Understanding ADHD: Misconceptions, Myths and Evidenced-based Facts

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# Disclosures (T. Wigal)

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<th>Consultant</th>
<th>Advisory Board</th>
<th>Speaker’s Bureau</th>
<th>Research Contract</th>
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Other Acknowledgements

- NIMH MTA Grant: MH02042
- NIMH PATS Grant: IUO1MH60903-01A1
- Public Health Service Research Grant: MO1RR00827 from the National Center for Research Resources
How to tell a cure still isn't at hand...
WHY NO CURE IN SIGHT?  
It’s Complicated

- STARTING WITH THE DEFINITION AND THE DIAGNOSIS

- What is ADHD?

- How is ADHD diagnosed?
What is ADHD?

Attention-Deficit/Hyperactivity Disorder (AD/HD) is a brain-based disorder that causes inattention, hyperactivity, and impulsivity at a level that exceeds that of others of a similar age and gender.
ADHD: Impact of Untreated & Under-Treated ADHD

Health Care System
- 50% ↑ in bike accidents\(^1\)
- 33% ↑ in ER visits\(^2\)
- 2-4 x more motor vehicle crashes\(^3-5\)

Patient
- 3-5x ↑ Parental Divorce or Separation\(^11,12\)
- 2-4 x ↑ Sibling Fights\(^13\)

School & Occupation
- 46% Expelled\(^6\)
- 35% Drop Out\(^6\)
- Lower Occupational Status\(^7\)

Society
- Substance Use Disorders: 2 X Risk\(^8\)
- Earlier Onset\(^9\)
- Less Likely to Quit in Adulthood\(^10\)

Employer
- ↑ Parental Absenteeism\(^14\)
  and Productivity\(^14\)

1. DiScala et al., 1998
2. Liebson et al., 2001
3. NHTSA, 1997
4-5. Barkley et al., 1993; 1996
7. Mannuzza et al., 1997
8. Biederman et al., 1997
9. Pomerleau et al., 1995
10. Wilens et al., 1995
11. Barkley, Fischer et al., 1991
14. Noe et al., 1999
Advantages of ADHD

High energy level

Highly Creative

Good at multitasking

Can hyperfocus (if interested)

Good responder in crisis situations

Quick learner

Risk taker
Some Myths of ADHD

- 1) Only affects children; you grow out of it
- 2) Ritalin has paradoxical effect in treatment (e.g., stimulation calms)
- 3) Possibility of addiction to other substances is high later
- 4) Brain scans can diagnose it
- 5) Poor Diet causes it
Who is affected?

ADHD affects 9.5% of children (3-17) in US
(50% of all mental health referrals in kids)

4.5% of adults affected in the US

Diagnosed more often in boys (12%) than girls (4.7%)

Societal Costs --- over $50 billion/yr

National Health Interview Survey (2011)
ADHD: Across the Lifespan

- Inattention
- Hyperactivity
- Impulsivity?

11
Adult ADHD

Adults have more issues than children because they have more “load”:

• Procrastination is easier
• Chaotic lifestyle - because more to balance – usually without help
• Difficulty organizing workspaces
• Being late/forgetting appointments
• Difficulty remembering
• Motivational problems
Myths & Misconceptions

- Causes of ADHD

- Diagnosis of ADHD

- Treatment of ADHD
What Causes ADHD?

Genetic Studies of ADHD

Overall, the “heritability” of ADHD is higher than any other psychiatric disorder (except bipolar).

We know that there are genetic factors at work, but... do not know all the genes.

It’s COMPlicated.
What causes ADHD?

ADHD is a heterogeneous behavioral disorder with multiple etiological sources.

