ADHD: Controversy, Key Research Findings, Rising Prevalence, and Promise

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Brain & Behavior Research Foundation
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Controversies/Myths

- How many times have you heard...
  - Everyone’s diagnosed these days
  - It’s all about bad schools…or permissive parents
  - Medications poison children’s minds…we should never use them for behavior control
  - It’s all genes and biology—context doesn’t matter

- When topic is kids/adults who ‘misbehave’—and without objective markers (as in all mental health)—controversy abounds

- Start with ads, and fair use
  - 1997-9: FDA and DTC advertising
I see Jason. Not his ADHD.

I see a big difference in my son – better test scores at school, more chores done at home – an independence I try to encourage a smile I always can count on.

If your child has been diagnosed with ADHD, talk to your doctor about your choices of medication.

Medical studies support the unique benefits of CONCERTA.

- 90% of patients did not report loss of appetite or sleep
- Higher scores when solving math problems and an overall improved classroom focus
- Fewer conflicts among adolescents with family members and friends
- Patented OROS delivery system controls symptoms consistently for 12 hours with a single dose

The Makers of CONCERTA believe in the importance of proper diagnosis and treatment of ADHD. Only a doctor can decide whether medication is right for you or your child. CONCERTA should not be taken by patients with: significant anxiety, tension or agitation; allergies to methylphenidate or other ingredients in CONCERTA, glaucoma, Tourette's syndrome, fecal or family history of Tourette's syndrome, recent/current use of monoamine oxidase inhibitors (MAO), or not be taken by children under 6 years of age. Abuse of methylphenidate may lead to dependence. Tell your healthcare professional if your child has had problems with alcohol or drugs. In the clinical studies with patients using CONCERTA, the most common side effects were headache, stomach pain, sleeplessness and decreased appetite.

Please see important product information on adjacent pages.

Talk to your doctor and see if CONCERTA is the right choice for you.

Call 1-888-302-7739 or visit www.concerta.net for a FREE Success Stories DVD or CD-Rom and Doctor Discussion Guide

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Wax Research Institute

November 2003
**BROKEN PROMISES**

**Divorce Decree**

Adults with ADHD were nearly 2x more likely to have been divorced.

The consequences may be serious.

Screen for ADHD.

Find out more at www.consequencesofadhd.com and download patient support materials, coupons, and adult screening tools.

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**“I’m Depressed...”**

**Could it be ADHD?**

ADHD was found in 32% of adults with a depressive disorder.

Look for ADHD in patients who present with depression.

Visit www.depressionandadhd.com for patient education kits and adult screening tools.

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*Results from a population survey of 500 ADHD adults and 901 gender- and age-matched non-ADHD adults which investigated characteristics of ADHD and its impact on education, employment, socialization, and personal outlook.


*From a retrospective survey assessing the prevalence, comorbidity, and impairment of adult ADHD in 3139 adults, aged 18 to 64. Depressive disorder includes major depressive disorder and dysthymia.

A third ad, from this decade

SHANE VICTORINO
ATHLETE AND
PHILANTHROPIST

I DIDN’T OUTGROW MY ADD.
THAT’S WHY I’M TELLING MY STORY.

If you had ADHD as a kid, you may still have it. Watch Shane’s video to learn it’s your ADHD. Own it.

Watch Shane’s video at
ShanesStory.com
Clinical Manifestations

• Two partially independent domains of behavior
  • Inattention/Disorganization
  • Hyperactivity/Impulsivity

• Nine symptoms in each domain
  • Developmentally extreme and *impairing* levels, not explained by clear medical issues or severe deprivation, may warrant diagnosis

• Diagnosis of types/presentations:
  • Inattentive
  • Hyperactive/Impulsive
  • Combined
Impairment

- **Academic (school failure)/Vocational**
  - $100 billion/year (youth) indirect costs (justice, sp. ed, SUD)
  - $200 billion annually (adults) indirect costs (job problems)

- **Social/peer/relationships**
  - Most peer-rejected condition

- **Family** (reciprocal chains of bidirectional influences)

