


# ADHD AND ITS EVOLUTION ACROSS THE LIFESPAN

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## ABSTRACT

Attention deficit hyperactivity disorder is not only a childhood disorder, but a disorder of childhood-onset. Attention deficit hyperactivity disorder, first described as attention deficit, encompasses a larger spectrum of symptoms that appear not only in children, but also in adults, even in those over 65 years of age. Evaluation of this symptom spectrum is important, as affected adults, especially females, are likely overlooked or misdiagnosed in childhood. They may present later with dire outcomes, such as academic failure, problematic parenting behaviours, workplace problems, risky sexual behaviour leading to miscarriages or sexually transmitted infections, and increased suicide rates due to their vulnerability to depression and anxiety-related symptoms. Structural and biochemical findings were associated with this disorder. Additionally, there are many neuropathological models proposed to explain the nature of attention deficit hyperactivity disorder, such as those proposed by Sergeant and Barkley. Although a lot is known about attention deficit hyperactivity disorder so far, there is still a large lack of information about its prognosis and prevalence in vulnerable or minority populations. In this review, we aim to provide an overview of not only the pathophysiology, but the spectrum of attention deficit hyperactivity disorder symptoms throughout the lifespan with an emphasis on the childhood-onset nature of this disorder.

**Keywords:** Attention deficit hyperactivity disorder, atomoxetine hydrochloride, neurodevelopmental disorders

## INTRODUCTION

"Mental restlessness", a common phenomenon encountered in the modern age, was described in the 18<sup>th</sup> century by Sir Alexander Crichton. His findings were based on his observations of children who appeared inattentive (1, 2). Almost a century later, in The Lancet, George Still noted that mental restlessness may be caused by both nature and nurture, therefore launching today's most common concept in explaining attention deficit hyperactivity disorder (ADHD) among other psychiatric disorders: An ever-ongoing interplay between the genes and the environment, with the latter encompassing not only inanimate objects but also interpersonal relationships, which was first recognized in the third version of the Diagnostic and Statistical Manual of Mental Disorders (2-4). It is now known that ADHD is not only a disorder of childhood but is better described as a childhood-onset neurodevelopmental condition, emphasizing the spanning nature of this disorder from childhood to

adulthood (3). Although the diagnosis of ADHD in children is becoming more common every day, many patients remain undiagnosed until adulthood (3). These patients tend to present in various clinical settings. The most common complaints in ADHD are hyperactivity, inattention, impulsivity, problems in social interaction, and a decrease in academic performance (5). This review aims to provide an overview for a less discussed side of ADHD, its effects on developmental milestones, as ADHD shows high rates of persistence into adulthood. A study conducted by Sibley et al. (6), in 2017 revealed that 60% of children with ADHD had persistent symptoms and 41% of these had impairment due to ADHD also in adulthood. The persistence rates of childhood ADHD into adulthood is also reported to be 20-80% in different studies (7). Caye et al. (8) identified the predictors of persistence into adulthood in the children with ADHD as the following: Comorbid major depressive disorder, comorbid conduct disorder, treatment for ADHD, severe symptoms of ADHD.



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## Pathophysiology of ADHD

The intriguing pathophysiology of ADHD can only be examined with the help of different perspectives, ranging from its neurobiology to psychological theories.

### Structural changes

Positron-emission tomography studies found out that global cerebral glucose metabolism was 8.1% lower in adults with childhood-onset hyperactivity than in the normally developed control group (9). Significant changes in glucose metabolism were observed in 30 of the 60 specific brain regions (9). The greatest reduction was observed in the premotor cortex (9). The premotor cortex is known to play a role in planning of movements and understanding the actions of others, participating also in the prediction of outcomes of actions and working toward a defined goal (9). Magnetic resonance imaging (MRI) studies showed significantly decreased gray matter, white matter, and brain parenchyma volumes in children with ADHD, with no significant differences in cerebrospinal fluid or myelin volumes (10). Additionally, a reduction in gray matter volume, specific to the right putamen/globus pallidus region, was detected in individuals with ADHD (11). This suggests a dysfunction in frontostriatal circuits, which normally contribute to executive functions (11). Other MRI studies reported volume reductions in frontal lobes and striatum in individuals with ADHD, associating lower tissue volume in these areas with clinical hyperactivity (12). In children with ADHD, clinical symptoms were associated with smaller right caudal anterior cingulate cortex thickness and left-pallidum volume, with the smaller right insular volumes being associated with verbal IQ decrease (13). Functional MRI studies revealed that children with ADHD, when compared to their typically developing (TD) counterparts, have reduced connectivity between the central-dorsal attention networks and default mode network, which play roles in both attention and concentration (14).

