I. Understanding ADHD

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Objectives

- be alert for signs and symptoms of ADHD
- know how and when to refer for medical ADHD treatment
- reduce lifetime burden of ADHD by helping patients work from their strengths
ADHD: what is it really?

- think of brain function as a number of different circuits, cooperating and competing
  - sensation
  - movement
  - emotions
  - cognition (calculation, classification, etc.)
  - “executive functions”
What are executive functions?

• impulse control (resisting temptation, overcoming strong emotion, etc.)
• selective attention (resisting distraction)
• sustained effort, delayed gratification
• flexibility (mid-course corrections)
• consistent sense of time
• prioritizing, planning ahead
The pre-frontal cortex (PFC)
The delicate balance

instant threat assessment, “fight or flight” reactions
Emotions and thinking

• the amygdala (“fight or flight”) makes decisions faster than the prefrontal cortex
  • jumping when startled
  • freezing on seeing a snake

• it’s hard for all of us to make good decisions when we’re very angry, scared, excited

• the balance between emotional and executive input determines the actions we take
  • “Do I punch this guy or ignore what he just said?”
Amygdala hijack*

- when the emotional/survival part of the brain overwhelms the input from the executive part
- “losing it”, “melting down”
  - or not being able to stop laughing
- in relationships: anger can trigger us to interact as enemies, see our partner as an enemy, and the argument a battle we need to win to survive

*Daniel Goleman, Emotional Intelligence, Simon & Schuster, 1995
ADHD: what is it really?

• in ADHD, executive function (PFC) signals are relatively weak
  • impulsivity, distractibility, inattention
  • emotional outbursts
  • ‘spacing out’, being late, losing things
ADHD and balanced thinking

- if people with ADHD have weaker input from their PFC (executive brain), would they have more or less trouble thinking clearly when emotional?
ADHD and balanced thinking

• consider the behavior of toddlers and small children: do you think our PFC’s mature early or later in development?

• what does this mean for parents?
PFC development in humans

Impulse control, anticipating consequences, overriding emotions

Growth continues into late 20’s

Insel, T. Perspectives, Nature, Nov 11, 2010
Do we grow out of ADHD?

- PFC function grows stronger with age in all kids, including those with ADHD
  - we all get less impulsive, can work more complex problems, and can calm ourselves better as we move into adulthood
- In ADHD there is usually more improvement in hyperactivity than executive functions with age
- kids with ADHD continue to be at a relative disadvantage into adulthood
ADHD challenges and gifts

- impulsivity, disorganization, lateness
- restlessness, boredom
- but ADHD “wiring” may be a strength in some kinds of work
  - “thinking outside the box”: ADHD advantage
  - hands-on/creative: artists, builders, mechanics
  - self-paced, varying tasks: farming, sales, small business
ADHD: a partly cultural construct

• in any culture/time, people with ADHD “wiring” would probably be at slightly higher risk for injury

• the current US economy and education/vocation training select intensely for those without ADHD
ADHD traits are adaptive in some traditional lifestyles

- the Ariaal, a nomadic Kenyan people, have a high incidence of a gene variant associated with ADHD (DRD4-7R)
  - those living nomadically who have the ADHD-associated gene tend to be **better**-nourished
  - those settled in towns who have the gene tend to be **under**-nourished

Eisenberg DTA, Campbell B, Gray PB, Sorenson MD. Dopamine receptor genetic polymorphisms and body composition in undernourished pastoralists: An exploration of nutrition indices among nomadic and recently settled Ariaal men of northern Kenya. BMC Evolutionary Biology. 2008; 8(173)
Who succeeds in today’s economy?