- Altered brain structure and chemicals
- Brain infection or brain injury
- Genes and G X E interactions
- Environmental factors

CNS = Central Nervous System
Causal Factors

• Genes: Average heritability of 0.85
  – Environmental factors contribute to the expression, severity, and course
• Genes involved:
  – Dopamine transporter (DAT1) gene implicated
  – 7 repeat of dopamine receptor gene (DRD4)
    Plus some Gene x environment interactions
• Dysfunction in prefrontal lobes
  – Involved in inhibition, executive functions
• Abnormal activation observed – on both attention & motivational tasks
• Differences in size of Prefrontal cortex, Corpus callosum, caudate nucleus in midbrain

Kieling, Gondaves. Tannock. & Castellanos. 2008; Mick &. Faraone, 2008
Motivation Deficit in ADHD is Associated with Dysfunction of the Dopamine Reward Pathway

Published in MOLECULAR PSYCHIATRY 2011

• Disruption of the dopamine reward pathway is associated with motivation deficits in ADHD

• DA Pathway originates in midbrain and projects into Frontal Lobe

• ADHD individuals are less “receptive to rewards” so children label everything as “boring”

• Nora D. Volkow, M.D.,1,2 Gene-Jack Wang, M.D.,3,4 Jeffrey H. Newcorn, M.D.,4 Scott H. Kollins, Ph.D.,5 Tim L. Wigal, Ph.D.,6 Frank Telang, M.D.,2 Joanna S. Fowler, Ph.D.,3,4 Rita Z. Goldstein, Ph.D., Nelly Klein, PhD., Jean Logan, Ph.D.,3 Christopher Wong, M.S.,3 and James M. Swanson, Ph.D.6
Lack of Motivation
or
Room with a view?
Brain Structure & Function

• Differences in brain maturation, structure and function (particularly abnormalities in frontal to midbrain circuitry):
  - Prefrontal cortex
  - Basal ganglia
  - Cerebellum (motivation and emotion)

• These areas of the brain are associated with important abilities:
  - Attention, motivation and short-term memory
  - Response inhibition, emotion and reward
Neurotransmitters

• Neurotransmitter differences, particularly in levels of:
  • Dopamine
  • Norepinephrine

• Dopamine has been associated with reward (approach and pleasure-seeking behaviors) and attention

• Norepinephrine plays a role in emotional regulation and attention
Neurotransmitters suspected to be primarily involved in ADHD

**Dopamine**
- Midbrain - Prefrontal
- Enhances Signal
- Improves Attention
  - Focus
  - Vigilance
  - On-task behavior
  - On-task cognitive

**Norepinephrine**
- Prefrontal
- Dampens Noise
  - Distractibility
  - Shifting
- Executive operations
- Increases Inhibition
  - Behavioral
  - Cognitive
  - Motoric

Increasing Dopamine can enhance interest and motivation

- PET scans doing boring math task with and without methylphenidate (MPH)
- When doing math task with MPH, Ss reported increased interest in task
- MPH during math task increased DA levels in the synapses

What Contributes to the Origin of ADHD?

Possible Causes of ADHD

- Bad Parenting
- Sugar or Food Additives
- Pregnancy issues
- Neurotoxin exposure
- Television Watching
- Genetic Factors

Research Support:
Myths & Misconceptions

- Causes of ADHD
- Diagnosis of ADHD
- Treatment of ADHD
You've played 6 hours straight! I think we've found a cure for ADHD. What level you on now?

Attention Deficit Hyperactivity Disorder Home Test

Mental Health Humor © 2010 Terms of Use: Free for Non-profits blogs and websites with proper credit & Backlink
What do we pay attention to?

