**ADHD: Beyond the DSM**

ADHD is a common condition:
- Old data: 3 – 5% of school age population
- True incidence 8 – 10% of population, not just school age
- Affect millions of American families
- Impacts almost every classroom in America
- Causes impairment in every aspect of adult function

Why do we need to know about it?:
- ADHD, untreated, is associated with substantial life-long morbidity
- estimated 4 to 5 million children are likely to have ADHD
- Many (?)most) grow up to be ADHD adults.
- There are not enough mental health providers to address this problem

Primary care providers will need to step up --- and our professional organizations have recognized this.

ADHD is defined by the description in DSM 5 (2013)
Difficulties along 2 parameters:
- Attentional focus
- Activity level and impulse control

**Attentional focus:**
Ability to pay attention to the right thing, with the right intensity, for the right amount of time --- and then to change focus to the next appropriate thing, with the right intensity for the right amount of time

**Activity level and impulse control:**
- Over activity is easy to recognize, hard to define
- Impulse control: ability to take the few milliseconds necessary to consider what you are going to say or do before it happens --- and then to modify your action to best suit your immediate and long-term interests.

This is a
- congenital,
- usually genetic,
- neurologic condition.

Problems with DSM :
- No mention of emotion.
- It does not include problems with the general area of executive functions.
- It does not explain why --- if this is a genetic condition--- 8 – 10% of children, but only 4.5% of adults have ADHD.

**Emotion in ADHD**

Historically, descriptions of people with attention difficulties always included striking emotional symptoms as well. In 1968, the label changed again to the more descriptive “Hyperkinetic Reaction of Childhood”; defined as a disorder: “characterized by over-activity, restlessness, distractibility, and short attention span, especially in young children; the behavior usually diminishes by adolescence”.
Reference to emotional symptoms was dropped and “emotion” became a “co-morbidity”.

Observations of ADHD individuals reveal a high degree of two specific difficulties with emotional control:
- volatility of emotional expression
- difficulty in downward regulating of this emotion

Emotional symptoms may be a dramatic component of (and sometimes the most impairing aspect of) the patient’s presentation.
Currently labelled:
- Oppositional Defiant Disorder (ODD), Disruptive Mood Dysregulation Disorder (DMDD), Intermittent Explosive Disorder.
- Many of these patients seem to have symptoms consistent with mood or anxiety disorders.

All of these are currently classed as co-morbid conditions, and sometimes they are. But sometimes, they are an integral component of ADHD. In these cases, it is common to see the emotional symptoms substantially diminish or disappear when the patient is properly treated with stimulant medication.
An “emotional symptom”:
- the expression of a normal emotion, but the intensity is inappropriate to the circumstances.
- A “mood disorder”:
  - a more persistent level of emotion that is abnormal in duration and degree.
  - the critical question is not about the flares of emotion, it is about how the individual does emotionally between these flares.

Executive Function in ADHD

Much of the early work on ADHD was based on studies of 6 – 12 year old hyperactive boys. The emphasis in evaluation and diagnosis was based on this symptom.
- DSM 3 (1980) changed name to ADD placing “attention” as a prime symptom.
- DSM 4 (1994) established current symptom set and recognized adult persistence
- DSM 5 (2013) only minor changes.

Late 1990’s: increasing recognition that adolescents, and especially adults, had additional problems beyond those symptoms listed in the DSM.
These additional symptoms fell broadly under the category of Executive Functions: psychological mechanisms involved in self-regulation, in self-management, in self-control.

They are directed at self-management, not following directions from others.

- Executive Functions are clearly mediated by the frontal lobes
- They begin to develop early in childhood, with the rate of development accelerating in late childhood and through adolescence
- Full adult development is achieved generally in the early 20’s.
- E.F.’s are independent of intelligence.
- E.F. is typically impaired in individuals diagnosed with ADHD.
- Improvement occurs over time, but E.F. deficits and challenges often persist throughout life.
- Thomas Brown and Russell Barkley have each made important contributions to the understanding of E.F. in ADHD.

