

ADHD at All Ages

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ADHD – Historical Highlights

- 1798 – “mental restlessness” described by Sir Alexander Crichton in *An inquiry into the nature and origin of mental derangement*
- 1937 – Use of stimulants first described
- First half 20th century – “minimal brain damage” “minimal brain dysfunction”
- 1968 - DSM-II “Hyperkinetic Reaction of Childhood”
- 1980 - DSM-III “ADD (Attention-Deficit Disorder) with or without hyperactivity”
- 1987 - DSM-III-R changed name to current “ADHD”

ADHD - Epidemiology

- Most quoted prevalence is 8% (children), 6% (adult)
 - Increasing adult prevalence since DSM V
 - Solidly 7% but possibly as high as 18%
- 11% are estimated to receive treatment
- Approximately 1:1, male to female, though males are more likely to receive treatment
- By Comparison:
 - All Anxiety disorders (including PTSD 6.8% and OCD 2.3%) about 18%
 - All Addictions/substance misuse 9%, maybe more
 - Depression around 7%
 - Bipolar around 4-5%
 - Schizophrenia and other psychotic disorders 0.25% - 0.64%, though these have an outsized economic impact d/t need for extensive public support.

ADHD – Morbidity Medical (Childhood)

- 2.5 x increase risk of seizures
- 1.5 x increased risk of obesity
- 57% more accident prone
- Worse oral hygiene leading to more dental problems
- 39-56% have sleep problems
 - Exacerbates attention problems
- 2-3 x higher medical costs
- Higher maternal medical and job-related costs (sick days, absenteeism, etc.)

Waring et al. (2008). *Pediatrics*, 122, e1-e6

Mayes, S. et al. (2008). *Journal of Developmental and Behavioral Pediatrics*, 29, 206-2012

Willoughby et al. (2008). *JAACAP*, 47, 186-194

Haackart-van Roijen, L. et al (2007). *European Child & Adolescent Psychiatry*, 16, 316-326

Leibson, C. et al. (2001). *JAMA*, 285, 60-66.

ADHD – Morbidity Medical (Adulthood)

- More accidental injuries, nonsurgical hospitalizations, ER utilization, and driving accidents
- More medical and dental problems in general
- More cigarette and EtOH usage
- Likely higher cancer risk (poor lifestyle choices)
- More likely to be obese
 - ADHD is over represented in patients treated for obesity at dedicated clinics (32%)
- More cardiovascular disease
 - Lower HDL and higher Total / HDL ratio
 - Higher Framingham CHD risk percent

Barkley, R. et al. (2008). *ADHD in adults; What the science says*. New York: Guilford
Goodwin et al. (2009) *Psychological Medicine*, 39 (2), 301 – 311
Journal of Obesity, (2009) March issue.

ADHD – Morbidity Sexual/Reproductive

- Earlier initiation of sexual activity (15y v. 16y)
- More “casual” sex outside relationships (37% v. 19%)
- STDs (17% v. 4%)
- More lifetime partners (13.6 v. 5.4)
 - 60% v. 28% have >4 by early adulthood
 - 2.4 v. 1.6 partners in prior year
 - Less time per partner
- Less use of contraception
- Early pregnancies
 - Teen pregnancy (24-38% v. 4-5%)
 - Births by age 21 – 37:1
 - By age 27, 51% have children v. 13%
 - 54% do not have custody

Barkley, R.A. , et al. (2006). *JAACAP*, 45(2), 192-202

Barkley, R.A. (2006). *Attention deficit hyperactivity disorder: A handbook for diagnosis and treatment (3rd ed.)*. New York: Guilford.

Barkley, R.A., et al. (2008). *ADHD in adults: What the science says*. New York: Guilford.

