An Overview of Attention Deficit Hyperactivity Disorder (ADHD)

Agenda

• What is ADHD? What are the new criteria in DSM-V?
• Prevalence and developmental trajectories for ADHD into adulthood
• Rx treatment highlights
• Working memory training highlights
• Behavioral treatment highlights
• School-based Interventions
• Summary
Attention Deficit Hyperactivity Disorder

- What are the new criteria for a diagnosis of ADHD in DSM-V?
- How is this different from earlier versions?
- Prevalence?
- Severity?
- Co-morbidity?

Definition Of ADHD:
“ADHD appears to be a developmental disability in the domains of sustained attention, impulse control and the regulation of activity level to situational demands.” Barkley, 1989.

Three ADHD Core Symptom Domains

- **Inattention** means a person wanders off task, lacks persistence, has difficulty sustaining focus, and is disorganized; and these problems are not due to defiance or lack of comprehension.
- **Hyperactivity** means a person seems to move about constantly, including in situations in which it is not appropriate; or excessively fidgets, taps, or talks. In adults, it may be extreme restlessness or wearing others out with constant activity.
- **Impulsivity** means a person makes hasty actions that occur in the moment without first thinking about them and that may have high potential for harm; or a desire for immediate rewards or inability to delay gratification. An impulsive person may be socially intrusive and excessively interrupt others or make important decisions without considering the long-term consequences.

Symptoms of ADHD

- Inattention, hyperactivity, impulsivity: Some people with ADHD only have problems with one of the behaviors, others have both inattention and hyperactivity-impulsivity. Most children have the combined type of ADHD.
- In preschool, the most common symptom is hyperactivity
- It is normal to have some inattention, unfocused motor activity and impulsivity, but for people with ADHD, these behaviors:
  - are more severe
  - occur more often
  - interfere with or reduce the quality of how they function socially, at school, or in a job.
DSM-5: ADHD

A persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development, as characterized by
1. Inattention and/or
2. Hyperactivity and impulsivity

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DSM-5: ADHD

- Age of onset?
- How many symptoms?
- How many settings?
- How many observers?
- Adverse impact?

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Question: What is the Age of Onset?

Symptoms for ADHD have to appear by what age?

a) 4 years
b) 7 years
c) 9 years
d) 12 years
e) 17 years
**Age of Onset Answer**

**Age of Onset change:**
- DSM-V: “several inattentive or hyperactive-impulsive symptoms were present prior to age 12”
- DSM-IV: “some symptoms that cause impairment were present before the age of 7”
- Adult diagnosis (age 17 and up) possible with 5 (rather than 6) symptoms.

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**DSM-5 Symptoms of Inattention (Six or More)**

a) Overlook or miss details, make careless mistakes in schoolwork, at work, or during other activities

b) Have problems sustaining attention in tasks or play, including conversations, lectures, or lengthy reading

c) Not seem to listen when spoken to directly

d) Not follow through on instructions and fail to finish schoolwork, chores, or duties in the workplace or start tasks but quickly lose focus and get easily sidetracked

e) Have problems organizing tasks and activities, such as what to do in sequence, keeping materials and belongings in order, having messy work and poor time management, and failing to meet deadlines

f) Avoid or dislike tasks that require sustained mental effort, such as schoolwork or homework, or for teens and older adults, preparing reports, completing forms or reviewing lengthy papers

g) Lose things necessary for tasks or activities, such as school supplies, pencils, books, tools, wallets, keys, paperwork, eyeglasses, and cell phones

h) Be easily distracted by unrelated thoughts or stimuli

i) Be forgetful in daily activities, such as chores, errands, returning calls, and keeping appointments
**DSM-5 Symptoms of Hyperactivity-Impulsivity (Six or More)**

a) Fidget and squirm in their seats  
b) Leave their seats in situations when staying seated is expected, such as in the classroom or in the office  
c) Run or dash around or climb in situations where it is inappropriate or, in teens and adults, often feel restless  
d) Be unable to play or engage in hobbies quietly  
e) Be constantly in motion or “on the go,” or act as if “driven by a motor”  
f) Talk nonstop  
g) Blurt out an answer before a question has been completed, finish other people’s sentences, or speak without waiting for a turn in conversation  
h) Have trouble waiting his or her turn  
i) Interrupt or intrude on others, for example in conversations, games, or activities

