Attention Deficit Hyperactivity Disorder

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INTRODUCTION

In recent years, advances in brain imaging techniques, genetic studies, psychosocial investigations, and studies of related disciplines have put forward compelling arguments that ADHD is much more complicated than anyone initially thought.
Attention Deficit Hyperactivity Disorder

• The DSM-V defines ADHD as a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or the development of one or two of the following:
  • Inattention
  • Hyperactivity and Impulsivity.
  • Inattentive or hyperactive-impulsive symptoms were present prior to age 12.
  • Inattentive or hyperactive-impulsive symptoms are present in two or more settings.
  • There is clear evidence the symptoms interfere with social, academic, or occupational functioning.
  • The symptoms do not occur exclusively during the course of another psychotic disorder and are not better explained by another mental disorder.
Attention Deficit Hyperactivity Disorder

ICD 10 code classification

• Developmentally inappropriate inattention, impulsivity, and hyperactivity.

• Originates in childhood. More frequent in males than females.

• Disorder marked pattern of inattention, hyperactivity, or impulsivity that is inconsistent with developmental level and clearly interferes with functioning at least in two settings. At least some symptoms must be present before the age of 7 years old.
ADHD: Endophenotypes

• Diagnosing ADHD and understanding that individual’s ADHD profile are two separate concepts. Establishing a diagnosis of ADHD is a useful starting point, but it should be followed by the quantitative determination of strengths and weaknesses on a finite set of dimensional measures that can serve as Endophenotypes.

• Endophenotypes are proposed to intermediate between genotype and phenotype, and can be defined as “heritable, quantitative traits that index an individual’s liability to develop or manifest a given disease.”
What are Endophenotypes?

- Endophenotypes are rooted in a biological etiology rather than in the symptoms of a clinical disorder.
- Endophenotypes are not a new concept in psychology. Schizophrenia, bipolar, Alzheimer’s, have all been studied as endophenotypes.
- Endophenotypes typically consist of four characteristics:
  1) They occur significantly, but are not universal, within the condition.
  2) They can be measured by tools with psychometric properties.
  3) There is evidence of heritability.
  4) There is the presence of familial-genetic overlap.
ENDOPHENOTYPE: Heritability

• ADHD is a highly prevalent (15%) and strongly heritable (70-75%) neurodevelopmental disorder (e.g. IQ is highly heritable).

• Family studies, parent and child neuropsychological profile analysis.

• Adoption Studies.

• Twin Studies.

• Testing unaffected siblings versus controls.

• Neuro-diagnostics.
Neuroimaging

• Associations with ADHD
  - Volumetric differences have been found in the dorsolateral prefrontal cortex, the dorsal anterior cingulate cortex, the caudate nucleus, the putamen and the globus pallidus.
  - Abnormalities have also been consistent in cortical regions and the cerebellum.

• Evidence of Heritability
  - Twin studies demonstrate the volume of certain brain regions is heavily influenced by genes, thus supporting heritability of ADHD.

• Presence of Familial-Genetic Overlap
  - Reduced volumes of relevant brain regions have been found in ADHD groups and unaffected siblings, particularly in the prefrontal gray matter and left occipital gray and white matter.
  - Other research suggests cerebellar reductions are affiliated with ADHD heritability.
Electrophysiology

• Associations with ADHD
  - Individuals with ADHD demonstrate greater slow-wave activity and reduced alpha and beta waves, indicating hypoarousal in frontal regions.

• Evidence of Heritability
  - Genetic factors contribute significantly to EEG measures, which support genetic influence.
The Role of Neuropsychotherapy

• Term Neuropsychotherapy dates back to 1913, Sir William Osler, later in the 1950s Dr. Reitan, Dr. Luria and others systematically began to measure cognitive brain functioning along side neurosurgery and neurology prior to the advent of neuro-diagnostic measurements. Later correlative analysis between neuropsychological data and neuro-diagnostic findings were utilized.

• Neuropsychological examination is a comprehensive process that evaluates an individual’s cognitive abilities (strengths/weaknesses), diagnostic clarity, treatment planning.