ADHD – Morbidity

Life expectancy

- Child externalizing behavior is linked with increased mortality by age 46
- ADHD is linked to very low “childhood conscientiousness”
 - Associated with increased likelihood of death by all causes, reduced adult health

Friedman et al (1995) *American Psychologist*, 50, 69-78

Friedman (2000) *Journal of Personality*, 68, 1089-1107

Hampson (2008) *Current Directions in Psychological Science*, 17, 264-268

Jokela et al. (2009) *JAACAP*, 48

ADHD – Morbidity

Educational

- Learning disabilities (24 – 70%)
- Special education services (25-50%)
- Poor academic performance (>90%)
- Repeat grade (20-45%)
- Suspensions (40 – 60%)
- Expulsions (10-18%)
- Failure to graduate high school (23-40%)
- Less likely to attend college (22% v. 77%)
- Less likely to graduate college (5-10% v. 35%)

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Barkley, R.A. (2006). *Attention deficit hyperactivity disorder: A handbook for diagnosis and treatment (3rd ed.)*. New York: Guilford.

ADHD – Morbidity Occupational

- Less skilled at entry into workforce
- Firings/dismissals
 - 55% v. 23% by age 21
 - Fired from 43% of jobs v. 14% by age 27
- Unemployment
 - 22% v. 7% at age 21
 - 26% v. 9% age 27
- Job Changes
 - 2.6 times v. 1.4 times age 18-21
 - 4.9 times v. 2.5 times age 18-27
- Symptoms noticed on the job (as rated by supervisors)
- Lower work performance ratings (as reported by supervisors)
- Lower job status rating
- Lower socio-economic status

Barkley, R.A. , et al. (2006). *JAACAP*, 45(2), 192-202

Sobanski et al. (2008). *European Psychiatry*, 23(2), 142-149

De graaf et al (2008). *Occupational and Environmental Medicine*, June

ADHD – Morbidity Driving

- Poorer steering
- Slower braking reaction time
- More likely to drive prior to obtaining license
- Fewer safe driving habits (rated by self, others, driving instructors)
- More tickets (mean # of speeding citations 4-5 v. 1-2)
- Suspensions/Revocations
 - 2.2 v. 0.7
 - 22-24% v. 4-5%
- Greater adverse impact of EtOH
- Accidents
 - 2-3x risk of being at fault
 - 40% v. 6% with 2+ crashes
- Worse accidents
 - \$4200-5000 v. \$1600-2200
 - Injuries – 60% v. 17%

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Barkley, R.A. (2006). *Attention deficit hyperactivity disorder: A handbook for diagnosis and treatment (3rd ed.)*. New York: Guilford.

ADHD Morbidity

Social

- Problems in peer relationships (>50%)
- Legal problems (25-35%)
- Substance misuse (25%)
- Fewer close friends
- Shorter duration of relationships
- Lower level of marital satisfaction

ADHD – Morbidity Family

- More child:
 - Noncompliance
 - Hostility
 - disruption
- Greater parental:
 - commands
 - Hostility
 - Reduced responsiveness
 - Lax yet harsh discipline
- Poorer sense of competence in parental role
- More parental stress and depression
- Divorce
 - Earlier and more often

Wymbs, B. et al. (2008). *Journal of Consulting and Clinical Psychology*, 76(5), 735-744

ADHD – Morbidity Economic/Societal

- \$40K per ADHD teen v. \$15K per non-ADHD teen spent over 6y period on mental health services, special ed, and juvenile justice system
- >\$80K if the ADHD teen also has Conduct Disorder

Jones, D.E., Foster, E.M. et al. (2009). Service patterns for adolescents with ADHD and comorbid conduct disorder. *Journal of Behavioral Health Services and Research*, 36(4), 436-449.