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**DSM 5 Changes From DSM-IV**

**Impairment vs. Interference**

**DSM-IV**

C. “some impairment from symptoms is present in 2 or more settings (e.g., at school or home or work)”  
D. “must be clear evidence of clinically significant impairment in social, academic, or occupational functioning”

**DSM-5**

C. “several symptoms (not impairment) are present in 2 or more settings (e.g., at home, school, … with friends or relatives, or in other activities)”  
D. “there is clear evidence that symptoms interfere with, or reduce the quality of, social, academic or occupational functioning”

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**DSM-5 Revisions**

- Diagnosis should be based on information obtained from parents and teachers, to establish pervasiveness  
- “Manifestations of the disorder must be present in more than one setting  
- Confirmation of substantial symptoms across settings typically cannot be done accurately without consulting informants who have seen the individual in those settings.”

Examination of the patient in the clinician’s office may or may not be informative
Prevalence of ADHD
The 2016 National Survey of Children’s Health (NSCH) interviewed parents and reports the following ADHD prevalence data among children ages 2–17 (Danielson et al. 2018):

- 6.1 million children (9.4 percent) have ever been diagnosed with ADHD. This includes:
  - About 388,000 young children ages 2-5 (or 2.4 percent in this age group)
  - 2.4 million school-age children ages 6-11 (or 9.6 percent in this age group)
  - 3.3 million adolescents ages 12-17 (or 13.6 percent in this age group)

- Adult ADHD: 4.4% of US adults have ADHD. Of these adults with ADHD, 38% are women and 62% are men (Kessler et al. 2006)

CDC (2011): Percentage of US Children (ages 5-17) Ever Diagnosed with ADHD
The Many Faces of ADHD

- **School Children**
  - Easily distracted
  - Disruptive and intrusive
  - Doesn’t complete work
  - Low academic achievement
  - Peer rejection

- **Adolescents**
  - Restlessness
  - Procrastination
  - Specific learning disabilities
  - School failure
  - Poor peer relationships
  - Low self-esteem
  - “Risky” behaviors
  - Clashes with authority

- **Adults**
  - Poor planning and organization
  - Doesn’t complete work
  - Low occupational achievement
  - Temper problems
  - Family problems
  - Substance abuse
  - Car accidents

How does WM of those with ADHD affect learning?

(Huang-Pollock & Karalunas, 2010)

When a task has a low WM demand, children with ADHD still make more errors and learn it more slowly.

When a task has a high WM demand, children with ADHD don’t get to automaticity.

Result of these struggles: distinct trajectory of less academic achievement.
ADHD: Is it genetic?

Is there any evidence to support the idea that these traits or this disorder may be genetically inherited?

Is there a ADHD Genome?

Is there a chromosomal difference?

Does the child with ADHD have a genetic component?

What is the inheritability? Is it the same for adults?

Answer: YES

It is about a .80 correlation based on the examination of DNA in a large European study of 26,000 children (February 2018 by Marta Ribases from Barcelona, Spain)

Santanu Ghosh
Associate Professor of Psychiatry, Tripura Medical College, Agartala, PhD scholar at Tripura University

What is life like for a person with ADHD?

Here in the US, Children with ADHD:

Are more likely to experience:

• Learning problems
• Missed school
• Troublesome relationships with family members and peers
• Mental and physical conditions
• > 7 million ambulatory care visits for ADHD per year

As adults, these risks result in 33% reduced earning and 15% increase in use of social assistance

ADHD Developmental Trajectory:
Symptoms Predict Social Functioning in High School

Hyperactivity predicted passive ignoring at (p<.001) level. Attention problems were a significant predictor of passive ignoring. Paralleled self-reported social outcomes.