• Things that are personally interesting
• Some new (or novel) situations
• Some challenging situations
• A deadline
• Situations resulting in a reward or consequence
ADHD: DSM 5 Criteria

Inattention

Six or more (5 in adults) of the following — manifested *often*:

- Inattention to details/makes careless mistakes
- Difficulty organizing
- Fails to finish tasks
- Avoids tasks requiring mental effort
- Seems not to listen
- Forgetful
- Loses things
- Easily distracted
- Difficulty sustaining attention

DSM-5, 2013
ADHD: DSM-5 Criteria

**Impulsivity/Hyperactivity**

Six or more (5 in adults) of the following – manifested *often*:

**Impulsivity**
- Blurts out answer before question is finished
- Difficulty awaiting turn
- Interrupts or intrudes on others

**Hyperactivity**
- Fidgets
- Unable to stay seated
- Inappropriate running/climbing (restlessness)
- “On the go”/very active
- Difficulty in engaging in leisure activities quietly
- Talks excessively

DSM- 5, 2013
ADHD DSM-5 Criteria

Symptoms of inattention or impulsivity/hyperactivity

A. have persisted for $\geq$ 6 months
B. have onset prior to age 12
C. Some symptoms in two or more settings
D. cause *significant impairment* in social, academic, or occupational functioning
E. are not better accounted for by another disorder

DSM-5, 2013
SECONDARY PROBLEMS MAY INCLUDE SOCIAL ISOLATION
# Rating Scales for Children

<table>
<thead>
<tr>
<th>Parent (or Teacher) Scales</th>
<th>Content</th>
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<tbody>
<tr>
<td>SNAP Scate (Swanson, Nolan and Pelham)</td>
<td>This is a 4-point severity scale that evaluates 18 of the patient’s childhood ADHD symptoms as described in DSM-5. ‘0 or 1” not a symptom; “2 or 3” is a symptom</td>
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<tr>
<td>Vanderbilt Checklist for ADHD</td>
<td>This is a 4-point severity rating scale that evaluates a broad range of symptoms using 35 questions</td>
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<tr>
<td>Child Behavior Checklist (Achenbach Scales)</td>
<td>There are a variety of rating scale that evaluate behavior and cognitive symptoms associated with attentional problems as manifested in school or home</td>
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<tr>
<td>Conners Attention Rating Scale</td>
<td>Designed for parents and adults to elicit information relative to attention and affect</td>
</tr>
<tr>
<td>Self Rating scales</td>
<td>NOT USEFUL IN CHILDREN UNDER 12</td>
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Comorbidity

ADHD seldom comes alone:

- 75% at least one other disorder

Average: 3 comorbid disorders
MTA Group, Archives General Psychiatry, 1999
(Comorbidities in the MTA Sample, n= 579)

In the MTA sample, 69% had comorbid conditions

Impairment was found with:

Peers
Family
Self-esteem
Development of Comorbidities
ADHD is associated with multiple impairments and the development of comorbidity

- Antisocial behavior
- School exclusion
- Substance abuse
- Conduct disorder
- Lack of motivation
- Complex LD

Age (years) 4 6 10 14
ADHD and sleep patterns: Comorbidity or Side Effect

• Difficulty …
• going to bed on time: 78%
• falling asleep within 20 min: 70%
• sleeping through the night: 50%
• getting up in the morning: 70%
• daytime sleepiness: 62%
• This pattern of difficulties over the lifetime is found in 60% of ADHD who are not treated with medication
Sleep loss causes appetite problems

Leptin (satiety hormone) and ghrelin (hunger hormone):

- 13 studies in adults and 8 in children: all conclude that sleep loss is associated with increased BMI
- Reducing sleep duration by 2 hours is known to lower levels of leptin, the satiety ("fullness") signal
- Sleep restriction study: leptin ↓ by 18% leading to increased appetite and ghrelin ↑ by 28%, incr. feelings of hunger
- Sleep loss is also a risk factor for insulin resistance and type 2 diabetes

Overlapping Diagnostic Criteria: Differential Diagnosis of Comorbid Conditions

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<tr>
<th></th>
<th>ADHD</th>
<th>GAD</th>
<th>Mania</th>
<th>Depression</th>
<th>CD/ODD</th>
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<tr>
<td>Restlessness</td>
<td>X</td>
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<tr>
<td>Poor concentration</td>
<td>X</td>
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<td>X</td>
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<td>Increased activity</td>
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<td>X</td>
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<tr>
<td>Distractibility</td>
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<tr>
<td>Irritability</td>
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Factors That May Delay Diagnosis of ADHD

