with stress, and the level of stress. Third, depending on the age of the patients, side effects might be manageable, so treatment methods like medication can be explored when patients grow up. Therefore, the effectiveness of the treatments to reduce symptoms, improve coping skills, and manage stressors are determined by age.

3.1 Preschool Child (Under 6 Years Old)

ADHD does not worsen with age, but coping skills and stressors can influence patients' experience of illness. To better manage the symptoms, under age 6 is an important period for children with ADHD to acquire and practice their coping skills to control their symptoms. If patients do not learn how to cope with their symptoms early in life, they may have more negative experiences in the future. The more stressors and rules they need to face when they grow up, their symptoms might become more intense. While it is known that medications are very effective for ADHD, there are not enough clinical trials to test the long-term effects on young children, and the negative effects of medications can be dramatic for them. Therefore, medication is not the recommended treatment for young children, and coping strategies can be beneficial for young children.

3.1.1 Behavioral Therapy

The first choice for helping young children control their temper and focus their attention is behavioral therapy. Research has shown that behavior therapy is very effective with young children [13]. Behavior therapy for young kids will focus on helping children to control impulsive behavior. Since family is an essential component in children's development, it will involve parental behavior training (BPT) designed to teach parents useful ways to intervene in their children's behavior. Typically, because of the symptoms of ADHD, children always receive negative feedback from their parents but no encouragement. Most parent training programs will teach parents to use praise and consistent consequences to encourage positive behavior.

3.2 Child (6–12 Years Old)

Medication and behavioral therapy are available for children from 6 to 12 years old. At this age, they are attending primary school and maybe facing stress from their studies, and it's a period of physical development as well. Medication can be very effective in helping them to be able to focus on tasks and lessons and to reduce impulsive behaviors during tasks and lessons, but medication comes with side effects. They need to find a balance between the benefits of medication and the side effects. Behavioral therapy, on the other hand, is one that has no side effects and can help them learn skills to manage impulsive behaviors.

3.2.1 Medication

Medication is proven safe for people above six years old. Children between 6 years old and 12 years old are recommended to take long-acting formulations to manage the release of neurotransmitters in their brain. Yet they still need to pay attention to their doctor's instructions because all medications for ADHD can cause more or less severe side effects, and some medications can also have serious side effects if not taken regularly. A common side effect that children and their parents need to be aware of is sleeplessness, which can affect physical growth. Considering the sleep cycle, they can take the medication earlier or switch to a short-acting medication [14]. If the side

effects are significant or interfere with daily life, it is recommended to stop taking the medication.

3.2.2 Behavioral Therapy

In addition to medication, behavioral therapy is still helpful for school-age children. There are two types of behavioral therapy for children, one is to control impulsive behavior, and the other one is to teach executive functioning skills. To control impulsive behavior, BPT and BCT will be involved in helping the children in the home setting and classroom.

Other than intervention from parents and teachers, another kind of behavior therapy will focus on teaching executive functions, which is a set of skills including remaining organized, scheduling tasks, and managing time [3]. According to the DSM-5 Criteria for ADHD, organizing tasks and activities, losing items, and being easily forgetful are the common symptoms for it. So, having checklists, planners, and time management skills can help children in daily life and to finish their tasks [15].

3.3 Adolescent

Adolescence is a time of intense emotional ups and downs. Due to the fact that psychologically adolescents crave for independence while at the same time craving for approval, they become more sensitive to peer evaluations and interpersonal relationships.

Adolescents should use medication and cognitive behavioral therapy. As a period of transition between childhood and adulthood, adolescents share much in common with both childhood and adult ADHD in the treatment of adolescent ADHD.

In terms of medication, adolescents should follow a similar treatment plan to that of children. As both children and adolescents are at a stage of physical development, they need to pay more attention to the side effects of medication. They also need to be concerned about managing possible mood disorders that may occur and worsen ADHD symptoms due to the dramatic emotional ups and downs of adolescence.

Behavior therapy was found to be effective compared to medication, and most CBT for adolescents is based upon traditional behavioral principles rather than cognitive therapy [16]. A recent large study has shown that both BT and CBT are effective for adolescents [17]. Moreover, adolescents with ADHD who have externalizing problems, such as oppositional defiant disorder and conduct disorder, gain lesser benefits from CBT, but adolescents with internalizing problems such as depression, gain more improvement from CBT [18].

3.4 Adult (More than 18 Years Old)

There are 50% of children with ADHD will last it to adulthood [19]. The pooled prevalence of adult ADHD was 2.5% [20]. ADHD is associated with psychiatric comorbidities such as major depressive disorder, bipolar disorder, and generalized anxiety disorders and affects patients' life quality, family relationships, occupational difficulties, and social dysfunction [8]. For adults with ADHD, pharmacological treatment and cognitive behavioral therapy (CBT) are recommended.

3.4.1 Medication

Pharmacological treatment, especially stimulants, is generally considered the first choice of treatment in adults with ADHD. However, it is rarely sufficient due to the poor compliance to medication and lack of continuity of medication [21]. In order to simplify the treatment and to reduce the possibility of drug abuse, long-acting formulations are more effective than short-acting preparations. If patients need to drive, study or work at night, they can take a small amount of short-acting formulation to maintain efficacy [8].

3.4.2 Cognitive Behavioral Therapy

Since the study found that patients have negative thoughts about themselves and their future and that 80% of people with ADHD suffer from lifelong emotional disorders [22]. Cognitive behavioral therapy (CBT) focuses on identifying, challenging, and changing the patient's perception of a situation. So CBT can help patients change unhelpful ways of thinking and behaving, thereby reducing the likelihood of exacerbating ADHD symptoms and controlling their comorbidity.

3.4.3 Combination Therapy

Research shows that CBT can help medication-treated patients improve their symptoms and last for 12 months after finishing CBT therapy [23, 24]. Also, a study shows that the combination strategies are more effective than pharmacological treatment or psychotherapy alone [25], and patients report less depression, anxiety, and other emotional problems.

3.5 Older Adult (More than 50 Years Old)

ADHD in all ages is linked to different psychiatric comorbidities. In research about older people with ADHD from Norway, 46.7% of participants report psychiatric comorbidities, including depression, anxiety, and bipolar disorder [26]. Compared to the elderly without ADHD, ADHD patients also found a lower sense of mastery, self-esteem, and self-efficacy; higher social inadequacy and neuroticism [27]. Older patients also need to take care of age related health issues such as mild cognitive impairment and dementia, which may affect the diagnosis and treatment of ADHD. Today's treatment for older ADHD is the same as adults: medication and other psychotherapies.

3.5.1 Medication

There isn't enough evidence on the long-term effects of pharmacological treatment for older ADHD [8], but it is known that the elderly usually has a diminished ability to be metabolized medications and are sensitive to the side effects of psychotropic drugs [28]. Therefore, drug doses and titration rates in older adults should be slowly increase in lower doses [29]. Moreover, there is evidence showing that the circulating levels of ovarian hormones can affect the central effect of stimulant drugs on women [30]; the stimulant medication can feel ineffective if estrogen levels are low. Female patients are suggested to consult with a physician about hormone replacement.

4 Conclusion

The purpose of this article is to discuss the treatment of ADHD in various age groups, as the treatment options vary somewhat by age. Moreover, there is still a need for continued research on the treatment of ADHD. Future research could focus on two areas. First, pharmacological treatment of adolescents, the elderly, and females with ADHD. Second, comparing different psychotherapy or intervention to find the best treatment option.

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