EXPERT REVIEWS

Clinical assessment and diagnosis of adults with attention-deficit/hyperactivity disorder

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Attention-deficit/hyperactivity disorder (ADHD) is a prevalent disorder in adult psychiatry, particularly in out-patient settings. There are no objective, laboratory-based tests that can establish this diagnosis. Present diagnostic criteria for ADHD are formulated primarily according to behavior in childhood, based on age inappropriate and impairing levels of hyperactivity, impulsivity and inattention. Other symptoms, such as mood instability and frustration intolerance, are not included in current criteria for ADHD, but are very prevalent in this patient group. ADHD is often comorbid with alcohol and substance abuse and other psychiatric disorders, in particular anxiety and personality disorders. Thus, the diagnostic assessment should both include a comprehensive clinical interview, rating scales for past and present symptoms and collateral information from multiple informants, as well as assessment of a broader spectrum of psychiatric and somatic conditions. As ADHD is associated with changes in brain function mediating different aspects of neuropsychological functions, assessment of those functions is important to understand the symptom patterns and to develop targeted treatment programs. Some topics for further research and for future developments of diagnostic criteria and tools are highlighted.

KEYWORDS: assessment • comorbidity • diagnosis • mood instability • neuropsychology • persistent ADHD

Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder characterized by age-inappropriate levels of motor hyperactivity, impulsivity and inattention. During the past century, the disorder has received many different names and abbreviations, partially reflecting changing views of its etiology and defining clinical features [1]. Until the late 1960s it was generally considered that ADHD was limited to children and adolescents, but it has gradually been realized that a large proportion of adolescents with ADHD continue to experience related problems as adults [2,3]. Although the exact proportion of persistence and prevalence rates of ADHD in adults are not settled, a large body of evidence has accumulated showing that the adults with persistent ADHD not only have a high symptom load, but also suffer from significant impairment [4–9]. Longitudinal studies have demonstrated fluctuations with respect to symptoms of ADHD and between different diagnostic groups [10–12].

Being a prevalent condition in both child, adolescent and adult psychiatry [1,5,8], particularly in out-patients settings, clinicians will frequently encounter individuals in need of diagnostic assessment of possible ADHD, either as a primary concern or comorbid condition [9]. An important challenge is to be aware of the possibility of ADHD when facing patients with problems manifested by different primary complaints or difficulties [13].

We review the clinical characteristics of adults with ADHD, present diagnostic criteria and exemplify co-existing problems. Finally, we emphasize the importance of an integrative assessment, including psychiatric interviews and self-reports, as well as performance-based measures.

Symptoms of ADHD in adults

The core symptom clusters of ADHD, defined as inattention, hyperactivity and impulsivity, are associated with problems remaining focused in a task and for prolonged periods, as well as difficulties in organizing activities, prioritizing tasks

and time management (see **Box 1**). Adults with ADHD will often report that tasks are finished just at deadline, or not at all, that bills are not paid and letters not answered [14–16]. Impulsivity in adults may have other and more serious consequences than during childhood, such as reckless driving, terminating valued relationships or quitting jobs without having any alternative [15,17]. The aimless restlessness and increased activity of childhood may change to become more adaptive and purposeful in adults, and in some adults the restlessness may be felt rather than manifested in overt behavior [15].

Both clinical experience and research have shown that the three core symptom clusters of ADHD only partly reflect the major problems that adults with ADHD encounter in their daily life. Temperament instability, overreacting to frustrations, irritability and poor motivation are frequently reported, and may constitute an even larger obstacle in their daily functioning than the

core symptoms alone [14,16,18]. Due to emotional over-reactivity, an adult with ADHD may be easily provoked and frustration may escalate to anger outbursts, possibly reflecting a deficit in behavioral inhibition [19]. Although such outbursts are usually short-lived, they may strongly interfere with social function [16]. Reactions to minor problems and frustrations may be excessive, and result in feelings of depression, confusion, anxiety or anger [16], causing difficulties both at home, in social interaction and in job situations [15]. Affective lability may be present as a life-long pattern, with shifts from normal mood to depression or to elevated mood or excitement. Mood shifts usually last for hours to a few days, and do not necessarily fulfill criteria for mood disorders as defined in the Diagnostic and Statistical Manual of Mental Disorders (DSM). However, they may resemble the mood shifts characteristic of cyclothymic temperaments as described by Akiskal and coworkers [20].