Getting ignored in high school...not a pleasant experience...

Core ADHD symptoms differentially predicted an adolescent’s location in the social network and peer-perceived acceptance/exclusion.

Increasing both hyperactivity and inattention was associated with increased risk of active social exclusion.

Getting excluded is as bad or possibly worse.

ADHD Students are more likely to be bullied, suspended and therefore more likely to dropout

Predictors of persistence of ADHD into adulthood: A systematic review of the literature and meta-analysis.

26,168 abstracts reviewed and selected 72 for full-text review. 16 studies used: 6 population-based retrospective samples and 10 clinical follow-ups. Persistence of ADHD into adulthood was predicted by:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Odds Ratio</th>
<th>Confidence Interval (95%)</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severity of ADHD</td>
<td>2.33</td>
<td>1.6–3.39</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Treatment of ADHD</td>
<td>2.09</td>
<td>1.04–4.18</td>
<td>p&lt;0.037</td>
</tr>
<tr>
<td>Comorbid with Conduct Disorder</td>
<td>1.85</td>
<td>1.06–3.24</td>
<td>p&lt;0.030</td>
</tr>
<tr>
<td>Comorbid with Depression</td>
<td>1.80</td>
<td>1.1–2.95</td>
<td>p&lt;0.019</td>
</tr>
</tbody>
</table>

(Caye, et al., 2016)

Research identified ADHD cases in a population based birth cohort from 1976-1982 birth cohort (n=5699). Ages 5 to 19

ADHD Developmental Trajectory:
Adversity in Adults with history of Childhood ADHD

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Ratio</th>
<th>Percentage</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not graduated from high school</td>
<td>2.95/1</td>
<td>17.7% vs. 6.0%</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>Degree beyond high school</td>
<td>1/1.81</td>
<td>37.1% vs. 67.5%</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>Married</td>
<td>1/1.71</td>
<td>26.7% vs. 45.7%</td>
<td>p&lt;0.03</td>
</tr>
<tr>
<td>Unemployed</td>
<td>1.91/1</td>
<td>9.9% vs. 5.1%</td>
<td>p&lt;0.09</td>
</tr>
<tr>
<td>Fired from a job</td>
<td>2.4/1</td>
<td>50.9% vs. 21.2%</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>Less well paid</td>
<td>1/1.5</td>
<td></td>
<td>p&lt;0.01</td>
</tr>
</tbody>
</table>

(Bartres, et al, poster session ISDP 2011)
ADHD trajectory into Adulthood
Consider Work: Unemployment & Underemployment

A longitudinal national sample with sibling pairs found that employment reduction among those with ADHD was "between 10 and 14 percentage points, the earnings reduction is approximately 33% and the increase in social assistance is 15 points" (Fletcher, 2014).

Clearly ADHD adults are a group that is at risk for underemployment and unemployment.

Clinic referred sample of adults with ADHD:
• 22.2% worked as their source of income

General population:
• 72% work for income

(Bjørnæs, et al., 2012).

Risks of childhood ADHD and long-term outcome of arrests, convictions, and incarcerations
(Mohr-Jensen & Strahlbom, 2016)

15,442 individuals with childhood ADHD
Childhood ADHD was significantly associated with:

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Risk Ratio*</th>
<th>Confidence Interval (95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adolescent and Adult Arrests</td>
<td>2.2</td>
<td>1.3–3.5</td>
</tr>
<tr>
<td>Convictions</td>
<td>3.3</td>
<td>2.1–6.2</td>
</tr>
<tr>
<td>Incarcerations</td>
<td>2.9</td>
<td>1.9–4.3</td>
</tr>
</tbody>
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* Risk Ratio is the ratio of the probability of an event occurring (for example, developing a disease, being injured) in an exposed group to the probability of the event occurring in a comparison, non-exposed group.