Female sex

Inattentive subtype

Highly supportive family – prevent impairment

Good social skills – “halo” effect

High Ability or Intellectual level
IQ and ADHD

- IQ can compensate for the impairments of ADHD
- Can forestall diagnosis of ADHD

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<th>Profession</th>
<th>Can Diagnose</th>
<th>Can Prescribe</th>
<th>Can Provide Therapy</th>
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<tr>
<td>Psychiatrists/Psychiatric Nurse Practitioners</td>
<td>yes</td>
<td>yes</td>
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<tr>
<td>Neurologists</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
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<tr>
<td>Family Physicians/Pediatricians/PA</td>
<td>yes</td>
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<td>no</td>
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<tr>
<td>Psychologists</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
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<tr>
<td>Clinical Social Workers, Mental Health Counselors</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
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Standard Assessment Instruments at the AVIDA Clinic

- Med History/Developmental Questionnaire
- Standardized Rating Scales
  - SNAP Parent and Teacher Rating Scales
  - Child Behavior Checklist (CBCL for parent and teacher)
- Structured observation or brief testing to screen for cognitive and learning concerns
- Clinical Interview – history and current complaints
- Semi-Structured Screen (e.g., K-SADS)
ADHD impairment

- Learning problems (as high as 60%)
- Less graduate college
- More SUD
- Less employed, more sick leave used
- More job changes (5 more)
- More often arrested & more divorced
- More driving accidents, ER visits, teenage pregnancies, suicide attempts
- Higher (mental) health care costs

(Wozniak, 2003)
Neuropsychological tests or brain scans to Diagnose ADHD

• TOVA – hi false positive rate (30%) “We are very clear that the T.O.V.A.’s ADHD score is not a diagnostic statement.”

• CPT – Identifies non-ADHD as ADHD half the time

• QEEG – only 2 studies; very limited - adds little value

• PET or MRI - no diagnostic utility
How can you diagnose ADHD?

Possible Diagnostics

- Rating Scales
- Brain Scan
- Blood test or Genetic Test
- Semi-structured Interview
- Computer Test: CPT or TOVA
- EXPERT CLINICIAN

Research Support?
Myths & Misconceptions

■ Causes of ADHD

■ Diagnosis of ADHD

■ Treatment of ADHD
ADHD Treatment

What works and what doesn’t work?
Just the facts: Evidenced-based research

Not supported – no positive studies
Possibly supported - a single study
Probably supported – 2 or more studies (but studies have flaws)
Supported by research - controls, statistics, greater than placebo, double-blind, random assignment
In 1994, the primary pharmacological treatment of ADHD was Ritalin (methylphenidate) administered two times a day.
Medications for ADHD are not for everyone

• **About 90% will respond positively**
  – MTA Study with 579 Children showed those with best initial response did best over time
  – Combination better than med alone better than behavioral alone

• **Side Effects**— Appetite suppression, sleep issues, headaches, stomach aches

• Less likely – tics. PA changes, Growth?

• **Some unwilling to try meds**: fears of abuse/misuse

*** MOLINA ET AL, 2009, 2013
FDA approved Medications

• **Methlyphenidate**
  – Ritalin IR and SR and LA
  – Concerta
  – Metadate ER and CD, Methylin
  – Methylin IR, Chewable, solution and ER
  – Focalin IR and XR
  – Daytrana Patch
  – Quillivant Liquid

• **Amphetamine** – Adderall XR, Vyvanse
  – Dexedrine and Dextrostat

• **Non-stim**: Strattera, Intuniv, Kapvay
Stimulants have side effects

• **Common**
  – Decreased appetite
  – Difficulty falling asleep
  – Headaches
  – Stomach aches
  – Dry mouth