Box 1. Diagnostic and Statistical Manual of Mental Disorders IV diagnostic criteria of attention-deficit/hyperactivity disorder.

(A) Either (1) or (2):

(1) Six (or more) of the following symptoms of inattention have persisted 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 and fails to finish schoolwork, chores or duties in the workplace (not due to oppositional behavior or failure to understand instructions)
- Often has difficulty organizing tasks and activities
- Often avoids, dislikes or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork and homework)
- Often loses things necessary for task or activities (e.g., toys, school assignment, pencils, books or tools)
- Is often easily distracted by extraneous stimuli
- Is often forgetful in daily activities

(2) Six (or more) of the following symptoms of hyperactivity–impulsivity have persisted 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 situation in which remaining seated is expected
- Often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)
- Often has difficulty playing or engaging in leisure activities quietly
- 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 (e.g., butts into conversation or games)

(B) Some hyperactive-impulsive or inattentive symptoms that cause impairment were present before the age of 7 years.

(C) Some impairment from the symptoms is present in two or more settings (e.g., at school [or work] and at home).

(D) There must be clear evidence of clinically significant impairment in social, academic or occupational functioning.

(E) The symptoms do not occur exclusively during the course of a pervasive developmental disorder, schizophrenia or psychotic disorder and are not better accounted for by another mental disorder (e.g., mood disorder, anxiety disorder, dissociative disorder or a personality disorder).

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All the symptoms seen in the realm of ADHD are examples of behavior that is also observed, with varying frequency, in adults without any mental disorder, particularly in periods of mental stress, sleep deprivation and intercurrent somatic disorders. From a dimensional perspective, ADHD symptoms can be viewed as a continuum, where adults with an ADHD diagnosis represent an extreme of a distribution of individuals with chronic symptoms that are severe enough to result in impairment across different life domains. Assessment of chronicity and impairment is, therefore, required in diagnosing adults with ADHD. The chronicity requirement makes information about behavior in childhood essential to understand present behavior. For example, information about learning disabilities at school may be a primer for the low education level and unemployment that is commonly found in adults with ADHD [21], and information about proneness to injuries due to accidents in childhood is important when evaluating whether driving accidents and other serious accidents are suggestive of ADHD [14,17]. Impairment may be difficult to evaluate, and is obviously influenced by compensatory factors, such as general intellectual capacity and support from significant others. However, it is still essential for a diagnosis of ADHD that the patient is functioning at a level clearly below that of individuals with similar age and educational background.

Current diagnostic systems

The official abbreviation 'AD/HD' was introduced in the current (1994) version of the DSM (DSM-IV) [22], but for convenience it is often abbreviated as 'ADHD', as suggested in a previous edition (DSM-III-R, 1987). In the DSM-IV multidimensional diagnostic system, ADHD is classified as an axis I disorder, but the description of this long-lasting trait is conceptually close to the axis II personality disorders used in adult psychiatry. Indeed, it has been shown that many children with ADHD are diagnosed with personality disorders when they grow up [23,24]. This may suggest that the axis II disorders arise as complications of insufficiently treated ADHD, but may also represent age-dependent manifestations of common, overlapping traits. Similar to other DSM-IV disorders, the criteria for ADHD are based on pure symptom descriptions, without implications regarding etiological factors. The three core symptom clusters are assessed through the 18 items, listed in **Box 1**, together with the other criteria required for an ADHD diagnosis. Three subtypes are recognized: ADHD combined type, ADHD predominantly inattentive type and ADHD predominantly hyperactive-impulsive type.

In many countries, ADHD is assessed according the International Classification of Diseases (ICD) [25], where the syndrome is termed 'hyperkinetic disorder' (HKD) in the current version (ICD-10) [26]. Although wordings of the criteria are somewhat different from the ones in DSM-IV, they are generally interchangeable. However, ICD-10 differs from DSM-IV in not recognizing the same subtypes of ADHD. Patients with predominant or pure attention problems will, therefore, not receive a diagnosis in the ICD-10 system. Studies comparing ADHD patients using the two diagnostic systems have mainly been performed in samples of children. These studies demonstrate that the diagnostic

criteria as defined by ICD-10 and DSM-IV recognize slightly different children. All children diagnosed with ICD-10-HKD fall within the DSM-IV diagnostic criteria. However, relative to DSM-IV, ICD-HKD seems to exclude some children with persistent ADHD symptoms [26], suggesting that the criteria defined in ICD-10 may be too stringent. Further comparative studies are needed to investigate this in samples of adults with ADHD.