Treatments of ADHD: Rx Treatment

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Treating ADHD with Medication

ADHD is a neurologically based disorder that results from a deficiency of either one neurotransmitter or a group of neurotransmitters.

### Types

<table>
<thead>
<tr>
<th>Examples</th>
<th>Types</th>
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</table>
| Stimulation increase norepinephrine and dopamine in the brain in order to improve concentration and even lessen fatigue. | • Ritalin  
• Vyvanse  
• Adderall  
• Dexedrine |
| Mild Stimulants (Methylphenidate) block the reuptake of dopamine and norepinephrine into the brain’s neurons. | • Focalin  
• Concerta  
• Daytrana  
• Metadate |
| Non Stimulants block the reuptake of dopamine and norepinephrine into the brain's neurons. | • Strattera  
• Kapvay  
• Intuniv |

ADHD and Medication by Age Group

Express Scripts Report (2014)

National Survey of Children's Health: children/adolescents aged 4 to 17 years

Medication Use Among Children Currently Diagnosed with ADHD (2011)

Data from National Survey of Children's Health (NSCH)

Prevalence of medicated ADHD increased by 28% from 2007 to 2011
Adult ADHD and Medication by Age Group
Express Scripts Report (2014)

Gender and Medication by Age Group
Express Scripts Report (2014)

While the % of males using ADHD medications decrease as they enter young adulthood.....

The opposite is true for females

ADHD and Medication by Age Group and Month
Express Scripts Report (2014)

MONTH-BY-MONTH UTILIZATION OF ADHD MEDICATION

BY AGE GROUP 2012
ADHD Adults & Prison:  
One way to reduce its likelihood: Rx  
Intriguing and massive population (n=25,656) study in Sweden  
“...among patients with ADHD who were taking medication there was a significant 32% reduction in the criminality rate for men and a 41% reduction in women.”  
Crime reduction notable even when:  
- Different drugs (stimulants vs nonstimulants) were used to treat ADHD  
- Different crimes were tracked (violent vs. non-violent).  
The reduction in criminality ranged from between 17%-46%.  
Critical first step: adults are thoroughly assessed and properly diagnosed and encouraged to obtain proper treatment.

Treatments of ADHD:  
Working Memory  
Do programs that train working memory, other executive functions, and attention benefit children with ADHD?  
A meta-analytic review of cognitive, academic and behavioral outcomes (Pearson et al., 2013):  
- 25 studies reviewed, showed improvements in short-term memory of a moderate magnitude (d = 0.63).  
- Far transfer effects of cognitive training on academic functioning were nonsignificant or negligible.  
- "Unblinded raters (d = 0.48) reported significantly larger benefits relative to blinded raters and objective tests (both p < .05)."
Is working memory training effective?

*A meta-analytic review. (Melby-Lervag & Hulme, 2013)*

23 studies with 30 group comparisons were made.

“Meta-analyses indicated that the programs produced reliable short-term improvements in working memory skills.”

The authors acknowledge that memory training produces “short-term, specific training effects that do not generalize.”

They do acknowledge: “Possible limitations of the review (including age differences in the samples and the variety of different clinical conditions included) are noted.”

One question: Does such training have clinical relevance?

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Are WM deficits clinically relevant for those with ADHD?

Does some other intervention address them more effectively?

1. Academic achievement highly correlated to WM capacity.
2. Employment strongly related to academic achievement (e.g. high school grad. Vs. college).
3. ADHD: Lower high school and college graduation rates.
4. ADHD: Unemployed and underemployed at lower rates.
5. Higher inattention levels are more strongly correlated with lower levels of employment.
6. Rx no notable impact upon academic functioning, working memory, etc.
7. Behavioral interventions have not been shown to improve WM.
8. Kasper et al., (2012) found that children with ADHD showed significant and “large magnitude working memory deficits” in both verbal and visual spatial WM compared to typical developing peers. Martinussen et al., (2005) found such deficits to be of ES levels of .85 spatial storage, 1.06 spatial central executive WM, .47 verbal storage, .43 verbal central executive WM.
9. Alderson et al., (2013) found that adults with ADHD continued to have moderately sized deficits in verbal WM, visual spatial WM & central executive WM.

