Attention-Deficit/Hyperactivity Disorder in Children: Medication and Lifestyle Approaches

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Disclosure

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Dr. Petty’s presentation will include the discussion of off-label, experimental, and/or investigational use of drugs or devices
Does Attention-Deficit/Hyperactivity Disorder Exist?

This question has been driven by countless books and articles claiming that it is a new “invention”

And/or that it represents a “different kind of normal”

Do you feel that it is something that causes impairment, distress or suffering?
History of Attention-Deficit/Hyperactivity Disorder (ADHD)

- Mid-1800s: Minimal Brain Damage
- 1902 Defects in moral character
- 1934 Organically driven
- 1940 Minimal Brain Syndrome
- 1957 Hyperkinetic Impulse Disorder
- 1960 Minimal Brain Dysfunction (MBD)
- 1968 Hyperkinetic Reaction of Childhood (DSM II)
- 1980 Attention-Deficit Disorder - ADD (DSM III) with-hyperactivity or without-hyperactivity residual type
- 1994-present: Attention-Deficit/Hyperactivity Disorder
Mr. President and Gentlemen.—In my first lecture I drew your attention to some points in the psychology and development of moral control in the normal child and then considered the occurrence of defective moral control in association with general impairment of intellect; before going further it may be well to review briefly the points which have been raised. Moral control, we saw, is dependent upon three psychical factors, a cognitive relation to environment, moral consciousness, and volition, which in this connexion might be regarded as inhibitory volition. Moral control, therefore, is not present at birth, but under normal psychical conditions is gradually developed as the child grows older. The variation in the degree of moral control which is shown by different children at the same age and under apparently similar conditions of training and environment suggested that the innate capacity for the development of such control might also vary in different individuals.
ADHD Statistics

- 3-5% of all U.S. school-age children are estimated to have this disorder
- 5-10% of the entire U.S. population
- Males are 3 to 6 times more likely to have diagnosed ADHD than are females
- At least 50% of ADHD sufferers have another diagnosable mental disorder
Conditions That May Co-Exist with Attention-Deficit/Hyperactivity Disorder

- Anxiety: 35%
- Conduct Disorder: 35%
- Oppositional Defiant Disorder: 40%
- Learning Disabilities: 50%
- Depression: 35%
- Bipolar: 20%
- Tics/Tourettes: 7%
Persistent pattern of:

- Inattention
- Hyperactivity
- Impulsivity

But using these dimensions to define ADHD oversimplifies the problem.
And misses some opportunities to help.
### Diagnostic Criteria for Attention-Deficit/Hyperactivity Disorder

**Table 8.1**

1. **Inattention:** Six (or more) of the following symptoms have persisted for at least 6 months to a degree that is inconsistent with developmental level and that negatively impacts directly on social and academic/occupational activities.
   - **Note:** The symptoms are not solely the manifestation of oppositional behavior, defiance, hostility, or failure to understand tasks or instructions. For older adolescents and adults (age 17 and older), at least five symptoms are required.

   - (a) Often fails to give close attention to details or makes careless mistakes in schoolwork, at work, or during other activities (e.g., overlooks of misses details, work is inaccurate).
   - (b) Often has difficulty sustaining attention in tasks or play activities (e.g., has difficulty remaining focused during lectures, conversations, or lengthy reading).
   - (c) Often does not seem to listen when spoken to directly (e.g., mind seems elsewhere, even in the absence of any obvious distraction).
   - (d) Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (e.g., starts tasks but quickly loses focus and is easily sidetracked).
   - (e) 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).
   - (f) Often avoids, dislikes, 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).
   - (g) Often loses things necessary for tasks or activities (e.g., school materials, pencils, books, tools, wallets, keys, paperwork, eyeglasses, mobile telephones).
   - (h) Is often easily distracted by extraneous stimuli (for older adolescents and adults, may include unrelated thoughts).
   - (i) Is often forgetful in daily activities (e.g., doing chores, running errands; for older adolescents and adults, returning calls, paying bills, keeping appointments).
(2) **Hyperactivity and Impulsivity:** Six (or more) of the following symptoms have persisted for at least 6 months to a degree that is inconsistent with developmental level and that negatively impacts directly on social and academic/occupational activities:

**Note:** The symptoms are not solely a manifestation of oppositional behavior, defiance, hostility, or a failure to understand tasks or instructions. For older adolescents and adults (age 17 or older), at least five symptoms are required.