- **Accidental injury** (across the age span)

- **Self-harm, suicide, lowered longevity**
Key Issues

• Clearly a syndrome, not a disorder: No single cause

• Sex differences: 2.5 during childhood
  • True for nearly all neurodevelopmental conditions
  • By adulthood, closer to 1:1, even in general population

• Remarkably consistent prevalence, worldwide
  • In nations with compulsory education
  • Exceptions: US, Israel (stay tuned)
Nature of ADHD: Models

1. “Attention” models
   - But which form(s) of attention?
     - Sustained/selective/capacity
   - And ADHD is less about ‘deficient attention’ than ‘dysregulated’ attention
     - E.g., video games/hyperfocus?

2. “EF” models: Executive functions/cognitive control
   - Planning
   - Interference control
   - Working memory
   - Error correction
   - But not specific to ADHD
     - Some who have ‘real’ ADHD do not show EF deficits
     - EF theories of many other conditions
3. “Inhibition” models
   - Barkley’s theory
   - But is response inhibition actually an EF?

4. “Motivation” models: Reward undersensitivity/delay aversion
   - Volkow et al. (2009): large medication-naïve adult sample, PET

**Key: Huge variability among/within individuals with ADHD**
   - Inconsistency a major theme
     - Resonates with brain imaging findings re: default mode/mind-wandering
Figure 1. Regions of Interest Used to Extract the D2 / D3 Receptor and Dopamine Transporter Measures.

The regions of interest for the midbrain are obtained in several planes, and the shadow is projected to the axial image shown in the figure, which explains why the third ventricle is covered by the region. The x coordinate maps the left-right position, the y coordinate, the anterior-posterior position, and the z coordinate, the superior-inferior position.

<table>
<thead>
<tr>
<th>Dopamine transporter</th>
<th>Accumbens</th>
<th>Caudate</th>
<th>Midbrain</th>
<th>Hypothalamic region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>0.71 (0.16)</td>
<td>0.63 (0.11)</td>
<td>0.59</td>
<td>0.03 to 0.13</td>
</tr>
<tr>
<td>Attention</td>
<td>0.66 (0.23)</td>
<td>0.53 (0.19)</td>
<td>0.62</td>
<td>0.04 to 0.22</td>
</tr>
<tr>
<td></td>
<td>0.16 (0.10)</td>
<td>0.09 (0.11)</td>
<td>0.66</td>
<td>0.03 to 0.12</td>
</tr>
<tr>
<td></td>
<td>-0.01 (0.10)</td>
<td>-0.05 (0.12)</td>
<td>0.36</td>
<td>-0.01 to 0.09</td>
</tr>
</tbody>
</table>
Prefrontal Cortical Thickening: Shaw et al.
Etiology

• Heritability and Genes:
  • $H^2$ of ADHD near .8
    • Teacher ratings: Lower figures (still moderate to high)
    • So, assumption that ADHD is ‘fixed’ and largely immutable
      • i.e., “parenting can’t matter”; parents as shepherds
      • Misreading of heritability

• Other risk factors:
  • Low birthweight, fetal alcohol, environmental toxins
    • Lead, perhaps pesticides

• Potential interactions of genetic vulnerability with other risk
Ultimate cause—or at least, the factor that ‘reveals’ ADHD?

- Compulsory education (same as for LD)
  - Certainly, ‘attention’ or ‘impulse control’ genes have been around for the history of our species, but extremes not salient until we made children sit and learn to read
  - Entirely possible to posit genetic, neurobiological, AND cultural forces as responsible
  - Many forms of mental disorder: ‘mismatch’ between vulnerability and current context
Aim: Predict peer acceptance from parenting

- Ideas About Parenting (Heming et al., 1989)
- 3 factors = Authoritarian, Authoritative, Permissive