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Working memory training for children with ADHD

Highlights of concerns

Reduction of the core ADHD symptoms based upon meta-analyses have not been found.

WM training has not been shown to accomplish far transfer to academic gains in the context of a meta-analyses. Since there is a strong relationship between WM and academic gains there is some expectation that this will develop over time.

Another consideration is that direct academic remediation may be necessary to achieve far transfer after WM training.

Important Cautions: It is noteworthy that neither medication treatment of ADHD nor behavioral treatment of ADHD have been found to show far transfer to academic gains at least in meta-analyses.
Costs? Previously some have argued this intervention is expensive. One issue is that traditional interventions are often covered by insurance while this intervention typically is not, but that is not true in all countries. In terms of face value the expense of this intervention is no longer much different than traditional alternatives. However, the length of time it has been found to last notably exceeds that of traditional interventions.
Behavior Therapy: Working with Kids and Their Parents

What parents can expect in behavior therapy

- Parents learn when trained in behavior therapy.
- What parents can expect in behavior therapy.
- Treatments of ADHD: School-Based Interventions.
Recommendations for Students with ADHD

- Instructional strategies to improve the management of behavioral, social, and emotional supports;
- Supports for teachers to improve classroom management;
- Collaboration and consultation with families to align efforts and promote consistency;
- Monitoring of interventions to ensure integrity of implementation and accountability by assessing impact on behavioral and academic outcomes;
- Education of staff and parents in the characteristics and management of ADHD as well as the continual communication of advances in supports, changes in policies, and implementations of new accommodations;
- Facilitate appropriate access to Special Education;
- Collaboration with community agencies and professionals providing medical and related services to students and their families;
- Individualized behavior support planning for students when necessary.

ADHD in the Classroom: Effective Intervention Strategies

Behavioral interventions for students with ADHD include both antecedent- and consequence-based strategies.

Self-regulation interventions: students with ADHD are encouraged to monitor, evaluate, and/or reinforce their own behaviors.

Academic Interventions: teacher mediated direct instruction in relevant skills that require remediation.

Home–School Communication Programs: Daily Behavior Report Cards

Interventions Addressing Social Relationship Difficulties

Collaborative Consultation: an equal partnership between two partners (e.g., school psychologist and classroom teacher) to define a problem and develop interventions.

The Effects of Classroom Interventions on Off-Task and Disruptive Classroom Behavior in Children with Symptoms of ADHD: A Meta-Analytic Review

Review of classroom interventions (antecedent-based, consequence-based, self-regulation, combined) that can be applied by teachers in order to decrease off-task and disruptive classroom behavior in children with symptoms of ADHD.

Classroom interventions reduce off-task and disruptive classroom behavior in children with symptoms of ADHD with largest effects for consequence-based (WSD = 1.82) and self-regulation interventions (MSMD= 3.61). Larger effects were obtained in general education classrooms than in other classroom settings.
Multi-tiered Support System Model for Students with ADHD

- Targeted small group interventions like Check-in Check-on or Abbreviated DBRC. Further assessment and FBA.
- Universal prevention with Early Identification and Classroom Management PD for Teachers.

Summary

ADHD Tools

1. RATINGS SCALES
   - BASC-3
   - Brown ADD Scales
   - D-REF

2. TASK-ORIENTED TESTS
   - Asthema
   - TEA-ch

3. INTERVENTIONS
   - Cogmed
   - Rehacom
   - BASC-3 Intervention Guide

4. PROGRESS MONITORING
   - BASC-3 Flex Monitor
   - Asthema
   - Brown ADD Scales

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Questions or Comments