DOCUMENT SUMMARY A comprehensive clinical review by Thomas E. Brown examining ADHD as a developmental impairment of executive functions rather than a behavioral disorder, with practical guidance for assessment and treatment in clinical practice.

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FORMATTED CONTENT

ADD/ADHD and Impaired Executive Function in Clinical Practice

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The disorder currently known as **attention-deficit disorder (ADD)** or **attention-deficit/hyperactivity disorder (ADHD)** is now recognized by most clinicians as a legitimate and widely prevalent disorder among children and adults. Yet there is still widespread misunderstanding as to the disorder's nature. Many clinicians mistakenly continue to think of this as a behavior disorder characterized by hyperactivity in children and excessive restlessness or impulsivity in adults. In fact, **ADD/ADHD is essentially a cognitive disorder, a developmental impairment of executive functions (EFs), the self-management system of the brain**. Although **EFs** are complex, their impairment constitutes a syndrome that can be recognized readily in clinical practice; impaired **EF** involves a pattern of chronic difficulties in executing a wide variety of daily tasks. Once recognized, this disorder can be effectively treated in most cases. In this article, I describe the nature of **EF impairments in ADD/ADHD** and how the syndrome can be recognized and effectively treated in clinical practice. (Note: The term **ADHD** is used in the balance of this article to refer to both inattentive and combined subtypes.)

Introduction

For decades, the disorder currently known as **attention-deficit/hyperactivity disorder (ADHD)** has been understood as a disruptive behavior disorder of childhood that usually remitted in early

adolescence. Research over the past decade has caused a major shift in understanding **ADHD**. It is now clear that many individuals suffering from **ADHD** have never had significant behavior problems; their difficulties are primarily in focusing their attention on necessary tasks and using **working memory** effectively. **ADHD** is now increasingly recognized as **developmental impairment of executive functions (EFs), the brain's cognitive management system** [1•–4•].

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Contrary to earlier understandings, recent research has also revealed that impairments of **ADHD** often are not apparent in early childhood but may become noticeable only in junior high, high school, or early adulthood, when the individual is required to self-manage an increasingly wide range of tasks. **Epidemiologic research has estimated prevalence of ADHD among adults to be 4.4% of the population 18 to 44 years old** [5•].

As this revised understanding of **ADHD** is becoming better known and more widely discussed in publications and popular media, psychiatrists and general physicians who treat adults increasingly are being approached by their patients with queries such as, "Do I have **ADHD**?" or with requests for prescriptions for medication to treat symptoms presumed to be those of **ADHD**. In some cases, parents are approaching their physicians to report that their children have been diagnosed and successfully treated for **ADHD** and that they realize they also have this disorder and want to be treated for it.

As most physicians' training did not include assessing and treating **ADHD** in adults, it is important for information about this newly understood syndrome to be readily available to general physicians and to psychiatrists. This article provides practical information to assist physicians in recognizing the new paradigm for understanding **ADHD** as it is seen in clinical practice. It also includes information about clinical assessment and treatment of this syndrome in adults.

ADHD as Impairment of Executive Functions

In the context of **ADHD**, the term **executive functions** refers to a wide range of central cognitive functions that play a critical role for all individuals as they manage multiple tasks of daily life. One model of **EF** includes the following six clusters of cognitive functions that tend to be impaired in individuals with **ADHD**. Descriptions of each function are listed below:

1. Activation

Organizing tasks and materials, estimating time, prioritizing tasks, and getting started on work tasks. Patients with **ADHD** describe chronic difficulty with excessive **procrastination**. They often put off getting started on a task—even a task they recognize as very important to them—until the last minute. It is as if they cannot get themselves started until the point at which they perceive the task to be an acute emergency.

2. Focus

Focusing, sustaining focus, and shifting focus to tasks. Some describe their difficulty in sustaining focus as similar to trying to listen to the car radio when driving too far away from the

station, at which point the signals begins fading in and out: you get some of it and lose some of it. They say they are distracted easily not only by things that are going on around them but also by their own thoughts. In addition, focus on reading poses difficulties for many. Words are generally understood as they are read but often have to be read over and over for the meaning to be fully grasped and remembered.