(a) Often fidgets with or taps hands or feet or squirms in seat.
(b) 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).
(c) Often runs about or climbs in situations where it is inappropriate
**Note:** In adolescents or adults, may be limited to feeling restless.

(d) Often unable to play or engage in leisure activities quietly.
(e) Is often “on the go,” acting as if “driven by a motor” (e.g., is unable to be or is uncomfortable being still for extended time, as in restaurants, meetings; may be seen by others as being restless or difficult to keep up with).
(f) Often talks excessively.
(g) Often blurts out answers before a question has been completed (e.g., completes people’s sentences; cannot wait for a turn in conversation).
(h) Often has difficulty waiting his or her turn (e.g., while waiting in line).
(i) 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).

(B) Several inattentive or hyperactive–impulsive symptoms were present before age 12 years.

(C) Several inattentive or hyperactive–impulse symptoms are present in two or more settings (e.g., at home, school, or work; with friends or relatives; in other activities).

(D) There must be clear evidence that the symptoms interfere with, or reduce the quality of, social academic, or occupational functioning.

(E) The symptoms do not occur exclusively during the course of schizophrenia or another psychotic disorder and are not better explained by another mental disorder (e.g., mood disorder, anxiety disorder, dissociative disorder, personality disorder, substance intoxication or withdrawal).

(continues)
### Diagnostic Criteria for Attention-Deficit/Hyperactivity Disorder (continued)

**Specify whether:**
- **Combined presentation:** If both Criterion A1 (inattention) and Criterion A2 (hyperactivity-impulsivity) are met for the past 6 months.
- **Predominantly inattentive presentation:** If Criterion A1 (inattention) is met but Criterion A2 (hyperactivity-impulsivity) is not met for the past 6 months.
- **Predominantly hyperactive-impulsive presentation:** If Criterion A2 (hyperactivity-impulsivity) is met but Criterion A1 (inattention) is not met for the past 6 months.

**Specify if:**
- **In partial remission:** When full criteria were previously met, fewer than the full criteria have been met for the past 6 months, and the symptoms still result in impairment in social, academic, or occupational functioning.

**Specify current severity:**
- **Mild:** Few, if any, symptoms in excess of those required to make the diagnosis are present, and symptoms result in no more than minor impairments in social or occupational functioning.
- **Moderate:** Symptoms or functional impairment between “mild” and “severe” are present.
- **Severe:** Many symptoms in excess of those required to make the diagnosis, or several symptoms that are particularly severe, are present, or the symptoms result in marked impairment in social or occupational functioning.

Inattention

- Inability to sustain attention, particularly for repetitive, structured, and less enjoyable tasks
- Deficits may be seen in one or more types of attention
  - Attentional capacity
  - Selective attention
  - Distractibility
  - Sustained attention/vigilance (a core feature)
Hyperactivity-Impulsivity

- Inability to voluntarily inhibit dominant or ongoing behavior

Hyperactive behaviors include:
- Fidgeting and difficulty staying seated
- Moving, running, touching everything in sight, excessive talking, and pencil tapping
- Excessively energetic, intense, inappropriate, and not goal-directed
Impulsivity

- Inability to control immediate reactions or to think before acting
- Cognitive impulsivity may include disorganization, hurried thinking, and need for supervision
- Behavioral impulsivity includes difficulty inhibiting responses when situations require it
- Emotional impulsivity includes impatience, low frustration tolerance, irritability and a “Hot” temper
ADHD Presentation Types

- Predominantly inattentive presentation (ADHD-PI)
- Predominantly hyperactive–impulsive presentation (ADHD-HI)
- Combined presentation (ADHD-C)
Predominantly Inattentive Type (ADHD-PI)