### Genes and neurobiology

New genetic diagnostic methods allowed researchers to define different loci related to childhood ADHD, which are listed in Online Mendelian Inheritance in Man, and include *ADHD1* on 16p13, *ADHD2* on 17p11, *ADHD3* on 6q12 (15). Additionally, mutations in the *TPH2* gene encoding tryptophan hydroxylase 2 isoenzyme, which is mainly found in the raphe nucleus of the midbrain and plays a role in serotonin synthesis, are not only

associated with a susceptibility to ADHD but also with unipolar depression (16, 17). Biederman et al. (18) reported that 28.6% of biologic parents of hyperactive kids had a history of hyperactivity, which raised questions about the complex genetic background of this condition. Monoaminergic neurotransmitters, including serotonergic neurotransmitters, are affected in ADHD. Along with the genes associated with the serotonergic system, coding genes in the dopaminergic system were also found to be involved in the pathophysiology. Some of these genes include *DAT1*, *SLC6A3*, *DBH*, *DRD4* and *DRD5* (19-24).

### Psychopathology

Although there are many theories that explain the changes in ADHD from a somatic perspective, two main neuropathological models dominate the field, those being "The Inhibition Model" by Barkley (25) presented in 1997 and "the Cognitive-Energetic Model" by Sergeant (26) presented in 2000. Both models are summarized in Table 1. Barkley proposed that the main issue in ADHD is poor response inhibition, which involves three interconnected processes. The chain of processes start with the inhibition of an initial prepotent response upon encountering an event, followed by stopping an ongoing response (25). This allows a delay in the decision to reply, and eventually the controlling of the outer interference leading to distraction (25). The impairment of this circuit ultimately leads to inefficient cognitive performance, including executive functions (25), which in turn results in problems with motor control. If behavioral inhibition is not successful in patients with ADHD, it's likely that a failure in executive functions will appear (25). These executive functions include self-regulation of emotions, motivation, arousal, and some parts of working memory (25). Sergeant describes his "Cognitive-Energetic Model" theory, where ADHD is addressed as a problem of energetic factors that eventually lead to the two hallmarks of the disease: inattention and hyperactivity (26). He also proposed three levels of involvement in the efficient processing of information. These three levels mesh together in various ways. The lowest level includes encoding, searching, decision-making, and motor organization, all of which are parts of computational mechanisms of attention (26). The middle level is composed of energetic pools, including arousal, effort, and activation, which altogether function to respond to stimuli (26). The response process takes place in the arousal phase, and eventually a physical action occurs (27). The upper level is the control center, which is associated with planning, response inhibition, and correction (26). In ADHD, it

**Table 1: Examples of neuropathological models to explain ADHD symptoms.**

Inhibition Model Barkley (25)	Cognitive-Energetic Model Sergeant (26)
Poor response inhibition during the following three processes: 1. Inhibition of a prepotent (immature) response 2. Stopping an ongoing prepotent response 3. Controlling the outer interference	Three levels in the efficient information procession: 1. The lowest level: encoding, search, decision making, and motor organization 2. The middle level: energetic pools, including arousal, effort, and activation 3. The upper level: control center, associated with planning, response inhibition, and correction All three levels could be disrupted in ADHD, leading to different phenotypes.