ADHD – Etiology

- All currently recognized causes are biological (neurological, genetic)
- Common pathway appears to be the fronto-striatal-cerebellar circuit
- Social causation has been disproven

ADHD – Etiology

Neuroimaging

Smaller, underactive, underdeveloped brain regions found on imaging studies (MRI, fMRI, PET, QEEG):

- Orbital-Prefrontal Cortex (right)
- Basal Ganglia (striatum and globus pallidus)
- Cerebellum (right hemisphere, central vermis)
- Anterior cingulate cortex
- Corpus callosum (anterior splenium)
- Size of abnormalities correlate with degree of ADHD sx
- No gender differences
- **Abnormalities persist into adulthood**
- Differences in areas of underactivation in children (supplementary motor and basal ganglia) v. adults (inferior frontal cortex and thalamus)

Hart H, et al.: *JAMA Psychiatry* 2013; 70(2):185–198.

Barkley, R.A. (2006). *Attention deficit hyperactivity disorder: A handbook for diagnosis and treatment (3rd ed.)*. New York: Guilford.

Barkley, R.A., et al. (2008). *ADHD in adults: What the science says*. New York: Guilford.

ADHD – Etiology

Popular but Disproven

Excessive TV/Gaming

More screen usage is a result of having ADHD (not a cause) and/or parental usage of media to help parent a difficult child

Food Additives

Broadly linked to worsened sx in small (5%) portion of ADHD cases and to ADHD-like sx in children not diagnosed with ADHD

Poor Parenting

Disproven by twin studies. Difficult parent-child relationship results from having ADHD and improves with treatment

Barkley, R.A. (2006). *Attention deficit hyperactivity disorder: A handbook for diagnosis and treatment (3rd ed.)*. New York: Guilford.

Changes in DSM V ADHD

- Re-categorized as Neurodevelopmental Disorder rather than Disruptive Behavior Disorder
- Adults/Late Adolescents need not show as many symptoms (5 instead of 6)
- Clearer examples provided of how symptoms can present after childhood.
- Symptoms present by age 12 rather than age 7
- Need for symptoms to cause “*significant impairment*” in functioning lessened (mildly) to having symptoms that “*interfere with, or reduce the quality of*” functioning

Changes in DSM V ADHD

- Removal of PDD-spectrum diagnoses as exclusion criteria
- Change from “subtypes” to predominantly combined/inattentive/hyperactive-impulsive “presentations”
- Designation of severity

DSM V ADHD Inattentive

- often fails to give close attention to details or makes careless mistakes in schoolwork, work, or during other activities (e.g. overlooks or misses details, work is inaccurate).
- often has difficulty sustaining attention in tasks or play activities (e.g., has difficulty remaining focused during lectures, conversations, or lengthy reading).
- often does not seem to listen when spoken to directly (e.g., mind seems elsewhere, even in the absence of any obvious distraction).
- often does not follow through on instructions and fails to finish school work, chores, or duties in the work place (e.g., starts tasks but quickly loses focus and is easily sidetracked).
- often has difficulty organizing tasks and activities (e.g., difficulty managing sequential tasks; difficulty keeping materials and belongings in order; messy, disorganized work; has poor time management; fails to meet deadlines).
- often avoids or is reluctant to engage in tasks that require sustained mental effort (e.g. schoolwork or homework; for older adolescents and adults, preparing reports, completing forms, reviewing lengthy papers).
- often loses things necessary for tasks or activities (e.g., school materials, pencils, books, tools, wallets, keys, paperwork, eyeglasses, mobile telephones).
- is often easily distracted by extraneous stimuli (e.g., for older adolescents and adults may include unrelated thoughts).
- is often forgetful in daily activities (e.g., doing chores, running errands; for older adolescents and adults, returning calls, paying bills, keeping appointments).

DSM V ADHD Hyperactive-Impulsive

- often fidgets with or taps hands or squirms in seat.
- often leaves seat in situations when remaining seated is expected (e.g., leaves his or her place in the classroom, in the office or other workplace, or in other situations that require remaining in place).
- often runs about or climbs in situations where it is inappropriate (e.g., in adolescents or adults, may be limited to feeling restless).
- often unable to play or engage in leisure activities quietly;
- is often “on the go” acting as if “driven by a motor” (e.g., is unable to be or uncomfortable being still for extended time, as in restaurants, meetings; may be experienced by others as being restless or difficult to keep up with).
- often talks excessively.
- often blurts out answers before questions have been completed (e.g., completes people’s sentences; cannot wait for turn in conversation).
- often has difficulty awaiting turn (e.g., while waiting in line).
- often interrupts or intrudes on others (e.g. butts into conversations, games, or activities. may start using other people’s things without asking or receiving permission; for adolescents and adults, may intrude into or take over what others are doing).