The description of symptoms of ADHD in the DSM-IV is based on symptoms and behavior seen in children [14,27], and it has repeatedly been suggested that specific criteria more appropriate for adults with ADHD should be developed. This motivated Paul Wender and colleagues to develop the Utah-criteria in the 1970s [16]. These criteria differ somewhat from those of the DSM-IV. In childhood, symptoms of inattention and hyperactivity, as well as one item from a list of impulsivity symptoms, behavioral problems in school, overexcitability or temper outbursts are required. In adulthood, persistence of both attention problems and motor hyperactivity are required, in addition to the presence of at least two of the following five problems: mood instability (mood shifts that last for hours or at most a few days), disorganization or inability to complete tasks, hot temper (anger outbursts or easily irritated), emotional over-reactivity (difficulty dealing with ordinary stresses of life) and impulsivity (e.g., impulsive buying, other hasty business decisions, driving behavior, initiation or termination of relationships). In this manner, the Utah-criteria take into consideration co-existing symptoms that are common in adults with ADHD, although not part of the DSM criteria. However, the use of the Utah-criteria has been limited in later years, because they fail to identify the predominantly inattentive subtype of ADHD, and because they may not adequately delineate ADHD from affective disorders [28]. Recently, Barkley *et al.* have suggested new items that seem to be more appropriate for adults, reflecting disturbances of executive functioning [14].

Gender differences

In children, gender differences in the prevalence rates of ADHD are pronounced, with at least three-times more boys than girls affected, but in clinical samples of adults this difference is attenuated or not present at all [29,30]. There is no clear-cut explanation for this, but it underscores the fact that adults presenting with ADHD symptoms constitute a group that differs from children with ADHD. A recent population-based study covering the age range of 7–29 years found that gender differences were lower than in clinical samples of children, but quite stable from childhood to adulthood [31], indicating that the gender differences seen in clinical samples may be an effect of referral bias and/or differences in co-existing symptoms and problems, rather than differences in the prevalence of ADHD itself. More research is needed to establish whether criteria or cut-offs on rating scales should be different for males and females.

Co-existing disorders in adults with ADHD

In general, adults with ADHD appear to have poorer mental health, more problems with adjustment, social skills and lower self-esteem than other adults [32]. Furthermore, adults with

ADHD often have other psychiatric disorders [9,33]. Such co-existing disorders should be taken into consideration during assessment and treatment. In some adults, it will be important to treat a comorbid psychiatric disorder prior to treating ADHD symptoms, particularly if the other psychiatric disorder presents acute and highly impairing symptoms, for instance an acute depression or prominent panic attacks. In other adults, the co-existing disorders will not be treated until the core ADHD symptoms are targeted, for example secondary generalized anxiety disorder or dysthymia. Furthermore, the clinician should consider whether the treatment itself induces psychiatric symptoms as a side effect. Stimulants, and possibly also the nonstimulant drug atomoxetine, may induce or worsen affective symptoms, depression, anxiety and irritability [34,35] .

Adults with ADHD commonly report co-existing disorders, such as: depression and anxiety [36,37]; bipolar disorder [9,30]; more often bipolar II than bipolar I [38]; drug abuse or dependence [9,30,37]; antisocial or borderline personality disorders [39]; somatic disorders, such as obesity [40,41]; health problems related to behavior associated with ADHD, such as smoking [42]; learning disabilities, such as dyslexia or specific learning disabilities [43]; and sleep problems [44,45]. Assessment of such co-existing problems is extremely important, both to understand problems related to the daily life of adults with ADHD and for treatment planning. However, it is challenging to distinguish between such comorbid disorders and disorders that should be evaluated as differential diagnoses, because many of the symptoms and problems encountered in adults with ADHD are also found in other psychiatric and somatic disorders. Brief overviews of the most common and important diagnoses that should be excluded in the diagnostic process are presented in **Box 2** and in the following paragraphs.