ADHD: Attention deficit hyperactivity disorder

is not rare to see impairments in all three levels of this model, from motor difficulties resulting from the impairment of the lowest level to the lack of inhibitive response against incoming stimuli in the upper level (26, 27). Additionally, earlier theories suggest an overall increased motivation in hyperactive children, leading to impulsive and uncontrolled performance. These hyperactive children tend to be over-motivated by tangible objects as rewards, suggesting an immature reward-motivation system (28). This leads to worse performance in situations that demand passivity and provide intangible rewards such as verbal acknowledgements or celebrations for special days (28). Non-somatic psychological theories suggest that the primitive reflexes responsible for the survival of the organism in early childhood evolves into a more complicated attention system (29). Overloading this early primitive system may result in alterations in the later more complicated system (29). One of these theories suggests that, selective attentive behavior requires the effortful suppression of other stimuli in order to channel attention to only single focus (29). It was also proposed and later proven that there is a superior system overseeing the target of selective attention (29) This discovery led to the identification of anterior cingulate gyrus as the potential mediator of this ability (29).

#### Spectrum of Symptoms and Their Variations

The prevalence of ADHD in both adults and children has been reported as 3-5% (30). The latest national survey reported its prevalence in Turkey as 19.5%, with 12.4% of affected individuals having impairments due to this condition (31). The symptoms may change across the lifespan. Younger children are more likely to exhibit externalizing symptoms such as hyperactive-impulsive behavior, while in later childhood inattentive symptoms are more prevalent (32, 33). Fortunately, self-reported suicidality and externalizing symptoms in this age group can be managed via modern ADHD medications (34). It is also important to note that boys tend to present mostly with motor symptoms, which may lead to an increased necessity for professional evaluation during childhood (35). On the other hand, girls present mostly with symptoms of inattentiveness and, as a result, stay clinically "silent" until school age, leading to a gender bias in diagnosis (35). In adulthood, earlier inattention tends to persist, while the hyperactive-impulsive behavior declines and gets replaced by emotional lability, with this symptom even presenting as the main one later in life (35). The gender ratios of newly diagnosed patients also change across the lifespan. 80% of the patients that were diagnosed in psychiatry clinics were males, even though in adult psychiatry, the proportion of males was closer to 50% (35). A gender bias for referral is present and results in a decreased referral rate for females with ADHD for treatment compared to their male counterparts. Gender differences are observed in adolescents, with adolescent girls having lower self-efficacy and problems finding coping strategies (32). They may present depressed or show anxiety-related symptoms more often than their male counterparts, with the male counterparts being more likely

to show physical aggression and other externalizing behaviors (32). ADHD is also the most common comorbidity to anxiety in children and odds ratio in anxiety disorders for comorbidity with ADHD was reported to be 3.0 (95% confidence interval 2.1-4.3) (36). Subsequently, one third of children with ADHD have comorbid anxiety disorders. Overlapping symptoms of both conditions may result in underdiagnosis (36). Additionally, incarceration rates are higher in men with ADHD than in women (32). At fertile ages, prevalence of prepartum, postpartum, and climacterium psychiatric disorders, including premenstrual dysphoric disorder, postpartum depression, and overall climacteric symptom scores, were higher in women with ADHD than in controls (37).

#### ADHD and Addiction

A study conducted in Oslo, Norway, between 2014-2018, observed the prevalences of alcohol use disorder (AUD) and drug use disorder (DUD) in 558 ADHD patients, in 12-month and lifetime periods (38). The lifetime prevalence was 12.0% for AUD and 27.7% for DUD, with men having higher rates when compared to women (38). However, DUD was more than twice as prevalent than AUD in both sexes (38). Lifetime DUD was associated significantly with symptoms of ADHD and emotional dysregulation. However, lifetime AUD did not correlate with either (38). Patients with significant ADHD symptoms were able to reduce their drug use, however, they were less likely to achieve abstinence, although having received the methadone replacement treatment at nine months post-admission (39). Because opiates are commonly abused drugs by individuals with ADHD, current therapies for opiate addiction should be adapted specifically for these individuals since ADHD plays a role in the recovery phase of opiate addiction therapy (39). Opiate abuse may even contribute to the etiology of ADHD. Children of opiate-dependent mothers were more likely to have ADHD than those whose fathers were opiate-dependent (23). This phenomenon was not affected by the fact that the parents had ADHD, suggesting the role of serotonergic and dopaminergic risk alleles (23). Research suggests that ADHD screening should be performed in all patients with substance use disorders because of the common co-occurrence of the conditions (40). The same study also suggests that a detailed substance abuse history should be taken when evaluating patients and that specific information about the status of ADHD-related symptoms in abstinent phases should be acquired. Therapy with stimulants or atomoxetine hydrochloride can be offered for the simultaneous treatment of both conditions (40). ADHD is known to bring about behaviors that contribute to an increased risk of AUD (40). Impulsivity and a malfunctioning award system puts the individuals at risk, therefore, it is common to encounter ADHD in individuals with AUD (40, 41). Addiction to video games is also a common phenomenon, with 23% of all video game players describing their relationship with video games as an addiction (42). In individuals with ADHD, ADHD symptom severity is reported to be positively associated with the severity of their video game addiction, independent from