• **Less common**
  – Dizziness
  – Mood problems
  – Tics, picking at skin
Strategies for Managing Side Effects

• Dry mouth
  – Water bottle
  – Avoid certain food

• Headaches
  – Change class of medication
  – Try β-blockers
  – If infrequent, treat as needed

• Edginess/nervous
  – Adjust dose
  – Assess for comorbid anxiety
  – Try β-blockers or wellbutrin

Wilens TE, Spencer TJ. Child Adolesc Psychiatr Clin N Am. 2000(July);9(3):573-603
Strategies for Managing Adverse Events

• Diminished sleep
  – Review sleep hygiene issues
  – Administer earlier in day
  – Add melatonin

• Mood
  – Assess for comorbid mood
  – Change formulation to longer-acting stimulant
  – Change medication class
Long-term Effects of Medication

• ADHD is the most frequently treated condition of childhood dysfunction in the USA

• The most common treatment (stimulant medication) has clear evidence of some short-term benefits (decreased symptom-severity) and some costs (decreased height and weight gain)

• Until the 1990s, there were few studies designed to evaluate the long-term effects of stimulant medication on ADHD
MTA Timeline (Time Since Baseline)

Most recent report; 8-yr Assessment Mean age 16.8 yrs

10 and 12 Year Data Being Analyzed Now
Effects of a Decade of Treatment in the MTA on Age at Peak (+4.5 mo) and Adult Height (-2 cm)

(From Bock, 2010)
Summary: Pharmacotherapy of ADHD

• Efficacy is very good
• A variety of effective drugs but stimulants work best
• Longer-term effectiveness has been demonstrated across the day
• Newer agents in development
So much easier than parenting.

RITALIN
It doesn’t have to be perfect

• Perfect is the enemy of the good
Evidenced-based PSYCHOSOCIAL TREATMENTS FOR CHILDREN with ADHD

• Behavioral Interventions
  – Parent “Management” Training
  – Behavioral Programs at school
  – Summer Treatment Programs

• Academic and organizational skills interventions – eg classroom mgmt.

• Social Skills Training with generalization*

Pelham, Wheeler, & Chronis, 1998 JCCP
Chronis, Jones, & Raggi, 2006, ClinPsyRev
BEHAVIORAL PARENT TRAINING

• Teaches parents to implement effective behavior management strategies
  – Increase clarity and specificity of expectations and instructions
  – Increase frequency, consistency, and immediacy of consequences
  – Increase powerfulness and variability of reinforcement
SCHOOL-BASED INTERVENTIONS

- Request teacher who is structured but flexible, and knowledgeable about ADHD
- Behavioral interventions in the classroom, similar principles as for parent training
- Academic Interventions
- Organizational assistance
ADHD Interventions
Lacking research evidence

- Cognitive Therapy
- Play Therapy
- Biofeedback
- Vitamin / Mineral Treatments
- Yoga, massage or **mindfulness**
- Sensory-Integration Training
- Elimination Diets
How can you treat ADHD?

**Possible Diagnostics**

- Academic/Organizational Skills: 🌟
- Play or Cognitive Therapy: 🚫
- Biofeedback or Sensory Integration: 🚫

**Research Support?**

- Academic/Organizational Skills: 🌟
- Play or Cognitive Therapy: 🚫
- Biofeedback or Sensory Integration: 🚫

**BEHAVIOR MANAGEMENT**

- DIET, VITAMINS, MINERALS: 🚫
- Medication Management: 🌟
CONCLUSION - It’s Complicated

- Heredity is a causal factor but environmental factors play a role
- Expert Clinicians must diagnose
- Untreated? Outcomes are poor
- Multimodal Treatments are best - e.g., Behavioral plus Medication
Conclusions: Treatment

• Evidence – based treatment includes behavior modification, academic/organizational tutoring, and medication

• Stimulants are a first-line therapy for ADHD (Non stimulants are second-line)

• Alternative therapies need more research