3. Effort

Regulating alertness, sustaining effort, and processing speed. Many with **ADHD** report they can perform short-term projects well but have much more difficulty with sustained effort over longer periods of time. They also find it difficult to complete tasks on time, especially when required to do expository writing. Many also experience chronic difficulty regulating sleep and alertness. They often stay up too late because they cannot shut their head off. Once asleep, they often sleep like dead people and have a big problem getting up in the morning.

4. Emotion

Managing frustration and modulating emotions. Although the **DSM-IV** does not recognize any symptoms related to managing emotion as an aspect of **ADHD**, many with this disorder describe chronic difficulties managing frustration, anger, worry, disappointment, desire, and other emotions. They speak as if these emotions, when experienced, take over their thinking as a computer virus invades a computer, making it impossible for them to give attention to anything else. They find it very difficult to get the emotion into perspective, to put it to the back of their mind, and to get on with what they need to do.

5. Memory

Using working memory and accessing recall. People with **ADHD** very often report that they have adequate or exceptional memory for things that happened long ago but great difficulty remembering where they just put something, what someone just said to them, what they have just read, or what they were about to say. They may describe difficulty holding one or several things "on line" while attending to other tasks. In addition, individuals with **ADHD** often complain that they cannot pull information they have learned out of memory when they need it.

6. Action

Monitoring and regulating self-action. Many individuals with **ADHD**, even those without problems of hyperactive behavior, report chronic problems in regulating their actions. They often are too impulsive in what they say or do and in the way they think, jumping too quickly to inaccurate conclusions. People with **ADHD** also report problems in monitoring the context in which they are interacting. They fail to notice when other people are puzzled, hurt, or annoyed by what they have just said or done and thus fail to modify their behavior in response to specific circumstances. They also often report chronic difficulty in regulating the pace of their actions, in slowing self and/or speeding up as needed for specific tasks.

> All the problems described in this model of EF are difficulties for everyone at various times. Those legitimately diagnosed with ADHD differ from others in that they are significantly impaired by chronic difficulty with these cognitive functions.

All the problems described in this model of **EF** are difficulties for everyone at various times. Those legitimately diagnosed with **ADHD** differ from others in that they are significantly impaired by chronic difficulty with these cognitive functions. Individuals with **ADHD** differ from one another in their profiles of impairment, but most experience chronic difficulty in each cluster of this model.

It should be emphasized that this model includes some cognitive functions that are not included in the **DSM-IV** diagnostic criteria for **ADHD** (eg, regulation of emotion). Managing emotion is an important aspect of the brain's self-management system; this function protects individuals from becoming overwhelmed by emotion as they weigh their priorities in many tasks of daily life.

Situational Variability of Symptoms

One major source of misunderstanding about **ADHD** is the **situational variability** of its symptoms. Patients with **ADHD** typically report that they can focus their attention very well for a few specific tasks in which they have strong personal interest or when they feel immediate pressure to complete a specific task. Thus, they may be relatively unimpaired by their chronic **ADHD** symptoms while they play a favorite sport, complete an enjoyable mechanical task, or communicate with others on the Internet. Their chronic **procrastination** may suddenly disappear the night before they are required to hand in an important report or when a colleague is working beside them.

> Seeing an individual's ability to focus very well and work productively under such circumstances may cause some to see ADHD impairments as a simple lack of willpower (eg, "If you can do it here and now, why can't you do it then and there?"). However, the cause of this situational variability is essentially chemical.

Seeing an individual's ability to focus very well and work productively under such circumstances may cause some to see **ADHD** impairments as a simple lack of willpower (eg, "If you can do it here and now, why can't you do it then and there?"). However, the cause of this **situational variability** is essentially chemical. When an individual is confronted with a task that he or she personally finds genuinely appealing or that is truly frightening because of probable negative consequences, the brain instantly provides chemical stimulation to activate relevant **EFs** [6,7]. These chemical activations are not subject to voluntary control any more than erectile dysfunction is.