the type of game played or preferred (42). Smoking mostly accompanies other substance abuse disorders, with 81.4% of all substance abuse patients smoking cigarettes. Similarly, substance abuse patients with ADHD tend to report smoking more cigarettes and having a higher dependency on nicotine compared to non-ADHD patients (43). Patients with ADHD also tend to start smoking earlier in life. The study by Sánchez-García et al. (43) suggested that the comorbid presence of personality disorders with impulsive features may contribute to excessive smoking in individuals with ADHD. The study emphasizes the importance of screening for ADHD in patients with substance use disorders, especially when they present with asocial or borderline personality disorders, where impulse control deficits are prominent (43).

### School and ADHD

A 10-year longitudinal study investigating executive function in children with autism spectrum disorder (ASD) and ADHD through its three components (working memory, inhibition, and flexibility) has proven that when compared to their counterparts with ASD, individuals with ADHD showed better improvement in all aspects of executive function, despite never reaching the performance level achieved by TD children (44).

In elementary school children, ADHD can present itself with poor relationships with classmates and poor social preference, resulting in low peer support (45). Children with ADHD tend to have more "non-friends", peers around them with no close friendship ties, and a smaller number of classmates that they share friendship ties with (45). Also, the number of children who are eager to establish friendship ties with their peers with ADHD is small (45). Additionally, the more symptoms a child with ADHD shows, the lonelier he or she is, which in turn leads to exacerbation of ADHD symptoms and peer functioning, further leading to poorer friendship patterns and a negative experience in the classroom (45). Highly symptomatic children were not as good at reading comprehension and decoding written texts when compared with controls (46). Grade one children with ADHD, when symptomatic, tend to have less emotional engagement with school after 3 years, which is partially due to student-teacher conflicts (41). If these conflicts are resolved, increased engagement with school can be achieved as well as increased school performance (47). This was proven by a study conducted in Taiwan where teachers were found to have more knowledge about ADHD than parents and the general public (48). It's important to note that children with ADHD are more likely to be bullied (49). This leads to increased symptom severity, however, no significant relation between bullying behavior and ADHD was established (49). In high school, individuals with ADHD are more likely to repeat years or drop out of school, with females having a higher risk ratio than males (50). On the other hand, participation in after-school activities can lead to a decrease in ADHD symptom severity and eventually less frequent school absences (51). Additionally, when performing writing exercises, students with ADHD tend to write texts of similar length but with less coherence and ideation when compared to TD students

(52). They also tend to think less about what they are writing and spend less time reviewing their texts, which results in poorer text quality (52). In college, students with ADHD self-reported higher levels of anxiety and depression, and their parents also reported higher levels of anxiety and depression in their children (53). The levels of anxiety and depression were higher in female patients, showing depressive and anxiety-related symptoms more often (53). Anxiety-related symptoms are more likely to be seen in inattentive type ADHD patients than in combined type patients (53). College students with ADHD are likely to have lower grades, take longer to graduate, and drop out of school. Before and during high school, they report that they are less prepared for college than their counterparts (54). Although it was established that ADHD substantially negatively affects the school performance in every step of the educational system, a treatment of 3 months appears to be helpful in improving school performance; therefore it is crucial to detect the ADHD as early as possible (55).