• Objective data that is compared to matched/known neurocognitive samples. Statistical correlation and configuration is obtained with discriminant functions.
The Neuropsychological Examination

A typical NPE assesses these areas

- General Intellect
- Achievement Skills (i.e. Math, Spelling, Reading, etc.)
- Higher Order Cognitive Skills (i.e. organization, planning, problem solving, abstraction)
- Attention
- Processing speed/cognitive flexibility of thinking
- Learning & Memory
- Language
- Visual-spatial Skills
- Motor Coordination
- Behavioral and Emotional Functioning
ADHD: Proposed Endophenotypes

1) Inattention
2) Hyperactivity
3) Impulsivity
4) Reaction Time/Processing Speed
5) Executive Functioning
History of Reaction Time

• In 1986, reaction time (RT) was termed for inattention with slowed processing. As of today, DSM/ICD does not differentiate inattention from reduced reaction time.

• In 2001, research suggested that RT symptoms can form a factor distinct from other ADHD dimensions, including inattention.

• The construct of RT grew out of efforts to identify the differences between subtypes of ADD and ADHD. ADHD-I could not account for all the variability that was seen in children since the 1980s.
RT Symptoms

1. Daydreaming
2. Mentally foggy/easily confused
3. Stares a lot
4. Spacey, mind is elsewhere
5. Lethargic
6. Under-active
7. Slow-moving/sluggish
8. Doesn’t process questions or explanations accurately
9. Drowsy/sleepy appearance
10. Apathetic/withdrawn
11. Lost in thoughts
Neuropsychological Endophenotypes

Reaction Time and Processing Speed.

• Individuals with ADHD may demonstrate difficulty with processing speed and reaction time however can attend.

• RT is typically replicated in the ADHD profile.

• Check processing speed in all sensory modalities.
Assessment of RT

• Start with the rule-outs
  • Sleep
  • Medical contributors: hearing loss, anemia, nutritional shortfalls, etc.
  • Consider family history
  • Consider environmental demands
  • Mood and coping
• What you should do:
  • Multi-method/multi-informant
• What you should not solely do:
  • Performance:
    • Processing speed measures
    • Fluency measures
    • Rapid naming measures
    • Computer-based reaction time measures
    • Observations of approach to tasks, responding
    • Ratings: parent, teacher, self
Executive functioning

- Response inhibition
- Working memory
- Emotional control
- Flexibility
- Sustained attention
- Task initiation
- Planning/prioritization
- Organization
- Time management
- Goal-directed persistence
- Metacognition
Executive functioning

Executive Functions

• Certain individuals with ADHD may demonstrate reduced performance on measures of executive functioning.

• Inhibitory control is commonly found deficit in individuals with ADHD.

• Although there is a strong association between deficits of executive functioning and ADHD, these deficits are not universal in individuals with the disorder.

• Age is a strong moderator in the relationship between ADHD and EF.
Prefrontal Brain System

• The prefrontal brain system plays a key role in the development of executive skills.
• The frontal lobes direct our behavior and link our behaviors together so we can learn from past experiences, and help us control our emotions and behaviors.
• Cerebral-cerebellar circuit and cortical basal ganglia circuit.
• When does EF stop developing?
Common Conditions Related to Executive Functioning Deficits

- Attention-Deficit/Hyperactivity Disorder (ADHD)
- Disorder of Written Expression
- Dyscalculia
- Dyslexia
- Autism Spectrum Disorder (ASD)
- Nonverbal Learning Disability (NVLD)
- Mood Disorders
- Acquired Brain Injury
- Neurological Conditions
- Cancer Treatments
- Fetal Alcohol Syndrome (FAS)
Not Just Being Lazy: Can’t vs Won’t

• Parents, teachers and others involved with a child with executive function difficulties must be careful not to attribute the particular production deficits they observe to character flaws or consciously chosen states of mind, such as laziness, lack of motivation, apathy, irresponsibility, or stubbornness.

• Rather, these behaviors can be a result of inadequate activation of executive function capacities that are necessary for regulating perceptions, feelings, thoughts and actions.
Conclusion

Proper diagnosis leads to proper treatment.

• Accurately identifying cognitive deficits and strengths help provide more information regarding remediation, medication management, psychoeducation to parents and child, etc.

• Accurately identifying cognitive strengths to utilize within the academic arena, build self esteem, provide information for educational/career planning, etc.

• School planning in terms of 504 plan/IEP. Etc.

• Lastly, the most realistic conclusion will be the understanding of polyphenotypes, the integration and blending of endophenotypes.
References


References

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