Differential diagnoses
Depressive disorders
Characteristic symptoms of a major depressive episode may be difficult to differentiate from ADHD symptoms [15]. For example, both disorders are characterized by a reduced ability to concentrate, an inner feeling of restlessness or physical agitation, low

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Box 2. Differential diagnoses.

Psychiatric disorders
- Bipolar disorder (bipolar II)
- Unipolar depressive disorder
- Anxiety disorders
- Obsessive–compulsive disorder
- Impulse control disorders
- Personality disorders (borderline)
- Alcohol and substance abuse

Medical disorders
- Endocrine and metabolic disorders (thyroid disorders)
- Neurological disorders (including traumatic brain injury)
- Sleep disorders (obstructive sleep apnea)
- Side effects of drug treatment

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self-esteem and sleep disturbances. This makes it difficult to diagnose ADHD in the presence of an ongoing depressive episode. However, symptoms related to depression should remit in periods between depressive episodes, whereas symptoms of ADHD should be present continuously. Still, patients with chronic depressive symptoms may date these problems back to childhood. Furthermore, medication used in the treatment of ADHD may both mimic and exacerbate symptoms of depression. As a general rule, if a diagnosis of major depression is probable, this should be treated first, and ADHD treated thereafter if symptoms are still present. However, in some situations both disorders should be treated concurrently, for instance by combining medication and cognitive–behavioral therapy [46].

Anxiety disorders
Anxiety is clearly associated with inattention, and there are overlapping symptoms between ADHD and generalized anxiety disorder. ADHD patients will often have strong emotional reactions that may mimic panic attacks [15] and the symptoms associated with a post-traumatic stress disorder may be difficult to differentiate from ADHD. Many ADHD patients present with turbulent and traumatic experiences, and symptoms of post-traumatic stress disorder may resemble ADHD symptoms. Furthermore, onset of anxiety symptoms is common in childhood, and the age criterion may, therefore, be less useful in distinguishing anxiety disorder from ADHD. If possible, it may help to identify the direction of symptoms, for example, whether it is a primary inability to concentrate and not to get work done (ADHD) that causes the stress and anxiety or the opposite.

Bipolar disorders
According to current diagnostic criteria [22], both ADHD and bipolar disorder (BD) are characterized by symptoms involving dysregulation of energy, activity, affect and impulsivity. Unlike ADHD, classical BD (bipolar I disorder) is a well-established diagnosis in adult psychiatry, and clear, full-blown manic episodes are easily distinguishable from ADHD symptoms. Some family studies have not shown a strong relationship between susceptibility to bipolar I disorder and ADHD [47,48]. However, in recent years the concept of BD has been broadened, including patients who were formerly diagnosed with unipolar depression. The episodic versus the chronic nature of BD and ADHD, respectively, has been considered to be a main factor in differentiating the two disorders in adults. However, there is now increasing evidence that affective temperaments, life-long dysregulation of mood, and other chronic symptoms are important parts of the phenomenology of bipolar spectrum disorders [49]. Furthermore, increased motor activity has been found to be even more characteristic of hypomanic episodes than elevated mood [50]. A detailed history of symptom appearance may be helpful in differentiating the two disorders, as the age of onset is generally lower for ADHD than for BD. However, the phenotype of juvenile BD, including the age of onset criteria, is currently being discussed among child psychiatrists, parallel to the debate on the developmental course and phenotype of ADHD in adulthood [51]. Therefore, it has become

increasingly difficult to categorize many patients with a mixture of mood instability, impulsivity, irritability and restlessness into clearly defined ADHD or bipolar disorder [30].

Borderline personality disorder

There are a number of overlapping symptoms between ADHD and borderline personality disorder (BPD), and age of onset of symptoms may be of limited value in the differential diagnosis, since adults with BPD show high rates of symptoms and behavior typical for ADHD in retrospective assessment of childhood symptoms [52]. The two disorders also have a similar profile of comorbid disorders, such as drug abuse, anxiety, depressive and bipolar disorders [9,53]. However, symptoms such as suicidal or self-mutilating behavior, chronic feeling of emptiness and stress-related paranoid symptoms are not typically seen in ADHD patients, and may be used to differentiate the two disorders [15,22]. On the other hand, both longitudinal and cross-sectional studies have demonstrated high rates of comorbidity between BPD and ADHD, implying that the presence of one of the disorders should not necessarily exclude the other [54–56].