Age at Onset of ADHD Symptoms

DSM-IV diagnostic criteria include a requirement that at least some symptoms of **ADHD** must have been present before the age of 7 years, but no empiric justification for this stipulation has ever been established. **Faraone and colleagues** [8•] compared a sample of adults who met all diagnostic criteria for **ADHD**, including the early age at onset (7 years), with a sample of adults who met all **ADHD** diagnostic criteria except for the age at onset requirement. They found no significant differences between those two groups in their patterns of psychiatric comorbidity, functional impairment, or familial transmission.

Data from this study and others suggest that clinicians should be flexible in regard to age at onset for **ADHD** symptoms and not refuse the diagnosis to a patient who shows significant

impairment and meets the other diagnostic criteria, even if such impairments were not noticeable until adolescence or beyond.

> This later age at onset for some patients makes sense because the cognitive functions impaired in ADHD are among the slowest brain functions to fully mature.

This later age at onset for some patients makes sense because the cognitive functions impaired in **ADHD** are among the slowest brain functions to fully mature. Brain functions that provide infrastructure for **EFs** do not fully come online until the late teens or early 20s. For some affected individuals, impairments of **ADHD** may not be noticeable until they are challenged with increased demands for self-management typically not presented until late adolescence or early adulthood.

Clinical Assessment of ADHD Impairments of Executive Function

Brown [2•] has reviewed current controversy in the field regarding how best to assess **EF impairments** associated with **ADHD**. Some researchers measure **EF impairments** associated with **ADHD** using a battery of **neuropsychological tests** (eg, the **Wisconsin Card Sort** or **Stroop**) that have long been used by psychologists for assessing traumatic brain injuries or schizophrenia [9]. When such measures have been used to assess patients with **ADHD**, only about 30% show significant impairment of **EF**; this has led some to conclude that **EF impairment** is a comorbidity associated with **ADHD** in only about one third of cases. In contrast, other researchers [10,11] have argued that **neuropsychological "tests of EF"** are not adequate for assessing **EFs** because they do not test for the integration of cognitive functions, a critical component of **EF**.

Barkley et al. [3•,4•,12] and **Brown** [1•,2•,13] have argued that **EF impairments** associated with **ADHD** are more easily and more validly assessed by querying patients and, when possible, a collateral (eg, spouse, sibling, or close friend) with **rating scales** and **clinical interviews** about the adequacy of their ability to manage a variety of tasks in daily life. They maintain that **EF impairments** are characteristic of all patients with **ADHD**.

Biederman et al. [14] tested a **behavior rating scale** to assess **EF impairments** in a sample of adults with **ADHD**; their data showed that scores above the 50th percentile identified individuals with the most severe functional outcomes from their **ADHD**. **Kooij and colleagues** [15] tested several **self-report rating scales** designed to assess **ADHD** impairments in adults. They found that adults who self-report their symptoms and score above specified cutoffs on the **Brown ADD Rating Scale for Adults** [16] or the **DSM-IV**—based **ADHD Rating Scale** tended to qualify fully for a clinical diagnosis of **ADHD**.

Clinical Tailoring of Medications for Impairments of Executive Function in ADHD

Several **stimulant medications** and one **nonstimulant medication** are currently approved by the US Food and Drug Administration for treatment of **ADHD** in adults. Details about recommended dosing for each are readily available [3•]. However, careful fine-tuning is required for **stimulant medications** for **ADHD**; these agents tend not to follow mg/kg guidelines for

many patients. Effective dosing of **stimulants** is not related consistently to age, weight, or symptom severity; the critical variable is sensitivity of the individual patient's body chemistry to the particular medication used. Dosing for **atomoxetine**, the **nonstimulant medication** approved for treating **ADHD**, is weight based.

> Good clinical practice involves starting each patient with a minimal dose of stimulant and then titrating gradually to find the optimal window between a dose that is too low and one that is too high for this specific patient.