Brown describes 6 clusters of Executive Functions that are impaired in ADHD:
1) Activation
2) Focus
3) Effort
4) Emotion
5) Memory
6) Action

1) Activation:
- Organizing tasks and materials
- estimating time
- Prioritizing actions
- Activating to work.
  - Putting things away for easy retrieval
  - Time management
  - Procrastination

2) Focus:
- Focusing
- Sustaining and shifting attention to tasks.
  - Easily distracted by things around them, by their own thoughts
  - Focus gets “stuck”, unable to fluidly shift focus.

3) Effort:
- Regulating alertness
- Sustaining effort
- Processing speed
  - Maintaining effort over longer time, handling multi-step projects
  - Difficulty regulating sleep and alertness
4) Emotion:
- Managing frustration
- Modulating emotions
- Motivation is intimately linked to emotional modulation
  - Managing frustration, anger worry, disappointment, desire
  - Down-regulating emotion to return to task at hand
  - Marshalling anxiety to drive motivation to finish a task

5) Memory:
- Utilizing working memory
- Accessing recall
  - Short term memory a problem
  - Difficulty retrieving learned information when needed
  - Reading comprehension a problem

6) Action:
- Monitoring
- Self-regulating action
  - Impulsive thoughts and actions, even in absence of hyperactivity
  - Monitoring the context, how others respond, modifying behavior to changing circumstances

There is a maturational process of E.F. in which development proceeds over a number of years:
- Predictable rate of development
- In ADHD, there is a substantial delay in the appearance of each of these traits
- Full development takes years longer in ADHD than in typical people
- Final level is less efficient
- This is a delay, not an abnormality of development

A study of Brain Cortical Maturation in ADHD and Typical Children (2007):
- 446 children, ½ ADHD, ½ typical
- Repeated fMRI's looking at thickness of cortex (a measure of maturity) at 40,000 points
- Children followed from 5 – 8 years old, thru young adult
- In typicals, saw a “wave” of maturation, moving from back to front, and filling in last (in the early 20’s) over the right pre-frontal cortex (major site of E.F.)

In the typical children, there was a “wave” of maturation, moving from back to front, and filling in last (in the early 20’s) over the right pre-frontal cortex (major site of E.F.)

Same studies were done in the ADHD children. They found:
- exactly the same sequence of brain development, exactly the same pattern of brain development --- except everything was delayed by 2 – 5 years.
- ADHD brain is not fully mature until the mid-late 20's, or even the early 30's.
- As children enter middle and high school, with all of the new challenges of organization and self-regulation, the ADHD youngster may be competing with his peers with a brain that is a few years younger.

- EF defined as the “mental faculties that are essential for the contemplation of hypothetical future states and the cross-temporal organization of behavior for the attainment of those future goals”.
- Behaviors are “for purposes of self-regulation, changing our current behavior in order to change our future”.

These EF’s may begin as externally observable events in young children, but over time they are internalized and privatized so that their expression is entirely mental.

The 1st, essential EF is inhibition: Inhibiting an automatic response to create a brief delay in time, a gap in which there is time for other mental functions. 3 related processes:
- Inhibiting the “automatic” response
- Interrupting an ongoing but ineffective response (permitting a delay and re-evaluation)
- Protecting the response from disruption by competing events.

Non-Verbal Working Memory (Visual Working Memory):
- You are imagining a past similar situation, giving you an opportunity to consider alternative responses, changing the “automatic” outcome.
- You are imagining the past (hindsight) in order to plan for a future response (foresight). You are working across time.
- From this eventually develops a sense of time.
Verbal Working Memory is next to develop:
- As speech is gradually internalized, (around the age of 5 or 6), it becomes “the voice in our heads” permitting self-description, reflection, self-instruction, self-questioning, problem-solving.
- Important for following rules and codes of conduct
- Necessary for comprehension when reading silently

Development of Emotional Working Memory:
- Initial inhibition of strong emotion and the subsequent modulation of emotional expression
- Corollary: emotion is necessary for motivation.
- Your motivation for an action is dependent upon an emotional state. If an action has no emotional meaning for you, there will be no drive to perform it.