Alcohol & substance abuse

It is difficult to evaluate psychiatric symptoms in patients with ongoing alcohol or drug abuse, and the substance use disorder should ideally be treated or stabilized before assessment of ADHD. Still, it may be difficult to determine whether the ADHD symptoms are related to early onset 'genuine' ADHD, or if they are a consequence of such abuse. Although special caution is required before prescribing stimulants to individuals with a history of substance abuse, it is important to recognize that the treatment of underlying ADHD could be protective against subsequent substance abuse [57].

Clinical assessment of ADHD symptoms & associated function
Clinical interview

A comprehensive clinical interview with the patient forms the basis for a proper evaluation of an adult patient presenting with symptoms suggestive of ADHD (see **Box 3**). Irrespective of whether patients are assessed in specialized units, or in general out-patient or hospital wards, clinicians diagnosing adult ADHD patients should have a broad knowledge base and experience from recognizing the most important psychiatric syndromes and their combinations (NICE, 2008 [201]). Although

ADHD is considered to be a common condition in both children and adults, it is not included in standard structured psychiatric interviews, such as the Structured Clinical Interview for DSM disorders (SCID) [58] or the Mini-International Neuropsychiatric Interview (MINI) [59]. Versions of the SCID and MINI developed for use in children (KID-SCID [60] and MINI-KID [61]) include sections for the assessment of ADHD, conduct disorder and oppositional-defiant disorder, but are not intended for use in adult patients. However, the MINI-Plus version of the MINI interview has extensive coverage of general psychopathology [59] and a separate module for ADHD, containing questions pertaining to both child and adult behavior. Although the wording of the questions concerning the diagnostic assessment are comparable, and in accordance with both DSM- and ICD diagnoses, the

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Box 3. Clinical assessment of attention-deficit/hyperactivity disorder in adults.

Current problems related to ADHD
- Difficulty concentrating, forgetfulness, difficulty organizing activities, restlessness and impulsivity

Associated symptoms
- Irritability, aggression, mood instability and sleep problems

Previous diagnosis of ADHD?
- Drug treatment?

Family history
- Presence of ADHD, depression, bipolar disorder or other serious psychiatric disorders in first-degree relatives?

Complications during pregnancy or delivery?

Problems during early development (motor activity and language)?

ADHD-related problems before the age of 7 years:
- Increased activity level?
- Problems interacting with other children?

ADHD-related problems during the first years of school:
- High activity level?
- Difficulty concentrating?
- Conduct problems?
- In need of special support or contact with school psychologist?

Work
- Frequent change of jobs?

Social
- Married/cohabiting?
- Frequent change of partners?

Use of tobacco, alcohol or illegal use of drugs?

Criminality?

Somatic diseases?

Psychiatric disorders?
- Depression?
- Bipolar disorder?
- Anxiety disorder?
- Psychoses?

Information from relatives (parents, siblings and spouse) or others who know the person well.
Information from school records, previous contact with psychologists, doctors or other relevant sources.
ADHD: Attention-deficit/hyperactivity disorder.

MINI-Plus is easier to use, and takes less time to complete than the SCID interview. Since evaluation of psychiatric comorbidity is an important aspect of any ADHD assessment, the MINI-Plus is a very useful tool both for the assessment of ADHD and for psychiatric disorders in general. The MINI-Plus has been translated into several languages and has been used in different patient populations [30,39].

The separate ADHD module of the MINI-Plus allows a systematic assessment of ADHD symptoms and guidelines for diagnosis. The questions are almost similar to those of the DSM-IV and ICD-10, covering symptoms of inattention, hyperactivity/restlessness and impulsivity. However, since there is still a lack of a defined 'gold standard interview' for diagnosis of ADHD in adulthood, a positive score on this ADHD module, as on other interviews for adult ADHD, is not sufficient for the diagnosis. Still, we would recommend its use in a general assessment of adult psychopathology, both in clinical and research settings, to ensure that ADHD is covered in the same way as other disorders that are more familiar to adult psychiatrists.

