A New Understanding of ADD/ADHD and Executive Functions

Thomas E. Brown, PhD
Associate Director,
Yale Clinic for Attention and Related Disorders
Department of Psychiatry
Yale Medical School

High IQ and Underachievement

Many students with high IQ show academic underachievement
Often blamed on:
laziness
boredom
insufficiently challenged
resistance to authority
substance abuse
depression or anxiety
May be any of the above, but may also be ADHD

Outline

1. A new understanding of ADD/ADHD
2. Executive functions develop gradually
3. Relationship of EF to LD & other disorders

Thomas E. Brown, Ph.D.
Dept. of Psychiatry
Yale Medical School
www.DrThomasEBrown.com
Prevalence and Genetics of ADHD

- 7.5% of children; 4.4% of adults
- Male-female: 6:1, 3:1, 1:1
- All levels of IQ
- All levels of socioeconomic status
- Family genetic transmission: 0.8
- Inheritance not specific to subtype


ADHD Genetics: Heritability Coefficient

18 year old college dropout
Honor student in hs; failed out of college

- “We could hardly wait to get out of hs…and our nosey parents”
- “Nobody cared when I went to bed or when I up got up or whether I went to class.”
- “Just their being around…”

Brown, 2005

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1. A New Understanding of ADD/ADHD

“Focus” and Executive Function Impairments of ADHD

- In DSM-IV “inattention” symptoms of ADHD
  - Do not mean
    - Unable to focus as in holding the camera still to take a photo of an unmoving object
  - Do mean
    - Unable to focus as in focusing on the task of driving a car

ADHD Symptoms Overlap With “Executive Functions” (EF)

- Wide range of central control processes of the brain
- Connect, prioritize, and integrate cognitive functions—moment by moment
- Like conductor of a symphony orchestra
Brown’s Model of Executive Functions Impaired in ADHD

Symptom Characteristics
- Dimensional, not “all-or-nothing”
  - Everyone sometimes has some impairments in these functions; in ADHD, it is a chronic, severe impairment
- Situational variability: “If I’m interested”
  - Most persons with ADHD have a few activities where ADHD impairments are absent

ADHD looks like a willpower problem, but it isn’t!

Executive Functions

1. Activation
   - Trouble getting started on work
   - Difficulty organizing tasks
   - Misunderstands directions

Brown’s Model of Executive Functions Impaired in ADHD

Brown TE. 2005

Brown TE. Brown ADD Scales; 1996.
2. Focus, Shift, and Sustain Attention

- Loses focus when trying to listen or plan
- Forgets what was read, needs to re-read
- Easily distracted-internal/external

3. Regulate Alertness, Effort, and Processing Speed

- Difficulty regulating sleep and alertness
- Quickly loses interest in task, especially longer projects; doesn’t sustain effort
- Difficulty completing task on time, especially in writing—“slow modem”

4. Manage Frustration, Modulate Emotion (Not included in DSM-IV criteria)

- Emotions impact thoughts, actions too much
- “Can’t put it to the back of my mind”
- Overreacts to frustration, hurts, wants, or worries
5. Utilize Working Memory, Access Recall

- Forgets to do planned tasks, where things have been put, what intended to say (difficulty holding info “bits” on-line while attending to other tasks)
- Difficulty recalling learned material ("search engine" of brain has difficulty activating stored memories when needed)

6. Monitor and Self-Regulate Action

- Difficulty in monitoring situation and self at same time
- Impulsive, does tasks too fast, not careful enough
- Difficulty in adjusting actions to setting

The New Paradigm

ADD/ADHD =
developmental impairment of executive functions

Developmental impairment = not emerging or developing as expected
2. Executive functions develop gradually & are challenged gradually

Development of Brain Structures that Support Executive Functions

- Structures and functions that support EF are not fully developed at birth
- Shortly before puberty, massive cortical growth & extensive synaptic pruning
- Brain myelination increases 100% during the teenage years
- Development of EF capacities continues into early adulthood


Executive Functions and Scaffolding

- In early childhood, others perform all executive functions for the child (parents, teachers, sibs and other caretakers)
- Scaffolding is provided by showing, directing, helping, reminding, coaching, critiquing
  (Examples: walking, getting dressed, crossing street, riding bike, driving car)
- Scaffolding is gradually withdrawn, as child becomes able to (or is forced to) perform these functions for self
- In adolescence & adulthood scaffolding may be provided by: friends, teachers, coaches, spouses, supervisors
Executive Functions: Development and Demands

- EF capacity develops through childhood, into adolescence, and beyond; it is not fully present in early childhood
- Environmental demands for EF increase with age, from preschool through adulthood
- EF impairments often are not noticeable by age 7!

When Are ADHD Impairments of EF Noticeable?

- Some are obvious very early and are noticeable in preschool years
- Some are not noticeable until middle elementary or junior high
- Some are not apparent until child leaves home to go to college or later
- Some emerge only later when confronted with increased EF challenges of adulthood

Challenges May Reveal Weaknesses

Cardiac weaknesses may not be noticeable in EKG taken while lying quiet on a table, but may be very noticeable while playing basketball, shoveling snow

EF weaknesses may not be noticeable until one’s self-management is challenged by increased demands of adult life
How Can Executive Functions Become Impaired?

- Developmentally, eg, ADHD
- Trauma, eg, traumatic brain injury
- Disease, eg, Alzheimer’s disease
- In trauma and disease, the patient usually has had adequate EF, then loses it
- In ADHD, EF has not developed adequately

3.