DSM – V: ADHD

(pick any 6, present before age 12)

- **Inattentive**

- Careless mistakes
- Difficulty sustaining attention
- Does not seem to listen
- Poor follow-through
- Poor organization
- Avoidance of tasks requiring effort
- Often loses things
- Easily distracted
- Forgetful

- **Impulsive**

- Blurts out answers
- Difficulty waiting turn
- Interrupts or intrudes

- **Hyperactive**

- Fidgets or squirms
- Trouble staying seated
- Runs or climbs excessively
- Loud during play/leisure
- “on the go” or “driven by a motor”
- Talks excessively

Current Clinical View of ADHD

Age-inappropriate behavior in two domains of neuropsychological development critical to Self Regulation – a.k.a. “Executive Functioning”:

Response Inhibition:

- Verbal and motor impulsiveness
- Trouble delaying gratification
- Disregard of future consequences
- Task-irrelevant movement and verbal behavior
- Emotional impulsiveness
- Distress intolerance
- “Doesn’t know when to quit.”

Attention/Vigilance:

- Poor persistence toward goals or tasks
- Difficulty re-engaging in tasks following disruptions
- Poor resistance to responding to distractions
- **Working memory impairment**

Barkley, R.A., (2001). *ADHD and the Nature of Self Control*. New York: Guilford.

How ADHD Interferes With Development of Executive Function

Self regulation requires an action directed at oneself.

Inhibition

- Creates the foundation of self regulation
- It is impossible to direct an action towards oneself without being able to inhibit outward responses one's environment
- Inhibition is a fundamental impairment in ADHD

How ADHD Interferes With Development of Executive Function

Self regulation involves three components:

An action directed at oneself

... that is intended to change how one would otherwise have behaved

...in order to influence the future

Attention – Working Memory

- The ability to hold a few different things in mind long enough to compare, contrast, understand, and decide
- The ability to temporarily store and manage info required to carry out complex cognitive tasks such as learning, reasoning, and comprehension
- Makes possible the consideration of the present in the context of the past and future

Barkley, R.A., (2001). *ADHD and the Nature of Self Control*. New York: Guilford.

Working Memory

- Allows one's actions to match their intentions.
- Allows one to act rather than react.

Working Memory

- Important brain regions: frontal cortex, parietal cortex, anterior cingulate, basal ganglia (Overlap with regions involved in ADHD)
- Consider how many ADHD sx evolve from this fundamental deficit
- Implications for psychotherapy, itself a *new learning process that requires frustration tolerance, nuanced consideration of thoughts and emotions, and follow through*

Barkley, R.A., (2001). *ADHD and the Nature of Self Control*. New York: Guilford.

Barkley, R.A. (2006). *Attention deficit hyperactivity disorder: A handbook for diagnosis and treatment (3rd ed.)*. New York: Guilford.

Practical Conceptualization of ADHD

- Impaired ability to organize behaviors across time to anticipate the future in the interest of long-term goals
- More INTENTION deficit rather than Attention Deficit
- A developmental disorder of self regulation across time
 - “Time Blindness” or “Temporal Neglect Syndrome”
 - Myopia to the future

Barkley, R.A., (2001). *ADHD and the Nature of Self Control*. New York: Guilford.