We will also mention some other diagnostic interviews, developed specifically for adult ADHD (reviewed in [62,63]). Conners' adult ADHD diagnostic interview for the DSM-IV (CAADID) is a commercially available structured interview that has proven useful in the process of diagnosing adult ADHD. More recently, the Dutch diagnostic interview for ADHD in adults (DIVA), developed by Kooij and Francken in 2007, has been translated into several different languages [202]. The Brown Attention Deficit Disorder Scale (BADDS) is a 40-item scale administered in the form of an interview, covering a wide range of symptoms related to inattention, ability to organize activities, sustaining energy and effort and memory [64]. However, ADHD symptoms of hyperactivity and impulsivity are not sufficiently addressed in BADDS [63].

Collateral information

To obtain a better understanding of the social impact of symptoms, the assessment should not exclusively be based on information from the patient. A major obstacle in the evaluation of adults is the time span from the start of symptoms in childhood. Many patients present for evaluation when they are in their 30s or 40s (and some are even older). They may have limited recollection of their childhood, and if they remember, it is difficult to determine the accuracy of the information. Preferably, information should also be obtained from significant others who have known the patient during childhood (e.g., a parent or sibling). Semi-structured interviews intended for the assessment of childhood ADHD, for example, the ADHD module of the Schedule for Affective Disorders and Schizophrenia (Kiddie-SADS) [203], may be adapted and used for this purpose. In the absence of such data, school records from the first years in school or the patient's recollection of the first year in school may be a proxy for information about preschool years. In addition, collateral information may also be important with regard to evaluation of current symptoms, level of impairment, and may be helpful if malingering is suspected.

Rating scales

In addition to the clinical interview and collateral information, it is useful to employ self-report forms. Several self-report scales have been developed specifically for adult ADHD [62,63]. They address ADHD from slightly different perspectives, and may all contribute with valuable information regarding severity and course of symptoms. However, it is important to cautiously interpret the results, since factors such as item positioning have been shown to influence symptom scores [65]. The Adult ADHD Self-Report Scale (ASRS) is the WHO's rating scale for adult ADHD and is designed to measure current ADHD symptoms [204]. It consists of 18 items based on DSM-IV symptoms/criteria adapted to adults with ADHD that are measured on a five-point scale (0 = never/seldom and 4 = very often). The items 1–9 cover the symptoms of inattention; items 10–18 the symptoms of hyperactivity and impulsivity. ASRS has recently been translated into many different languages [66,204] and normative data and information on psychometric properties are available for several populations [62,67]. A shorter screening version of ASRS has also been developed [68]. The Conners' Adult ADHD Rating Scale – Long Version (CAARS-L) covers symptoms of inattention, hyperactivity and impulsivity, and items related to emotional lability and problems with self-concept, with a total of 66 items [63,69]. Age- and sex-based norms for US populations are available, and collateral versions are available for collecting information from significant others. The Wender Utah Rating Scale (WURS) is designed to retrospectively record symptoms and signs of ADHD in childhood [70]. The scale exists in different versions, one commonly used variant contains 25 questions, each rated on a five-point severity scale (WURS-25). The WURS-25 has been validated by several investigators in different countries and populations and normative data are available from these studies [52,71]. Other rating scales for retrospective assessment of childhood symptoms may also be used [72]. Functional impairment scales, such as the Weiss Functional Impairment Rating Scale (WFIRS), have been useful in clinical work and research [73]. As an increasing number of different rating scales are published, it is important for the clinician to get familiar with a limited number of validated scales, available in the relevant language, allowing for proper training and accumulation of sufficient personal experience [62,74]. Importantly, the main purpose of these rating scales is to screen for ADHD, or to evaluate the treatment efficacy, but they are in general not sufficient as diagnostic tools.

Neuropsychological assessment of adults with ADHD

Impairment of executive functions is regarded as core cognitive deficits in the daily life of adults with ADHD [75–77]. In a recent article, Barkley and Murphy emphasize the importance of these deficits by describing impairment of response inhibition of motor, verbal, cognitive and emotional activities and self-regulation as essential to understand symptoms of ADHD [78]. For example, emotional impulsivity is described as an impairment of cognitive inhibition. To obtain self-regulation of an emotion, it must be moderated by what they refer to as metacognition. However, not all cognitive deficits reported in adults with ADHD can be

explained within the concept of executive function [79]. Studies by Dockstader and colleges have demonstrated the importance of alterations in somatosensory processing [80] and in what they refer to as 'perceptual set' [81] in adults with ADHD. Furthermore, the slowness of cognitive processing and learning disabilities that have been reported in studies of children [82,83] are also expected to influence everyday functioning of adults with ADHD.