Authoritative Factor: 15 items

- Warmth, Limits, Autonomy Encouragement--e.g.,
  - “I encourage my child to be independent of me”
  - “I expect a great deal of my child”
  - “I have clear, definite ideas about childrearing”
  - “Raising a child is more pleasure than work”
  - “When I am angry with my child, I let him know”
  - “I reason with my child regarding misbehavior”
Findings

- Mothers of ADHD boys: lower on Authoritative (ES = .75)
  - Yet variance in ADHD group equivalent to comparison group’s

- Tested predictive power of parenting factors, observed overt and covert behavior, and internalizing score (CDI, observed withdrawal) via hierarchical regressions
  - Neither Authoritarian nor Permissive beliefs predicted peer nominations, but Authoritative beliefs did so (beta = .3), even with diagnostic group controlled

- Moderation: strong prediction (B > .4 in ADHD group)
  - But near zero in comparisons
Explained Variance--Positive Nominations

- Overt
- Covert
- Intern
- Mom A-R
Adoption study in UK
  - Controls for biological relatedness

Even in adoptive families, kids’ levels of ADHD elicit overcontrolling parenting from parents

AND, levels of harshness predict further ADHD symptoms, over time

It’s not all in the genes!
1990s: Try to ascertain a large, diverse, viable female sample
- Group matched comparison sample

Assess carefully/summer programs
- Told families at outset that we wanted to study their daughters for the rest of their lives

Our sample (BGALS):
- Largest in existence of preadolescent girls with ADHD (140, with 88 matched comparison girls)
- Baseline: marked impairments across symptoms, impairments, neuropsych measures

See Hinshaw (2002), *Journal of Consulting and Clinical Psychology*
Childhood (Ages 6-12)  
$M = 9.5$

Adolescence (Ages 11-17)  
$M = 14.2$  
Retention: 92%

Early Adulthood (Ages 17-24)  
$M = 19.6$  
Retention: 95%

Adulthood (Ages 21-29)  
$M = 25.6$  
Retention: 93%
Adolescence:
• All domains reveal that impairments maintained
• E.g., academic/social/comorbidities/self-perceptions/parenting/EF

Early adulthood:
• Keep most measures same, BUT expand into developmentally salient domains
• Impairments still pronounced, but NOT re: substance abuse

Mid-late 20s:
• Still, significant and medium/large effect sizes for ADHD vs. comps
• Few effects of baseline subtype/presentation:
  • Exceptions: antisocial behavior, peer rejection
• Even for neuropsychological /EF measures:
  • NO effects of type/presentation, with tiny ESs
• All analyses: rigorous adjustment for baseline SES, even IQ
Heterotypic Continuity: Self-harm as outcome

• Suicidal behavior: intent is to die
  • Suicidal ideation (common)
  • Suicide attempt (rarer)

• Non-suicidal self-injurious behavior (NSSI)
  • No express intent to die, but to express (or ease) intense psychological pain
  • Linked to poor emotion regulation
  • Wide range—cuticles to cutting/burning

• Yet many suicide attempters have history of NSSI
  • NSSI stronger predictor of suicide attempts than previous attempts
  • NSSI may be lethal
BGALS Follow-up: Self-harm

W3 follow-up (M age = 19.5)

- ADHD-C
- ADHD-I
- Comparison

Hinshaw et al. (2012)
MEDIATION: WAVE 1 ADHD STATUS TO WAVE 3 NSSI

Data represent indirect effect and standard errors using 10,000 bootstrap samples to obtain bias-corrected and accelerated 95% confidence intervals.