Practical Conceptualization of ADHD

A disorder of:

- Performance rather than skill
- Doing what one knows rather than knowing what to do
- Referencing the past in the present
- The when and where rather than the how or what
- Actions not matching intentions

ADHD Symptom Progression from Childhood to Adulthood

Difficulty sustaining attention

Does not listen

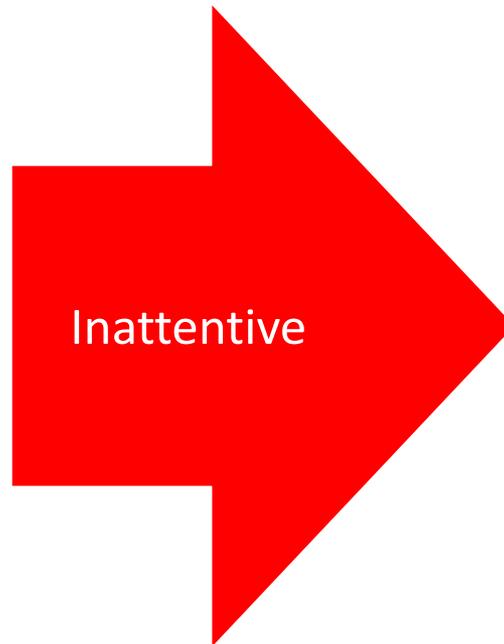
Poor follow through

Poor organization

Loses things

Easily distracted

Forgetful



Difficulty sustaining attention

Misses details in meetings,
paperwork, reading

Slow and inefficient

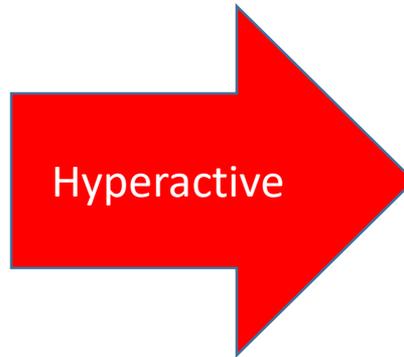
Procrastination

Poor organization

Poor time management

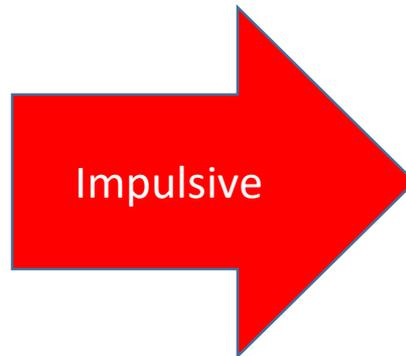
ADHD Symptom Progression from Childhood to Adulthood

Fidgets and squirms
Cannot stay seated
Runs/climbs excessively
Cannot work/play quietly
“On the go”/“Driven by motor”
Talks excessively



Workaholic
Overscheduled/overwhelmed
Choose very active job
Constant activity leading to family tension
Talks excessively

Blurts out answers
Impatient
Interrupts/intrudes



Low frustration tolerance
Quits jobs/unstable employment
Ends relationships
Irresponsible/risky driving
Loses temper
Addictions

ADHD - Diagnosis

Diagnosis is made via clinical interview of the patient

AND, ideally

Collateral history from close contacts

- Individuals with ADHD have reduced insight and minimize their symptoms
- Rating scales can be helpful (Connors, Vanderbilt; ASRS, BDEFS)
- Psychometric testing may help support diagnosis

ADHD – Diagnosis

Neuropsychological/Psychometric Testing

Traditional Testing does not reliably catch ADHD related executive function deficits

- 35% or fewer of ADHD cases show impairment on testing
- Yet, 90-98% are rated as impaired using self and observer rating scales
- Testing tends to assess “instrumental” level executive function well but not so well the “tactical” and “strategic” levels involved in ADHD and measured more successfully by rating scales

Barkley, R.A. (2006). *Attention deficit hyperactivity disorder: A handbook for diagnosis and treatment (3rd ed.)*. New York: Guilford.
Barkley, R.A., et al. (2008). *ADHD in adults: What the science says*. New York: Guilford.