• 30 years ago, small businesses were more likely to be started by those with less formal education—now the opposite is true

• well-paying jobs with benefits that do not require a college degree are increasingly rare
  • automation, global competition, decline of unions
  • ‘Mom and Pop’ businesses can’t compete with chains

• our current economy rewards those who can sit in chairs and process written material
Decline of “hands-on” careers

Number of farms in the U.S. 1900-2000

Between 1950 and 1970 the number of the farms in the U.S. was cut roughly in half before the rate of decline leveled off. [Source US Dept. of Commerce & USDA]
Decline of manufacturing jobs 1990-2010

BLS data
ADHD in the US

- **CDC: ADHD prevalence, age 4-17**
  - 2003: 7.8%
  - 2007: 9.5%
  - 2011: 11.0% (boys 13.2%, girls 5.6%)

- **adult prevalence estimated at 4% in separate surveys**

https://www.cdc.gov/ncbddd/adhd/features/key-findings-adhd72013.html
ADHD and the educational environment

• class sizes have increased in most public school systems
  • Arizona’s is among highest in country

• with more focus on standardized test results, class environment is less flexible
  • tangential ideas are more likely to be seen as misbehavior instead of contribution
What is school like if you have ADHD

• she’s just not making an effort
• he’d rather clown around
  • ...or socialize, or daydream, or fidget
• there’s just no motivation!!
Motivation: a mix of emotion and executive functions

- excitement, pleasure, novelty
- anticipating short-term reward
- avoiding negative consequences
- acting on priorities
- planning, delayed gratification
Motivations for a homework task

- Wow! this is really fun!
- I want to be prepared in class to impress that girl.
- I’ll be grounded this weekend if I don’t finish this.
- It’s important to make my parents proud of me.
- I want to be a veterinarian someday.

Planning, delayed gratification, acting on priorities, avoiding negative consequences, anticipating short-term reward, excitement, pleasure, novelty.
Kids with ADHD get frustrated with themselves

- they care about what their parents and teachers think, they worry about the future, and they know what they SHOULD do
- but the motivational “gears” that involve prioritizing, planning, and staying focused simply have no (or fewer) teeth
- the internal sense of failure leads to anger at self, giving up, shutting down, depression
Kids with ADHD are frustrating to be around

• “All he cares about is entertaining his neighbors.”

• “We can’t trust her any more! She KNOWS she’s not supposed to do that!”

• “She’s so immature, that’s why no one likes her.”

• “There’s nothing wrong with that kid! He/she just needs to make an effort.”
Disorders co-occurring with ADHD

- depression: 14% (children), 47% (adults)
- anxiety: 30% (children), 53% (adults)
- sleep issues: 25-50% (children)
- learning disorders: ~ 50%
- increased risk of: early smoking, alcohol and drug use disorders

ADHD and health risks

- children/teens with ADHD have more:
  - bone fractures - 1.3 times as many
  - car accidents - 1.3 times as many
  - hospitalization for any reason - 2.1 times as many

Nigg JT. Attention-deficit/hyperactivity disorder and adverse health outcomes, Clin Psychol Rev. 2013 Mar; 33(2): 215-218
ADHD and risky sexual behavior

• in teenagers,
  • earlier first intercourse
  • more partners
  • higher teen pregnancy rate (self or partner)
  • a fourfold higher rate of STD’s

Nigg JT. Attention-deficit/hyperactivity disorder and adverse health outcomes, Clin Psychol Rev. 2013 Mar; 33(2): 215-218
The transition to adulthood

• approaching 18, if teens disagree with taking medication, consider:
  • a gradual taper, watching for changes in grades
  • a negotiated medication holiday, starting on a school break, with conditions for resuming meds

• many kids stop meds at 18, but decide to resume as young adults when facing job or school problems due to ADHD
ADHD and the military

• having ADHD does not disqualify someone from military service in most cases

• but being on medication IS DISQUALIFYING
  • need to be med-free for 12 months

• anticipate the future
  • if kids plan to enter the military right out of high school, try to taper off meds by the end of 11\textsuperscript{th} grade at latest
Educational outcomes

- Study group ~500 people diagnosed with ADHD from 1987-1996
- Follow-ups between 1999-2008
  - 32% had dropped out of high school (15%)
  - 15% held a 4-year degree (48%)
  - 0.06% held a graduate degree (5.4%)

Occupation at age 23-32

• employment/education status compared to peers without ADHD
  • 11 times more likely to be unemployed and not in school
  • 6 times more likely to be in unskilled vs. professional occupations
  • those employed made $2 less per hour

Does ADHD treatment improve adult outcomes?