### Work Life and ADHD

Adulthood ADHD is mostly associated with being a "night owl" with only 18.5% describing a preference for early hours (56). The preference for staying up until late hours is associated with inattention and increased impulsive behavior, which might eventually lead to decreased work performance (56). Although individuals with ADHD self-report dissatisfaction when it comes to meeting their own standards and perceived potentials, a lack of performance leading to job loss is less common (57, 58). Employment levels and productivity are reduced in affected individuals, and employment of individuals with ADHD is usually associated with higher costs because of the loss of productivity and frequent work absences (57, 58). Additionally, adults with severe childhood-ADHD, who presented with inattention and comorbid mental disorders, particularly anxiety disorders, are known to be more prone to long-term work disability and occupational impairment (59). An early recognition of ADHD and swift interventions, especially for the inattentive type, is crucial to avoid further impairments in the adult work life. Fundamental workplace interventions and primary care recognition can eventually lead to earlier treatment of the disorder-associated symptoms, not only providing a cost-efficient employee-employer relationship but also an increased overall productivity in the workplace (58, 59). Another suggestion is focusing on ameliorating inattentive symptoms for the treatment of adult ADHD, which can be achieved by combining workplace interventions with pharmacotherapy to promote functioning and to prevent long-term work disability. Addressing ADHD in the workplace can help make use of its positive aspects, such as creative thinking (59). Other ADHD symptoms are less likely to get recognized by co-workers, unless mentioned by the person themselves (60). These may include internal restlessness, difficulty maintaining vigilance, and intolerance of boredom (60). Simulated workplace studies suggest that these symptoms are associated with lower workplace performance in individuals with ADHD (60).

### Sexuality and ADHD

There is no significant difference between children with or without ADHD when it comes to the development of sexual characteristics, as proven by Tanner-stage observation through 3 years (61). Sexual development does not seem to be altered with stimulant medication use (61). In adolescence, individuals with ADHD tend to have a higher rate of romantic relationship turnover and a lower rate of physical intimacy, with individuals self-reporting more severe emotional dysregulation tending to engage more in romantic relationships and sexual intercourse as well as unprotected sex (62). In women, the association between emotional dysregulation, impulsivity, oppositional symptoms, and hypersexuality seems to be more prominent than in men. ADHD is more commonly associated with risky sexual behavior (RSB) in women than in men. In women, additionally, ADHD symptomatology has more influence on temper, impulsivity, and oppositional behavior, through its association with RSB; whereas, RSB seen in men with ADHD is only associated with temper (63). Another study conducted on Russian adolescents discovered that being easily distracted and forgetful, along with deficits in planning, is associated with RSB (64). RSB includes history of unprotected sex, increased number of sexual partners, sex under intoxication, and unwanted pregnancies (64). Adolescents with ADHD also are at greater risk of pregnancy, including early pregnancy, which can be alleviated with long-term use of ADHD medications (65). It is important to note that marijuana use potentiates the relationship between RSB and ADHD to conduct problems (66). People with ADHD report more sexual desire and less sexual satisfaction, accompanied by more sexual dysfunction and more masturbation frequency (67). With some studies reporting hypersexual individuals suffering from not only ADHD but also from paraphilias (68). There is not enough data to support a clear relationship between ADHD and paraphilias, although it's known that a high prevalence of ADHD is observed in hypersexual and paraphilic individuals (68). In youth aged 13-22 years, who identify themselves as lesbian, gay, bisexual, transgender, queer, asexual, intersex, or non-cisgender (LGBTQAI+), anxiety disorders, depressive disorders, and post-traumatic stress disorder occur more commonly (69). Data on LGBTQAI+ individuals with ADHD and their sexual practices is scarce, although it is known that LGBTQAI+ high school students are at an increased risk for illicit drug use (70). It was shown that at risk individuals benefit from socially supportive organizations such as gay-straight alliances, as those in alliances were found to consume illicit drugs less frequently (70). A study on men who have sex with men (MSM) with previous adverse childhood experience revealed that the treatment of a concomitant ADHD may prevent the development of depression in the MSM population (71). It is also important to note that in MSM, hypersexuality is a common feature, primarily associated with emotional reactivity, risk taking, and impulsivity, regardless of the presence of ADHD (72).