- Inattentive, drowsy, daydreamy, spacey, in a fog, and easily confused
- May have difficulty learning, process information slowly, trouble remembering things, and therefore lower academic achievement than expected
- Often anxious, apprehensive, socially withdrawn, and may display mood disorders
Predominantly Hyperactive-Impulsive Type (ADHD-HI)

- Primarily symptoms of hyperactivity-impulsivity (rarest group)
- Primarily includes preschoolers and may have limited validity for older children
- May be a distinct subtype of ADHD-C
Combined Type (ADHD-C)

- Children who have symptoms of both inattention and hyperactivity-impulsivity
- Most often referred for treatment
Additional DSM-V Criteria

- Appears prior to age 12
- Persists more than 6 months
- Occurs more often and with greater severity than in:
  - Other children of the same age and sex
- Occur across two or more settings
- Interferes with social or academic performance
- Not explained by another disorder
Pitfalls in Diagnosis

- DSM criteria could also describe “NORMAL” children!
- No physical or laboratory markers
- Significant overlap with other disorders
- Public awareness, misinformation and colloquial usage
Problems of Diagnosis

- Subjectivity of criteria
- Inconsistent evaluations: presence of symptoms usually given by teacher or parent
- Studies have shown that the number of diagnosed cases of ADHD decreased 80% when observations of parent, teacher and physician were used rather than just one source
- Symptoms in females more subtle: may lead to under-diagnosis
DSM-V definition is based on *behavior*

But *attention* describes a cognitive function

Use of attention in behavior and cognition leads to confusion: which - or what - are we describing?

The pre-frontal cortex is associated with ADHD and cognitive dysfunction (e.g. executive functions)
What are Executive Functions?

- At least 34 definitions
- The term was originally derived from the “frontal lobe syndromes” in which people with lesions in the frontal lobes of the brain show disturbances in self-regulation and intentional behavior.
- Mainly concerned with the co-ordination of other cognitive resources.
- It is a dynamic, ‘online’ system.
- Involved in goal-directed behavior and self-regulation:
  - Set-shifting
  - Planning/organizing
  - Working memory
  - Inhibition
The Brain’s Executive Functions

**ACTIVATION**
- Organizing
- Prioritizing
- Getting to work

**FOCUS**
- Tuning in
- Sustaining focus
- Shifting attention

**EFFORT**
- Regulating alertness
- Sustaining effort
- Adjusting processing speed

**EMOTIONS**
- Managing frustration
- Modulating emotions

**MEMORY**
- Holding on and working with information
- Retrieving memories

**ACTION**
- Monitoring and regulating one’s actions

Adapted from Brown, TE (2006). *Attention Deficit Disorder: The Unfocused Mind in Children and Adults.*
What Causes It?

- MANY things
- With cognitive, behavioral and psychiatric problems, “All Roads lead to Rome”
- There is often a strong genetic component
- Prematurity and birth difficulties can be associated
- Prenatal exposure to:
  - Lead pollution
  - Cigarette smoke - first and secondhand
  - Pesticides
  - Illicit substances
What May Be Associated With It?

- Disturbances of balance and gait
  - Cerebellar
  - Vestibular
- Disturbances of handedness/laterality
- Disturbances in the reward/saliency systems of the brain
- ~70% have sleep disturbances
- Allergies
- Vitamin D deficiency
Treatment
Attention-Deficit/Hyperactivity Disorder: The Diabetes Analogy 1

- It is valuable to consider why we treat diabetes:
- It is not so much to reduce the symptoms associated with elevated glucose and lipids, it is primarily to prevent:
  - Retinopathy
  - Neuropathy
  - Renal disease
  - Vascular disease etc.
- The same principle should guide the management of patients with cognitive problems
If someone has diabetes we understand that:
- Continuous treatment is essential
- Sudden fluctuations in glucose levels - or medications - can be devastating
- Adverse effects of treatment are not only the "side effects"
- Adverse effects also include the withholding of adequate treatment
Inadequately Treated ADHD Disorder May Have Serious Consequences

The problems may “migrate” into adolescence and adulthood.