Swanson, Owens, & Hinshaw (2014), *Journal of Child Psychology and Psychiatry*
MEDIATION: WAVE 1 ADHD STATUS TO WAVE 3 SUICIDE ATTEMPTS

Data represent indirect effect and standard errors using 10,000 bootstrap samples to obtain bias-corrected and accelerated 95% confidence intervals

Swanson, Owens, & Hinshaw (2014), *Journal of Child Psychology and Psychiatry*
Figure 3. The relationship between W1 Commissions and W3 NSSI was partially mediated by W2 Peer Victimization over and above: WISC Full-Scale IQ, mother’s education, household income, and age at W3. Data represent indirect effect and standard errors using 10,000 bootstrap samples to obtain bias-corrected and accelerated 95% confidence intervals.
Figure 2. The relationship between W1 Commissions and W3 Suicide Attempts (y/n) was partially mediated by W2 social preference scores over and above: WISC Full-Scale IQ, mother’s education, household income, and age at W3. Data represent indirect effect and standard errors using 10,000 bootstrap samples to obtain bias-corrected and accelerated 95% confidence intervals.
Predictors, Mediators

- Guendelman et al. (2016, *Devel. and Psychopathology*):
  - Physical abuse, sexual abuse, and/or neglect: > in ADHD than comp’s
  - For ADHD group, the maltreated subgroup was much more likely to show depression and suicide attempts (not externalizing behavior)
  - COMBINATION OF EARLY IMPULSIVITY AND MALTREATMENT PREDICTS SUICIDE ATTEMPT RATE OF OVER ONE-THIRD
  - See parallels with bipolar disorder (highly heritable, too)

- Meza, Owens, & Hinshaw (2020, *Devel & Psychopathology*):
  - Lifetime rates of self-harm related to childhood…
    - ADHD severity
    - Externalizing problems
    - Negative *father-child* interactions
    - Low self-worth, EF deficits
Wave 4 (mid-late 20s)
Owens, Zalecki, Gillette, & Hinshaw, JCCP (2017)

• Unplanned pregnancy rates:
  • Comparison: 10%  ADHD: 44%
  • REGARDLESS of persistence of ADHD symptoms across time
  • Owens & Hinshaw (2020): Key mediator: Low academic performance

• Owens & Hinshaw (2016, Development and Psychopathology)
  • Early cognitive vulnerability predicts adult comorbidity through
    • Adolescent poor self-control
    • Low delay of gratification
    • Low academic achievement
Tidal Wave/ADHD Explosion

National Survey of Children’s Health (Visser et al., 2014)
Journal of the American Academy of Child & Adolescent Psychiatry

- Parent-reported ADHD ‘ever diagnosed’
  - 2003: 7.8%
  - 2007: 9.5%
  - 2012: 11.0%
    - 41% INCREASE IN 9 YEARS, for all 4-17 year-olds
    - Low-income rates now = middle-class; Black = White
    - Hispanic lower (but fast growing)

- Medication rates higher, too:
  - Just under 70% of those ‘currently diagnosed ‘now receive medication
  - Largest medication increases: adolescents, adults
Earlier Explosions: 1990s

- **Policy shifts:**
  - IDEA: ADHD as OHI
  - Medicaid: authorizes ADHD
  - SSI: ADHD (with other impairment) can qualify

- **Late 1990s:** FDA changes regulations on DTC ads

- **2000:** Concerta (first effective long-acting form)

- **More and more LBW babies survive**
  - Distinguish *TRUE PREVALENCE from DIAGNOSED PREVALENCE*
Diagnostic Prevalence:

- 5.62-7.53% (4)
- 7.54-10.13% (15)
- 10.14-13.07% (19)
- 13.08-18.71% (13)

United States Average: 10.98%

Source: 2011-2012 NSCH, Children Aged 4-17
What does *not* explain “area variation”

- **Demographics**
  - Hispanic population clearly higher in California, and traditionally the lowest rates of diagnosis
  - Eliminated a little of the CA-NC difference but not most
  - **Hispanic rates growing FAST, esp. in California**

- **Rates of health-care providers**
  - Explains other disorders, but not here

- **State “culture”**
  - May explain some regional differences (not state differences)
1970s-80s: public school reforms “input focused”
- Reduce class size, pay teachers more, etc.