### Parenting with ADHD

More than 50% of adults with ADHD have at least one child with the same disorder, and approximately 25-50% of the children with ADHD also have a parent with ADHD (73). The

parenting behavior can be conceptualized in two dimensions, as proposed Rothbaum and Weiz (74) in 1994 and by Darling and Steinberg (75) in 1993: Effective behavioral control and emotional responsiveness to the child. On the first dimension, the difficulties appear when parents either present insufficient behavior controls or extremely harsh and overreactive parenting behaviors (74, 75). On the emotional responsiveness dimension, an impairment appears as low levels of emotional responsiveness, which can be either expressed as insensitivity to the child's needs, or a distant stance toward the child (74, 75). When a parent with ADHD has self-deficits in working memory, planning, and inhibitory control, this parent will not be able to provide adequate monitoring and clear guidance to his or her children, neither will the parent be able to offer a systematically organized solution to the children's problems. On the other hand, deficits in self-regulation, and therefore the repeating impulsivity of the parent, will likely contribute to the problem, as he or she will not be a proper role model for correct behaviors (73). This situation leads to ineffective parental behavioral control. Parenting stress may eventually lead to hostile or over-reactive discipline, lack of warmth and sensitivity, even rejection by the parent in children, further leading to failure in establishing good emotional responsiveness (73). ADHD-related impairments are also known to affect parenting behavior. According to a meta-analysis of 32 studies, parental ADHD symptoms contributed to harsh parenting behaviors with a variance of 2.9%, to lax parenting behaviors with a variance of 3.2%, and to positive parenting behaviors with a variance of only 0.5%, depending on the child's gender, number of individuals in the family with ADHD, and the method of evaluation (76).

### ADHD in Older Population

Although there is still no consensus on how late in life the diagnosis of ADHD is possible, studies about adults over 60 years with ADHD is rare (77). Nevertheless, the diagnostic criteria used in children and young adults can be applied to some extent in older patients ( $\geq 50$  years), and may correspond to the symptom spectrum in this age group (77). A Dutch study revealed that older adults manifest ADHD symptoms as doing lots of physical activities, sometimes lasting for hours, and having their agendas almost always full, complaining of the shortness of time due to their hobbies or free time activities (78). Some of them also describe themselves as talkative, and some report the existence of an internal restlessness leading to excessive activity, like that of a child (78). It is not rare to observe signs of physical restlessness such as constant head scratching or problems with sitting still (78). Many of the respondents in the study reported restricting themselves from talking a lot, therefore trying to inhibit their verbal impulsivity, as it may result in humorous but also hurtful situations (78). Concentration problems that were encountered in younger ADHD patients seemed to persist in this age group, with difficulty reading a book or official letters, difficulty doing more than one thing simultaneously, or difficulty to concentrate during a boring conversation (78). Low self-esteem, which was

also present in childhood, was rare in this population, however its association with symptom severity is not well-understood (78). The symptom-oriented studies conducted by Guldberg-Kjär et al. (79, 80) in adults aged 65-80 also suggested the persistence of childhood-onset ADHD symptoms even in late adulthood. Additionally, no significant difference was found in levels of quality of life when compared with younger adults with ADHD, however their overall psychological health seems to be better than younger adults with ADHD (81). The age-associated symptom patterns in patients with ADHD is summarized in Table 2.

**CONCLUSION**

With the latest guidelines emphasizing the childhood-onset nature of ADHD and the increasing effect of cultural differences in the diagnosis, it is important to state that the risk of a gender bias for diagnosis still exists (32). This is especially true for child and adolescent psychiatry, as males are more hyperactive and impulsive, therefore resulting in problems in social environments, and females being more inattentive, leading to decreased school performance (32). When the childhood-onset nature of this condition is taken into account and considering that 80% of diagnosed child and adolescent ADHD patients are male, contrary to only 50% of adult patients, it is important to search for an overlooked childhood-onset ADHD that persists in newly diagnosed female adult patients (26). Adolescence is critical for ADHD patients, as females in these ages mostly have anxiety-related symptoms and depression, which may contribute to suicidality, if combined with other life-threatening psychiatric conditions of this age such as anorexia nervosa or bulimia nervosa (82, 83). It is also important to note that concomitant borderline personality disorder, unlike anorexia and bulimia nervosa, do not significantly contribute to mortality and morbidity (84). For adolescent males, the legal and medical consequences of impulsive actions may result in life-long discomfort (66). Addiction is a serious problem in ADHD and generally a result of impulsive behaviors (38). ADHD is a serious problem in addiction medicine (39). Therefore, not only screening for addiction in patients with ADHD, but also a screening for ADHD in substance abuse patients should