How are ADD/ADHD related to LD & other psychiatric problems?

ADHD vs LD
Separate entities?

Some think:
ADHD = chemical problem in brain
LD = “hard-wiring” problem in brain
Current research suggests that ADHD and LD may not be so separate
Evidence suggests shared genetic etiology in Reading Disorder and ADHD (Willcutt, Pennington & DeFries, 2000)
**Working Memory**
plays crucial role in:

- **Reading**
  - learning to read-integrating fragments
  - recalling & comprehending
- **Math**
  - recall of facts and procedures
  - computation & problem-solving
- **Written Expression**
  - organizing & elaborating

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**Reading Comprehension**
(3 Items on Brown ADD Scales)

- Distracted frequently when doing **required reading**: keeps thinking of things that have nothing to do with what is being read.
- Loses track in required reading of what has just been read and needs to read it again; understands the words, but what was read “just doesn’t stick.”
- Remembers some of the details in required reading but has difficulty grasping the main idea.

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**Reading & ADHD**

- Reading is often impaired in children, adolescents and adults with ADHD
- 25% of persons with ADHD are dyslexic (vs. 5% of general population)
- ADHD impairments of working memory, processing speed, attention, etc. often impair reading, even if there is no dyslexia

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Thomas E. Brown, Ph.D.  
Dept. of Psychiatry  
Yale Medical School  
www.DrThomasEBrown.com
Psychiatric Comorbidities in adults with ADHD

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1Impulse = antisocial pd, ODD, CD, Intermittent explosive disorder, bulimia, Gambling (from Ntcn Comobidity Survey- Replication data presented by R.Kessler at APA, 5/1/04)

Other problems don’t eliminate possibility of ADHD or vice-versa
- Specific Learning Disorders
- Substance abuse
- Depression
- Anxiety
- OCD
- Asperger’s Disorder (autistic spectrum)

**ADD/ADHD is a foundational disorder that increases vulnerability to LD & other disorders**

How Is ADHD Related to Comorbid Disorders?
- **ADHD**: developmental impairment of executive functions that organize and regulate many specific functions of mind cf: impaired orchestra conductor
- **Comorbidity**: ADHD with 1 or more specific mental functions also impaired cf: orchestra player(s) + conductor impaired eg: reading comprehension vs dyslexia
Impairment?

- Is student’s functioning significantly impaired relative to apparent ability?
- Has impairment been fairly consistent over time and/or exacerbated with increasing challenges?
- Functioning OK on tasks with strong personal interest or “gun to head”?

8 Measures of EF Impairment

- **Working Memory** Index +/- or **Processing Speed** Index ≥ 1 SD below VCI or POI
- **Story Memory** Test Score (CMS/WMS) ≥ 1 SD below Verbal Comp Index
- T-score on any of the 5 cluster scores on Brown ADD Scale ≥ 65
- Overall impairment of EF = ≥ 4 of 844 or more of 8

Brown, Patterson, Quinlan, 2003

WISC-IV & WAIS-III
Index Scores Discrepancies to Assess ADHD

- Index Scores [VCI, POI] less sensitive to problems in attention, memory, processing speed
  vs
  - Index Scores [WMI, PSI] more sensitive to these problems

(Brown, Manual for Brown ADD Scales for Children & Adolescents 2001)
Verbal Working Memory assessment

- Digit Span test (esp. backward) picks up some impairments of working memory
- another important aspect can be tested with story memory test of WMS-III (Logical Memory Subtest)
- compare individual score to verbal IQ
- many with ADHD 1 SD or more below VIQ

VIQ vs. Prose Memory Index:

Prose Memory Index= Logical Memory Score on Wechsler Memory Scale-R (transformed into IQ-type score) (Quinlan & Brown, 2003)

126 High IQ Patients with ADHD
4 age groups
- Charts of 126 consecutive children, adolescents and adults
- Seen in specialty clinic for ADHD
- Ages 6-40 yrs
- Fully met DSM-IV criteria for ADHD
- VIQ and/or PIQ ≥ 120 (top 9% of pop.)
- Predom Inattentive 63%; Combined 37%

Brown, Patterson & Quinlan, 2003
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Yale Study of High IQ Adults with ADHD

- 103 treatment seeking adults (not representative of all high IQ)
- Ages:
  29% 18 to 29 yrs
  32% 30 to 39
  39% 39 to 63
- 72% male
- fully met DSM-IV criteria for ADHD
  - Verbal + or Performance IQ ≥ 120 (9%)

Brown & Quinlan, 1999

Educational & Vocational Achievement

- 98% completed high school
- 56% completed at least 4 yr college degree
- 22% completed advanced degree
  (M.S., J.D., M.D., Ph.D.)
- 42% dropped out of post-secondary school at least once (some later returned)
- 41% currently in low-skilled, unskilled jobs

Brown & Quinlan, 1999

38 yo woman

- reading sentences in kindergarten
- “almost a genius”
- gifted classes until high school
- Dropped from TAG classes - hw
- Outstanding in theatre & sports
- Admitted to excellent university
- Kicked out middle of 2nd year
26 yo man

- “I've always had a hard time making choices”
- “Keep trying things out and then I get bored”
- Dropped out of college after switching major x5
- 7 jobs in past 4 years
- “always have to keep changing channels.”

Brown, 2005

Key Points

- EF develop gradually infancy to 20+ yrs
- ADHD = developmental impairment of EF
- Impairment in emotion regulation is aspect of ADD syndrome
- ADHD meds often alleviate EF impairments
- EF impairments underlie comorbid dx

My Website

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