Good clinical practice involves starting each patient with a minimal dose of **stimulant** and then titrating gradually to find the optimal window between a dose that is too low and one that is too high for this specific patient. Also important for establishing an optimal dosing regimen is questioning the patient about how this medication is working at different times during the day relative to tasks of school or employment and other household or social functions that may occur outside of normal working hours. Patients vary considerably in their needs for medication coverage for their **ADHD** symptoms at various times of each day.

One possible source of confusion in adjusting **stimulant medication** dosing is **rebound**, a problem that is often misunderstood. The medication being taken likely is being dosed too high or is just not well suited for that patient if he or she is experiencing any of the following during the hours a **stimulant** should be working: excessive irritability, feeling too "wired" (as if the patient has had too many cups of coffee), or blunting of affect so the patient can get work done but lose his or her "sparkle" and sense of humor.

However, if these symptoms are not present during the hours in which the medication is expected to be effective but do appear during the hours the medication is likely to be wearing off, such problems may be due to **rebound** (ie, the blood level may be dropping too quickly, causing the patient to "crash"). **Rebound** often can be alleviated by administering a small dose of the immediate-release version of the same **stimulant medication** shortly before the time of day when the **rebound** onsets, smoothing the curve so the drop-off is more gradual.

For some, adequately adjusted medication alone is sufficient treatment for their **ADHD**. For others, additional interventions, such as **cognitive-behavioral therapy**, may be indicated. **Ramsay and Rostain** [17•] have published guidelines for assessing and implementing such integrated treatments.

One practical problem that many clinicians find burdensome is providing monthly refills for **stimulant medications** for **ADHD**. Recent changes in the **Drug Enforcement Administration** regulations now allow physicians to provide a patient stabilized on **stimulant medications** for **ADHD** with three prescriptions, each dated for a 1-month supply. The first is to be dated for the current month; two additional prescriptions, each dated for 1 sequential month, can then be given. Refills are still not allowed for these **schedule II drugs**, but this postdating arrangement reduces excessive paperwork considerably for busy clinicians. Documentation of the new regulations can be found online at http://www.deadiversion.usdoj.gov/fed_regs/rules/2007/fr1119.htm .

Other Disorders Comorbid With ADHD

Kessler et al. [5•,18] have shown that adults with **ADHD** are six times more likely to suffer one or more additional psychiatric disorders in their lifetime than individuals without **ADHD**. This

means that any individual diagnosed with **ADHD** is likely to have been diagnosed with another disorder that may or may not be concurrent. In some cases, a patient may need concurrent treatment for **ADHD** and a previously diagnosed disorder. **Brown** [13,19•] provides detailed information about treating **ADHD** with **comorbid disorders**.

Conclusions

> This new understanding of ADHD as developmentally impaired EFs is gaining increasing support from research and the experience of a wide variety of clinicians who recognize this syndrome in their adult patients and witness these patients' positive response to appropriate treatment.

This new understanding of **ADHD** as developmentally impaired **EFs** is gaining increasing support from research and the experience of a wide variety of clinicians who recognize this syndrome in their adult patients and witness these patients' positive response to appropriate treatment. Although some with **ADHD** report symptoms that have persisted from early childhood, for many of those affected, significant impairments of **ADHD** do not clearly appear until adolescence or early adulthood, when they are faced with increasingly challenging demands to self-manage their schooling, employment, and other aspects of daily life.

Although this is a complex syndrome, diagnosing **ADHD** in adults does not require esoteric **neuropsychological tests**. This syndrome can be more effectively diagnosed with **clinical interviews**, normed **self-report** and **collateral report rating scales**, and screening for possible **comorbid psychiatric disorders**. In assessing for **ADHD**, clinicians need to keep in mind that symptoms of this disorder are **situationally variable**, that affected individuals generally have a few specific domains in which they may be able to manage themselves quite well despite chronic impairments in their ability to exercise **EFs** in most other situations. Clinicians who familiarize themselves with this syndrome can provide to affected patients treatment that is usually quite effective and, for many, very helpful.

Disclosure

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