Self-Play (or Reconstitution):
- It involves analysis and synthesis (the process of taking apart ideas and then recombining information in different ways to form novel or useful recombinations).
- This is essential for problem-solving, mentally testing different ideas and then choosing the one that best meets your needs.
- In the ADHD child, each of these stages is delayed in its appearance.
- The ADHD individual will develop all of these executive abilities, but each will take considerably longer to show up.
- And when these executive abilities do develop, they are usually weaker, less effective at influencing relevant behaviors.

Fundamentally, ADHD is a developmental delay (and relative weakness) in self-regulation.

In psychological terms, it is a developmental delay (and relative weakness) in Executive Function.

In neurophysiological terms, it is a developmental delay (and relative weakness) in frontal lobe function.

Our official DSM description of ADHD as a problem with attentional focus, impulse control and hyperactivity is actually the special case of what executive function weakness looks like in a primary school-age child.

Why is ADHD less common in adults than in children?

ADHD occurs in 8 – 10% of children, but most studies of adults find an incidence of only 4.5%.
- Where did the others go?
- Is this important?

Where did they go?:
- Up until 2013, the requirement for diagnosis of ADHD in adults was the same as for children, 6 of 9 ‘I’ and/or 6 of 9 ‘H/I’ symptoms.
- These criteria identify the 99th percentile in adults, not the 93rd, as it does in children.

ADHD is a developmental disorder, abilities get better with time.
- The overactive symptoms start to remit around adolescence.
- Impulsive behavior becomes more internalized, less apparent to observers.
- Attention improves: adults are more likely to limit activities to the things we inherently enjoy and are good at.

DSM 5 begins to recognize this. Adults need to meet only 5 (not 6) criteria in ‘I’ or ‘H/I’.

To identify adults >93rd percentile:
- Age 18 – 29:  4 ‘I’ or 5 ‘H/I’
- Age 30 – 49:  3 ‘I’ or 4 ‘H/I’
- Age >50 :       2 ‘I’ or 3 ‘H/I’

In identifying adult ADHD, we should be looking at those symptoms that are relevant, viz. features of E.F. deficits.
- Rating scales that access these functions are likely to be more useful.
- This, plus a history consistent with typical ADHD in childhood provides a much more accurate assessment.

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Pharmacology

Principles of treatment of ADHD:
1) We are not treating ADHD, we are treating the impairments that come from ADHD
2) If you are going to treat, treat well! Under-treating does your patient no favors
3) The challenge is to balance optimal benefits with tolerable side effects
4) Responses to stimulant medications are high individualized

Titration:
- Start with a low dose and titrate upward.
- The time on each dose level does not have to be prolonged. 4 to 7 days is usually sufficient.

Absolutely essential: Use of semi-quantitative assessment (e.g. the ADHD-RS) to assess the response at each visit:
- from the teacher, parent, any other adult in a caretaking role.
- know the timing of the observation and relate that with the expected medication level at that time.

Proper medication management will largely eradicate the 30% executive delay we see in ADHD --- as long as the medication is active in the system.
When the medication wears off, there is a return to baseline function.

There are two classes of stimulant medications, methylphenidate and amphetamines:
- 40 – 50% of patients do well on either class of meds. It doesn’t matter what you choose.
- 20 – 30% of patients do best on amphetamines.
- 15 – 20% of patients do best on methylphenidate.

Pick one class. Set up a titration schedule, moving from low to moderate dose, then evaluate progress.
- If the response is not satisfactory, do the same with the other class.
- A small proportion of patients do not do well on either class of stimulants. (Some may be misdiagnosed).
- If the diagnosis is correct, try the non-stimulants.