be considered, especially when disorders associated with impulsivity such as asocial or borderline personality disorders are present (40, 85). At school age, emotional binding to school through establishing a functioning and constructive teacher-student relationship is required (47). It is also important to note that, children with ADHD are usually the victims of bullying but rarely the bullies themselves (49). In high school and college, psychological support for individuals with ADHD through their problems is of critical importance. These patients have higher drop-out rates, which might result in overall dissatisfaction and feeling of failure (50, 59). The main problem in the work life for ADHD individuals might be widespread working hours, as they tend to stay awake until the late hours. Career counselling to find a fitting career is important, and in the work environment, the education of both employers and employees might raise awareness, therefore contributing to the productivity of individuals with ADHD. Individuals with ADHD have higher turnover of romantic relationships and lower commitment and physical contact, however, they indulge in risky sexual practices more often (62, 65, 66). There is also a great lack of information about LGBTQIA + individuals with ADHD, a population where other psychiatric conditions are common, including suicidality (69). Lack of appropriate or customary parenting behavior may result in behavioral abnormalities in the children of parents with ADHD. The children of these adults may also lack the role model that they need, as individuals with ADHD are more likely to neglect the needs of their children (33, 64, 73). It is important to keep in mind that older adults with ADHD may still have an overall feeling of boredom or emptiness associated with their condition, and this may contribute to suicidality in the older population, when combined with the common presence of depression (80). To summarize, due to delayed diagnosis in childhood, or due to the possibility that its onset was in adulthood, remembering that ADHD is diagnosable in adults is of utmost importance, especially in patients with psychiatric comorbidities that are hard to manage or resistant to therapeutic options (41, 43, 68). When diagnosing, the care provider should overcome gender bias by proper history taking, especially in younger female individuals with suspected ADHD

**Table 2: Phenomena associated with ADHD by age group.**

Children	Young adults	Adulthood	Elderly
<ul style="list-style-type: none"> <li>- Often conflicts with teacher and classmates, leading to low self-esteem</li> <li>- Decreased academic performance (problems with reading comprehension tasks)</li> <li>- Inattention (mostly girls)</li> <li>- Motor hyperactivity, sometimes accompanied by destructive behavior on self or peers (mostly boys)</li> <li>- Addiction to video games</li> <li>- Talkativeness</li> </ul>	<ul style="list-style-type: none"> <li>- Substance abuse</li> <li>- Risky sexual behavior (especially sex under intoxication)</li> <li>- Problems creating emotional or sexual bonds</li> <li>- Small number of friends but a large number of acquaintances</li> <li>- Decreased academic performance (especially in writing tasks)</li> <li>- Anxiety and depression (especially in females)</li> <li>- Addiction to video games</li> </ul>	<ul style="list-style-type: none"> <li>- Harsh or lax parenting behaviors</li> <li>- Stress-management problems</li> <li>- Impulsiveness</li> <li>- Hyper sexuality but less sexual satisfaction</li> <li>- Risky sexual behaviors</li> <li>- Preference for late hours</li> <li>- Inattention</li> <li>- Problems in workplace leading to job loss or inadequate performance</li> <li>- Substance abuse disorders</li> </ul>	<ul style="list-style-type: none"> <li>- Excessive physical activity</li> <li>- Completely full agendas</li> <li>- Shortness of time for hobbies etc.</li> <li>- Talkativeness</li> <li>- Internal and physical restlessness (leading to excessive activities)</li> <li>- Concentration problems (during conversations or reading)</li> <li>- Low self-esteem</li> </ul>

ADHD: Attention deficit hyperactivity disorder

(32). In older patients, it should be kept in mind that ADHD can still be a possible diagnosis (77). Finally, it is important to remember that ADHD is a disorder with many features, and it is the duty of the care provider to explore the unseen ones.

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