Although prominent cognitive deficits in adults with ADHD are shown to affect performance on a wide range of neuro-psychological tests [84,85], cognitive deficits reported in the daily life of an individual with a diagnosis of ADHD are not always identified by psychometric tests [86]. A meta-study of children and adolescents with ADHD reported that only approximately 30–50% displayed an executive dysfunction on standard test measures [75]. This lack of universality suggests that a standard neuropsychological test procedure may miss out important characteristics of individuals with ADHD [87]. First of all, the tests currently used may not be sensitive enough to detect the mild cognitive impairment that is obvious in the complexity of daily life. In a test situation, the adult may be able to use cognitive resources to compensate for impairment of executive dysfunctions. One method to detect everyday cognitive deficits is to combine results from performance-based tests with information from behavioral rating scales [78,88], for example, by including the Behavior Rating Inventory of Executive Function (BRIEF) [89]. Furthermore, tests based on theoretical models of attention may give more detailed information about strengths and difficulties than more traditional tests. This has been demonstrated in studies using the Attention Network Test [90], showing that both adults [91] and children [92] with ADHD are more variable, less accurate and slower than expected. Similar findings have also been reported in studies using Continuous Performance Tests [85,93] and Go/No-Go tasks [94]. Finally, one should consider whether the sensitivity of different test measures is dependent on noncognitive factors, such as the profile of behavioral and emotional symptoms, gender and age. Symptoms of emotional lability, frequently reported in adults with ADHD [30], are shown to influence neuropsychological test results [94,95]. The association between the neural system, gender and ADHD symptoms was emphasized in a recent study [96], and it is well known that the cognitive function of an individual may change over the course of development [97].

Questions about malingering may be raised as part of a neuro-psychological examination of individuals with ADHD, who may be motivated to obtain a diagnosis due to external incentives (e.g., access to medication). Persons who have been instructed to simulate ADHD are able to mimic the pattern of deficits of ADHD patients, but both their ADHD symptoms and performance on tests of cognitive function tend to be exaggerated [98]. Therefore, neuropsychological tests designed to detect malingering, such as the Test of Memory Malingering, should be considered to be part of a neuropsychological examination [99].

In conclusion, to characterize the function of individual adults with ADHD it is important to include a clinical neuro-psychological assessment as part of an integrated approach. No single psychometric test or self-report questionnaire assessing cognitive function has in itself high enough positive predictive value to validate the ADHD diagnosis. Rather, the results are important to understand the symptoms presented by the patients, to give advice regarding school or work, and hopefully also to develop treatment programs similar to the ones developed to remediate cognitive function in children [100,101].

Psychophysiology & activity monitoring

Various brain imaging and electroencephalographic techniques are increasingly being used in research settings to study brain function in ADHD [102,103], but their role in the routine diagnosis of adult ADHD patients remains to be established. There is also a long tradition using skin conductance tests in the evaluation of children with ADHD. Reduced skin conductance, indicating reduced activation, may be found in these patients [104]. However, studies of ADHD patients are ambiguous [105], and the test has at present no place in the evaluation of adults with ADHD symptoms. Actigraphy is a well-established method and has been in use for many years, mainly in sleep studies and in the routine evaluation of sleep disorders. It has also been used in studies on ADHD patients [106,107]. It provides information regarding the level of motor activity and on activity patterns [108,109]. However, at present the method is not being used in the routine assessment of patients with ADHD.

Medical evaluation

A medical evaluation is important to differentiate between ADHD and other causes of ADHD symptoms, and to evaluate contraindications to drug treatment (mainly stimulants). Many different somatic conditions, including neurological, endocrine and metabolic disorders, can give symptoms that mimic classical ADHD symptoms [110]. A careful history, with recording of when the symptoms started, will often help to exclude ADHD. A special case is ADHD symptoms that develop after traumatic brain injury after the age of 7 years. Although this should not be confused with idiopathic ADHD, the response to stimulants may be similar [111]. Cardiovascular disorders are not important in the differential diagnosis of ADHD, but a comprehensive evaluation is necessary before treatment with stimulants. An ECG will help to exclude patients with conduction disorders that may be aggravated by stimulants. In patients with hypertension, stimulants may increase blood pressure [112]. Evaluation of thyroid function is particularly important. Disorders of the thyroid gland are common in adults, and there is an increased prevalence of such conditions in patients with ADHD or mood disorders [113].