Healthcare System:
- 50% increase in bicycle accidents
- 33% increase in ER visits
- 2-4 times more motor vehicle accidents

School:
- 46% expelled
- 35% drop out
- Lower occupational status
Inadequately Treated ADHD Disorder May Have Serious Consequences

- **Family:**
  - Parental separation or divorce 3-5x higher
  - 2-4 fold increase in sibling fights

- **Substance use disorders:**
  - 2 fold increased risk
  - Earlier onset
  - Less likely to quit in adulthood
Assessments

- Comprehensive clinical evaluation
- Check for IQ, learning disabilities
  - Check for other diagnoses
  - Rule out bipolar disorder, neurocognitive problems and other disorders
- ADHD rating scales
- Conners Scales for Teachers
- Neuropsychological testing
- Continuous Performance Test (CPT)
Constructing the Treatment Plan
Beyond “Strengths and Weaknesses”

- Treat the symptoms, the behaviors and quality of life
- Reduce the longterm risks
- Build resilience
- For each, we need to consider the whole person:
  - Biological
  - Psychological
  - Social
  - Spiritual
Behavioral Treatment of ADHD

- Structure, structure, structure!
- Manage time and energy
- Sleep hygiene
- Nutrition
- Physical exercise
- “Green” environment
- Planners, cell phones, iPhone, iPod to help deadlines, appointments, academic assignments
- Teach teachers and professors
- Avoiding temptations (!)
- Maintaining personal relationships

Kuo, FE, Taylor, AF. Am J Public Health 2000; 95: 1580-1586
Medications can be an essential piece, but every guideline in the world points out the importance of a problem solving environment.

For example, early morning functioning impairments:

- Time between waking and arriving at school - 20% of the waking day - requires:
  - Attention/focus
  - Time management
  - Working memory skills
A Sample Behavior Plan

- Establish and review the early morning routine
- Consider adequacy of sleep on early-morning arising

Bedtime routines:
- Provide structure
- Review sleep hygiene
- Consistent on awakening school/non-school days
- Limit naps
- Strive for early bedtime
- Make decisions at night:
  - Pick out school clothes
  - Pack lunchbox
  - Pack backpack
Promoting Good Sleep Hygiene

- Establish the child’s “chronotype”
- Establish a regular bedtime and wake time
- Avoid caffeine and other stimulants
- Avoid activating over-the-counter medications (and, of course, alcohol or street drugs. At any age)
- Exercise early in the day, not right before bed
- Avoid working in the bedroom
- Restrict television or electronics in the bedroom
- Avoid highly stimulating activities before bedtime
- Anticipate stressors that could destabilize daily routines; develop a management plan
- Use “faded bedtimes”
The Pharmacological Treatment of ADHD
Stimulants and Others

- Psychostimulant medications:
  - Methylphenidate
    - e.g. Ritalin: 5-60mg; Concerta 18-81mg/day

- Amphetamines:
  - e.g. Dextro-amphetamine: Dexidrine SR: 5-15mg/day
  - 4 mixed amphetamine salts: Adderall XR: 10-30mg; Vyvanse 30-70mg/day

There are now a large number of different formulations of these medications
The Pharmacological Treatment of ADHD:

Stimulants and Others

- Atomoxetine: Strattera (non-stimulant)

- Others:
  - Modafinil: Provigil
  - Bupropion: dopamine and norepinephrine reuptake inhibitor
  - Clonidine: α-adrenoceptor agonists
  - Guanfacine {Tenex and Intuniv}: α2-adrenoceptor agonists
Some Medication Myths

- Stimulants cannot be used if someone has anxiety
- Stimulants cannot be used if someone has tics or Tourette’s
- Stimulants increase the risk of developing substance abuse
- Combinations treatments, a.k.a. “Polypharmacy” are always bad
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<thead>
<tr>
<th><strong>ADD-OC1</strong></th>
<th><strong>Unclear mechanism</strong></th>
<th><strong>PharmaLogika</strong></th>
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<td><strong>ATS</strong></td>
<td><strong>Decamphetamine transdermal</strong></td>
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<td><strong>Vortioxetine</strong></td>
<td><strong>Novel actions on 5-HT reuptake, 5-HT(<em>{1A}), 5-HT(</em>{3}), 5-HT(<em>{7}), 5-HT(</em>{1B}), 5-HT(_{1D})</strong></td>
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<td><strong>Centanafadin</strong></td>
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<td><strong>Dasotraline</strong></td>
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<td><strong>Eltoprazine</strong></td>
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<td><strong>mGluR neuromodulator</strong></td>
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<td><strong>NLS-1</strong> (mazindol)</td>
<td><strong>Tetracyclic: inhibits reuptake of norepinephrine, dopamine and 5-HT</strong></td>
<td><strong>NeuroLife Sciences</strong></td>
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<td><strong>Adrenergic and dopamine uptake inhibitor</strong></td>
<td><strong>SK Biopharm</strong></td>
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Why Isn’t He/She Better Yet?

