

IMPACT OF EXECUTIVE FUNCTION DEFICIT ON ADHD COURSE AND PROGNOSIS

Essay

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Abbreviations

AAN American academy of neurology

ADD Attention deficit disorder

ADHD attention-deficit/hyperactivity disorder

BA Brodmann area

BOLD Blood oxygenated levels

CD Conduct disorder

CBT Cognitive behavioral therapy

CNS Central nervous system

CRF Cardiorespiratory fitness

DAT1 Dopamine transporter 1

DCD Developmental coordination disorder

D-KEFS Delis–Kaplan executive function system

DLPFC Dorsolateral prefrontal cortex

DRD4 Dopamine receptors D4

DRD5 Dopamine receptors D5

DSM Diagnostic statistical manual

EA (or EB) Executive actions (or executive behavior)

EC Executive cognition

EEG Electroencephalogram

EF Executive function or executive functioning

EFDD Executive function deficit disorder

fMRI functional magnetic reasoning imaging

GABA Gamma amino butyric acid

GAD Generalised anxiety disorder
HSS High-span subject
ICD International classification of diseases
IGT Iowa gambling task
IQ Intelligence quotient
LSS Low-span subject
MMSE Mini-mental state examination
MoCA Montreal cognitive assessment
MRI Magnetic resonance imaging
OCD Obsessive-compulsive disorder
ODD Oppositional defiant disorder
PASS Planning, attention, simultaneous, and successive processes
PCP Primary care practitioner
PET positron emission tomography
PFC Prefrontal cortex
PKU Phenyl ketonuria
PTSD Post-traumatic stress disorder
rCBF regional cerebral blood flow
RST Reading span test
SAS Supervisory attentional system
SCR Skin conductance response
SCWT Stroop color-word test
SNAP-25 Synaptosomal-associated protein 25

SPECT single-photon emission computerized tomography

SSRI Selective serotonin reuptake inhibitor

TMT trail making test

TVCF Test of verbal conceptualization and fluency

UK United Kingdom

US United States

VLPCF Ventrolateral prefrontal cortex

VSAT Visual serial addition task

WCST Wisconsin card sorting test

WHO World Health Organization

WM Working memory

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Introduction

Attention deficit hyperactivity disorder (ADHD) is one of the most prevalent and heritable behavioral disorders of childhood. The disorder is characterized by onset of age-inappropriate hyperactivity, impulsivity and inattentiveness before the age of 7 years (*Asherson et al., 2007*).

Generally, children are brought to their physicians because parents or teachers are concerned that the child's behavior is preventing him or her functioning normally at home, in school, or in other settings. In the majority of cases, teachers are the first to suggest that a child might have ADHD (*Parens and Jonston, 2009*).

Numerous longitudinal studies now support the conclusion that ADHD is a relatively chronic disorder affecting many domains of major life activities from childhood through adolescence and into adulthood (*Barkley, 2006*), however, ADHD symptoms have been shown to change with age (hyperactivity and impulsivity behavior decrease, while inattention increasingly becomes predominant) (*Coghill et al., 2008*).

Studies have indicated that, compared to their peers without ADHD, young people with ADHD also exhibit higher levels of comorbidity with other psychiatric disorders as ODD (oppositional defiant disorder), CD (conduct disorder), anxiety disorder and depression, and with somatic conditions such as asthma. Furthermore, they have an increased risk of accidents and severe injury (**Roijen et al., 2007**).

For ADHD, these types of comorbidity could be represented by residual ADHD in adults or the emergence of an affective syndrome at sometimes in the course of ADHD (**Elia et al., 2008**).

Unlike the psychiatric model, in which inattention has been linked primarily to disruptive behavior, neurological models tend to emphasize linkage of attention to memory and to a cluster of other cognitive function often labeled “executive function” (EF) (**Brown et al., 2000**).

This term is used to describe a spectrum of the brain’s control processes that integrate, focus, activate, and prioritize other neurological functions to allow the individual to function effectively, and on which external demands increase as humans develop, and become more

complex and important as maturity continues (*Rickel and Brown, 2007*).

This was based on the observation that prefrontal lesions sometimes produce behavioral hyperactivity, distractibility or impulsivity as well as deficits on EF tasks, whereas EF involves multiple disturbed neural networks that include the thalamus, basal ganglia and prefrontal cortex (*Sinzig et al., 2008*).

Aim of the work

The aim of this work is to:

- (1) Distinguish the areas of overlap between the symptoms of ADHD and those of executive function (EF) deficit.
- (2) Highlight the impact of EF deficit on the course and prognosis of ADHD.

Definition

Attention deficit hyperactivity disorder (ADHD), similar to hyperkinetic disorder in the ICD-10 is a psychiatric disorder of the neurodevelopmental type (*Sroubek et al., 2013*) in which there are significant problems of attention, hyperactivity, or acting impulsively that are not appropriate for a person's age (*Childress & Berry, 2012*). These symptoms must begin by age 6 to 12 and persist for more than 6 months for a diagnosis to be made (*Dulcan & Lake, 2011*).

Epidemiology

ADHD is estimated to affect about 6–7% of people aged 18 and under when diagnosed via the DSM-IV criteria (*Willcutt, 2012*). When diagnosed via the ICD-10 criteria rates in this age group are estimated at 1–2% (*Schachar et al., 2007*).

The ICD-10 system requires, in addition to at least 6 inattention symptoms (from a list of 8), the presence of at least 3 (of 5) hyperactive symptoms and at least 1 (of 4) impulsive symptoms. The application of these more restrictive criteria results in that fewer patients with this diagnosis than with DSM ADHD, with people meeting

ICD-10 criteria being more severely impaired (*Cowen et al., 2012*). If the same diagnostic methods are used, the rates are more or less the same between countries (*Tsuang et al., 2011*).

It is diagnosed approximately three times more often in boys than in girls (*Singh, 2008*). This difference between sexes may reflect either a difference in susceptibility or that females with ADHD are less likely to be diagnosed than males (*Staller & Faraone, 2006*).

Rates of diagnosis and treatment have increased in both the United Kingdom (UK) and the United States (US) since the 1970s. This is believed to be primarily due to changes in how the condition is diagnosed (*Lange et al., 2010*) and how readily people are willing to treat it with medications rather than a true change in how common the condition is (*Cowen et al., 2012*).

Etiology

The cause of most cases of ADHD is unknown; however, it is believed to involve interactions between biological and environmental factors (*Thapar et al., 2013*).