ADHD – Treatment

Empirically Proven

- Medications
- Regular physical exercise
- Parent education about ADHD
- Parent training in child management
- Family therapy for teens
- Teacher education about ADHD
- Teacher training in classroom management
- Special education (IEP, 504)
- Support groups (CHADD, ADDA)

Allison, D.B., et al (1995). Antecedent exercise in the treatment of disruptive behavior: A meta-analytic review. *Clinical Psychology: Science and Practice*, 2. 279-304.

ADHD – Treatment

Experimental / Less Proven

- Biofeedback
- Computer working memory training
- Video Games
- Time management and organization training for school
- CBT for Adults
- Challenging Horizons program
 - After school program for social, academic, recreational skills.

Loo, S. & Barkley, R.a. (2005). *Applied Neuropsychology*, 12, 64-76.

Klingberg, T. et al. (2005). *JAACAP*, 44, 177-186.

Molina, B. et al. (2008). *Journal of Attention Disorders*, 12, 207-217.

Safren, S. et al. (2005). *Behaviour Research and Therapy*, 43, 831-842.

ADHD – Treatment

Unproven or Disproved

- Individual psychotherapy
- Play therapy
- Elimination Diets (sugar, additives, dyes, etc.)
- Supplements (megavitamins, anti-oxidants, minerals)
- Cognitive (self-control) training in children
- Social skills training

Chann, E. et al. (2003). Complementary and alternative therapies in childhood attention and hyperactivity problems. *Journal of Developmental and Behavioral Pediatrics*, 24, 4-8.

Vargas, S., & Camilli, G. (1999). A meta-analysis of research on sensory integration treatment. *Journal of Occupational Therapy*, 53, 189-198.

Pharmacologic Management of ADHD

Medications

- Stimulants
 - Methylphenidate (Ritalin, Focalin, Concerta, Metadate, Daytrana, Quillivant XR, aptensio XR)
 - Amphetamines (Adderall, Dexedrine, Zenzedi, Vyvanse, Evekeo, Mydayis)
- Atomoxetine (Strattera)
- Viloxazine (Qelbree)
- Antidepressants (bupropion)
- Alpha-adrenergic agents (clonidine, guanfacine)
- Other

Stimulants

- Used for more than 60 years
 - The most well-studied drugs in psychiatry (> 350 studies)
- Most clinical trials in school-age children
- 70% response rate with first trial
 - >90% response rate with subsequent trials
 - “normalization occurs in 50-60% of cases
- Very safe, convenient, relatively inexpensive
- May be used for years, well into adulthood.
- LOW placebo response
- Rapid, robust symptom improvement

Stimulants: Myths and Misunderstandings

Overprescribed

- 4.3% receive meds; 7.8% prevalence

Over-dosed

- Non psychiatrists tend to under-dose compared to research trials and practicing psychiatrists

Increases risk of substance abuse

- 15 studies refute this; several of these show decreased risk if adherent to treatment

Addictive (used as Rx'd)

- Only if inhaled or injected

Cause Tics

- 30% show increase while 35% show decrease

Olfson et al. (2009) *JAACAP*, 48(1).

Connor, D. (2006). Stimulants. In Barkley, R.A. (Ed.), *Attention deficit hyperactivity disorder: A handbook for diagnosis and treatment*. New York: Guilford.

General Treatment Principles

- Cope rather than cure
- ADHD is a chronic illness
- The individual is ultimately always responsible for his/her actions
- Medications are usually essential but are rarely 100% effective
- Cover as many waking hours as possible
- Manage comorbidities

Summary

- ADHD is common and not “grown out of”
- ADHD is under-diagnosed and under-treated
- ADHD is highly genetic
- ADHD is a “biological,” neurochemical, neurodevelopmental, brain disease
- ADHD rivals or surpasses most other outpatient psychiatric illness in impairment and cost
- ADHD is among the most treatable of all mental illnesses
- Treatment should begin as early in life as possible and cover as much of the day and as many settings as possible
- Medications are usually the cornerstone of treatment efforts