Know the formulation you are using and how it releases active drug into system:
- Bead formulation. Some are 50:50: Adderall-XR, Metadate-ER, Focalin-XR, Ritalin-LA
- Metadate-CD is 30:70.
- OROS: Concerta (22% immediate release)
- Enzymatic: Vyvanse (30% Dexedrine)
- Patch: Daytrana (Use ~1/2 of oral dose)

Helpful tidbits
- For most children (i.e. pre-pubertal), the optimal level of Ritalin will be 0.3 – 0.6 mgs/kg/dose, more often than not at the lower end of that range.
- To use this with long-acting MPH formulations, calculate the initial “MPH level” and use that to figure out what would provide at least 0.3 mgs/kg/dose.

For most children, the optimal Adderall (mixed amphetamines) dose is a little lower, 0.2 – 0.3 mgs/kg/dose.

- It is not infrequent to see children build up a “mini-tolerance” to a given medication over the initial few months.
- They may require a little bump up in dosage.
- Sequential ADHD-RS’s will alert you to the need to consider this.

The main side effects of stimulant medication are loss of appetite and interference with sleep initiation.
- If there is NO effect on appetite, your dose is probably too low.
- If there is a problem with sleep initiation, is it due to persistence of stimulant or an underlying sleep problem?

To minimize the impact on appetite:
- Breakfast before the medication.
- Aim for a protein-based breakfast.
- (Lunch is always difficult.) Appetite for eating is mainly impacted, not appetite for drinking. A nutritional beverage at lunch is a good choice.
- By dinner time, appetite has usually returned. It is prudent to plan dinner for a little later in the evening.
For at least some children, the intestinal absorption of stimulant medication will be appreciably slowed if they take it with food that is acidic in nature.

- Within an hour of taking meds, no fruit, vit.C, anything else acidic.
- Take a vitamin supplement in the evening.

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If they are starting to have difficulties falling asleep, and the only thing that is different is the addition of meds:

- See if you can maintain the early med level at an optimal level, but reduce the later part of the med effect to reduce side effects.
- Another option is to do a trial of the alternative class of stimulant medication.

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If sleep is impacted by the ADHD:

- Review sleep hygiene.
- Music or books-on-CD can help
- Consider Melatonin (helps regulate the sleep-wake cycles).
- Sedating meds are an option (clonidine, Trazodone, mirtazapine).
- Occasionally, a low dose of stimulant will allow enough focus to fall asleep.

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Treating ADHD is challenging and time-consuming --- but the rewards are great.
We have effective treatments

- That are safe
- That dramatically improves function in virtually all aspects of life.
### APPENDIX: ADHD Rating Scale

<table>
<thead>
<tr>
<th>ADHD Rating Scale</th>
<th>Not at all</th>
<th>Just a Little</th>
<th>Pretty Much</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Often fails to give close attention to details or makes careless mistakes in work or other activities.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2) Often has difficulty sustaining attention in tasks or play/group activities.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3) Often does not seem to listen to what is being said to him or her.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4) Often does not follow through on instructions and fails to finish school work, chores or duties in the workplace (not due to oppositional behavior or failure to understand instruction).</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5) Often has difficulties organizing tasks and activities.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>6) Often avoids, expresses reluctance about, or has difficulties engaging in tasks that require sustained mental effort (such as school work)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>7) Often loses things necessary for tasks or activities (e.g. school assignments, pencils, books, tools or toys).</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>8) Is often distracted by extraneous stimuli.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>9) Is often forgetful in daily activities.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>10) Often fidgets with hands, feet, or squirms in seat.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>11) Leaves seat in classroom or in other situations in which remaining seated is expected.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>12) Often runs about or climbs excessively in situation where it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness).</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>13) Often has difficulty playing or engaging in leisure activities quietly.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>14) Is always &quot;on the go&quot; or acts as if &quot;driven by a motor&quot;.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>15) Often talks excessively</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>16) Often blurts out answers to question before the questions have been completed.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>17) Often has difficulty waiting in lines or awaiting turn.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>18) Often interrupts or intrudes on others (e.g. butts into other's conversations or games).</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Do Not Write Below This Line**

Rating Scale: I___________________ H/I___________________