- Are we still sure that it is ADHD?

Medications:
- Efficacy?
- Adherence
- “Blocking”
- “Burning”
Treating the Whole Person

Medications: Essential to explain to the child - and adults - that treatment must be year-round

Integrated medical approaches:
- Nutrition
- Food additives
- Herbs and supplements including fish oils
- Homeopathy
- Acupuncture

Parent Training – Positive Discipline
BIP (Behavior Intervention Plan)
Why Isn’t He/She Better Yet?

Reconsider Comorbidity:

★ Anxiety
★ Mood:
  • Depression
  • The ADHD/bipolar question
★ Obsessive compulsive disorder
★ Autism spectrum disorder
★ Sleep disorder
★ Substance abuse
★ Medical problem?
Non-pharmacological and Lifestyle Approaches to ADHD: 1 Diet

The Feingold Diet

- Eliminate synthetic colors and flavors + aspartame, neotame and alitame
- Eliminate foods containing salicylates
- Difficult to follow
- May help in 10-30% of children. No credible data in adults

Sugar restriction

- Evidence poor

Avoiding suspected allergens

- Allergies and celiac disease are more common in ADHD, and avoidance of specific food items may help some children
Non-pharmacological and Lifestyle Approaches to ADHD: 1 Diet: Conclusions

- Difficult to predict who will respond to dietary changes
- Keep a diet diary for 1-2 weeks
- Avoid potential triggering foods and re-introduce one at a time

Petty, Richard G. Alternative Medicine Alerts, 2007; 7: 82-86
Non-pharmacological and Lifestyle Approaches to ADHD: 2 Nutritional Supplements

Vitamins

★ Recommended Daily Allowance (RDA) multivitamin preparations
★ Megavitamin multiple combinations
★ Megadoses of specific vitamins

★ Evidence for each strategy is poor
★ Usually sufficient to ensure a balanced diet

Petty, Richard G. Alternative Medicine Alerts, 2007; 7: 82-86
Non-pharmacological and Lifestyle Approaches to ADHD: 2 Nutritional Supplements

- **Fish oils**
  - Rats with low levels of brain omega-3 fatty acids are hyperkinetic\(^1\)
  - Children with lower levels of omega-3 fatty acids are more likely to have behavior, learning and sleep problems\(^2\)
  - Trials have shown some improvement when given at a dose of 1000-3000mg/day\(^3\)

- **Melatonin**
  - May be of value in ADHD with sleep problems\(^4\)

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Non-pharmacological and Lifestyle Approaches to ADHD: 3

Herbal and homeopathic medicines
- Poor evidence, but a large body of anecdotal material

Mind-body approaches
- Published data on the value of:
  - Biofeedback/neurofeedback\(^1\)-\(^4\)
  - Yoga\(^5\),\(^6\)
  - Meditation\(^7\)
  - Light therapy

Summary 1: ADHD

- Attention Deficit Hyperactivity Disorder
  - A common childhood disorder
  - Many causes
  - Often genetic (e.g. DAT-1, DRD2, D4 genes)

- Can produce serious life distress
  - Learning, behavior, social, teen safety

- Goal is to create resilience:
  - Positive discipline, structure, medications
The treatment of both ADHD and bipolar disorder benefits from attention to four factors:

- **Physical:**
  - Appropriate medications
  - Nutrition
  - Environmental factors
- **Psychological**
- **Social**
- **Spiritual**