Expert commentary

Attention-deficit/hyperactivity disorder is a prevalent disorder in adult psychiatry, particularly in out-patient settings. There are no objective, laboratory-based tests that can establish the diagnosis. Current diagnostic criteria that were formulated in the 1994 edition of DSM and slightly rephrased in the DSM-IV TR edition [22] are mainly a result of historical traditions, research and consensus in the field of child and adolescent psychiatry. The criteria have

resulted as a compromise between many opposing views and are not equivocally supported by empirical findings. The requirement that symptoms should start before the age of 7 years in the DSM-IV was chosen mainly for practical reasons. Mood instability is not included in current criteria for ADHD, but is very prevalent in this patient group, in addition to other symptoms of mood disorders. Evaluations should include a comprehensive clinical interview, preferably using a structured format, supplemented by the use of rating scales for past and present symptoms, and collecting collateral information from multiple informants. Neuropsychological evaluation may be important to understand the symptoms and tailor treatment procedures to individual patients. Finally, we emphasize that the procedure recommended to diagnose ADHD should not be different, or more difficult, than assessment procedures for other psychiatric disorders, which are all still descriptive in nature. The main obstacle in diagnosing ADHD in adult psychiatry is the lack of awareness of ADHD as a possible differential diagnosis, both in research and clinical settings, as reflected by the lack of implementation of ADHD in commonly used screening tools for general psychopathology.

symptoms, which could also pave the way for more specific, targeted prevention or treatment programs. Recently, factor analytic studies have indicated that ADHD symptoms are the expression of underlying general (g-factor) and partially distinct (specific) latent components of inattention and hyperactive-impulsive symptoms [114,115]. This model may explain the variability in symptom profiles over time within the ADHD group, as well as why distinct etiological influences can converge within the syndrome.

It is still unclear how many changes will be implemented in the fifth edition of the DSM, scheduled for publication in May 2013 [205], but it seems that the age of onset criterion for ADHD is likely to be raised from 7 to 12 years [116]. Employment of 12 years as age of onset will probably not significantly elevate prevalence rates of ADHD [117–119]. It is also possible that cut-off levels for some symptoms should be adjusted for adults [118].

As new generations of mental health professionals are trained, they will not only have to adjust their clinical practice to changing diagnostic criteria, but also to new developments in neuroscience that may lead to fundamentally new ways of diagnosing mental disorders [120].

Five-year view

Although ADHD is currently defined by a cluster of symptoms defining a disorder that starts early and possibly persists throughout life, there is an urgent need to develop more developmentally specific diagnostic criteria and age-appropriate scales for measuring impairment. This will not only be useful for diagnosis, but also define relevant treatment targets in clinical studies. As research on adult ADHD is intensified, we will have access to more information about specific genetic and environmental risk factors. Combined with brain imaging and functional studies, such investigations may reveal discrete pathways leading to ADHD

Key issues

- Attention-deficit/hyperactivity disorder (ADHD) is a common disorder in the adult population, with a prevalence of 4–5%.
- Diagnosis is made according to Diagnostic and Statistical Manual of Mental Disorders IV criteria, adjusting for changing presentation in adults compared with children.
- A detailed clinical interview is mandatory for diagnosis, but information from parents or others who have known the patient in childhood is important.
- Affective dysregulation is a common feature in adults with ADHD.
- ADHD is often comorbid with other psychiatric disorders, in particular mood and anxiety disorders, personality disorders and drug/alcohol abuse.
- Medical evaluation is important in order to rule out somatic disorders that can mimic ADHD symptoms and for evaluation of contraindication to treatment with stimulants.
- A neuropsychological evaluation can add valuable information regarding sensorimotor and cognitive function.
- Diagnostic assessment of ADHD is not principally different or more difficult than assessment of other psychiatric disorders.

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