Results not consistent; shift in 1990s to “output focused”
- I.e., incentivize test score improvements per se

Consequential accountability—districts get ‘noted’ or even cut off from funds, unless test scores go up
- 30 states implement such laws < 2000

Then, becomes law of the land for all states with No Child Left Behind (takes effect 2002-3)
Consequential accountability introduced via NCLB was associated with higher ADHD diagnostic prevalence increases among low-income children aged 8-13 from 2003-2007, but there was no association from 2007-2011 (unadjusted results)

District of Columbia is included within the 21 No Child Left Behind consequential accountability states.

NCLB: No Child Left Behind; FPL: Federal poverty level


“Unintended effect”

Accountability laws encourage ADHD diagnosis for at least two reasons:

1. Diagnosis may lead to treatment, which may help boost achievement test scores
   - Scheffler et al. (2009), Zoega et al. (2012)

2. In some states/districts, diagnosed youth are excluded from the district’s average test score!
   - Gaming the system, although NCLB eventually outlaws this

Why poorest kids? NCLB targets Title I schools
Main culprit--Quick and dirty assessments?

• We haven’t emphasized assessment, but it takes several hours to ‘do it right’
  • Thorough developmental history
  • Normed parent and teacher rating scales
  • Medical eval: rule-outs
  • Achievement and cognitive testing re: learning issues
  • Yet computerized attention tests, brain scans not definitive

• In practice, however, 10-15’ with non-specialist carries day
  • Lack of training, lack of reimbursement
  • Need ‘team approach’
Treatment—Quick Overview

- Only 2 evidence-based treatments for ADHD:
  - Medications and behavioral interventions (CBT for adults)

- Promising but not as supported
  - Neurofeedback (better controlled studies, but control group...?)
  - Cognitive training (e.g., Working Memory)
  - Diet/exercise (recent dietary trials; very recent aerobic exercise trial)
  - Omega-3s, other supplements
  - Meditation?

- Not supported
  - Marijuana, chiropractic, many others
Treatment Monitoring

• Absolutely essential:
  
  • Must evaluate treatment effectiveness carefully!
  
  • *Medication*: Large range of effective dosages, little to predict which dose range will work for any given child
  
  • *Behavioral treatment*: Which rewards? Which punishments? Can tell only by monitoring…
    
    • Use narrow rating scales, with individualized items, to assess treatment responsiveness
Medication Treatment

• **Stimulant medication: Best evidence**
  - Myth of “paradoxical” response
  - But, can be drugs of abuse, so use only when needed
  - Children do not appear to develop tolerance
    - Recent genetic evidence!

• **Until 2000, years ago, limitation = 3-4 hr coverage**
  - Now, a range of longer-acting formulations

• **Alternatives to stimulants**
  - Atomoxetine, Antihypertensives: NE rather than DA
More on Medications

• Large response rate re: stimulants
  • 80% vs. 15% placebo, if well titrated and monitored

• Effects on attention, impulsivity, behavioral control

• Learning and achievement:
  • Positive effects, too (not simply making kids docile)
Stimulants should be called “SDRIs” (or “SDNRIs”) 
  • Action: block transport

Where are DA paths in brain? 
  • Reward, motor control, executive tracts

SNRIs or antihypertensives: better than placebo but not equivalent to stimulants, overall
Behavioral Treatment

- Integration of home and school components, along with child components (e.g., social skills)
- Need for parents and teachers to collaborate
- Manageable goals—Rome wasn’t built in a day!
- Reasonable expectations and extrinsic rewards
- “Prudent” negative consequences (without anger) > positive consequences alone
- Gradual fading of extrinsic rewards
- CBT for Adolescents/Adults:
  - Time management
  - Organizational skills
  - Anger control
Outcomes Across 14 months
Teacher SNAP DB
Negative/Ineffective Discipline: Greatest Decrease
Stigma and ADHD

• Wouldn’t stigma pertain to ultra-severe disorders (e.g., psychosis), and not ADHD?

  • Paradoxically, inconsistency in behavior (with high expectations) may trigger strong stigma
    • E.g., high-functioning ASD

  • Overdiagnosis, paired with accounts of faking symptoms, stigmatize the entire condition

  • Parents still fearful of receiving the diagnosis for their kids, etc.
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