• compilation of 351 international studies with follow-up of 2 years or more

• treatment improved outcomes, but did not fully mitigate the effect of ADHD on:
  • ++driving, obesity (most improved outcome)
  • +self-esteem, social function, academic attainment
  • +/- drug use, antisocial behavior, occupation

ADHD Treatment: AAP* Guidelines

- “the primary care clinician should initiate an evaluation for ADHD for any child 4–18 years old who presents with academic or behavioral problems and symptoms of inattention, hyperactivity, or impulsivity”

* American Academy of Pediatrics
AAP Treatment Guidelines

• for children 3 through 5 years old
  • parent and/or school-based behavior training
  • methylphenidate* only if behavioral interventions do not provide significant benefit and there is moderate to severe disturbance in the child’s function
    • * note that this is off-label: MPH is approved for use in children 6 or older, while only IR-dextroamphetamine is approved for age 3 and up
AAP Treatment Guidelines

• for elementary school children (6-11 years old)
  • prescribe an FDA-approved medication
  and
  • school environment changes (accommodations, IEP if indicated), behavior plans
AAP Treatment Guidelines

- for adolescents (12 to 18 years)
  - prescribe an approved medication
  - behavior therapy is recommended as adjunct
AAFP* adult ADHD guidelines

• evaluate functioning in last 6 months using validated adult rating scale

• establish a history of symptoms dating back before 12 years of age (recently changed from 7 years old)

• rule out other disorders
  • esp. substance abuse, depression, anxiety

• obtain family and developmental histories

• physical exam (with urine drug screen)

*American Academy of Family Practice
AAFP adult ADHD guidelines

• be alert for diversion of stimulants
  • esp. in white males, college students, fraternity members, those with academic difficulties, or with a substance use disorder history

• drug screening can verify that the prescribed medication is being taken, and rule out other substance use

• non-stimulants or Vyvanse are least abusable
Initiating treatment

• decide on desired duration of action
  • younger kids, shorter duration (usually)

• start with low dose, titrate weekly to point of response, side effects, or maximum dose
  • initial follow up should be within 30 days of starting medication

• if not tolerated/effective, try a different duration or the other stimulant
  • if not tolerated/effective, try non-stimulant

Stimulants: two main drugs, loads of options

- **methylphenidate**
  - Ritalin
  - Metadate
  - Concerta
  - Quillivant
  - Daytrana
  - Focalin

- **amphetamine salts**
  - Dextrostat
  - Adderall
  - Vyvanse
Choosing a stimulant

- duration of action (consider homework, evening activities)
- dosing flexibility (sprinkles? liquid? patch?)
- past response
- other
  - family history of response
  - cost
  - parent preference
Different formulations

1. The inactive molecule, lisocabemetamine dimesylate, is rapidly absorbed from the GI tract into the bloodstream.

2. Once in the bloodstream, lisocabemetamine dimesylate is hydrolyzed primarily by red blood cells to the active molecule d-amphetamine.

3. d-amphetamine is thought to be taken up by DA and NA transporters.

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Osmotic gradient, multiple layers provide tablet's desired drug profile

Immediate-Release Bead
- Bead Core
- Drug Layer
- Overcoating

Delayed-Release Bead
- Bead Core
- Drug Layer
- Overcoating
- Release-Delaying Polymer
Stimulant effectiveness

- 70% of patients respond to 1st stimulant tried, and
- 90% respond with switching or titration
- response rate is lower for atomoxetine, guanfacine, clonidine, *antidepressants (off label)
Other medications for ADHD

- atomoxetine (Strattera)
- alpha-2 adrenergic agonists
  - guanfacine, clonidine are both available in extended-release formulations and approved for use in ADHD
- off-label (not FDA-approved) medications are also used
No response? reconsider diagnosis

- anxiety, PTSD, fetal substance exposure
- autism spectrum disorders
  - ADHD meds may cause anxiety
  - start with low-dose, short-acting stimulant for a child with both ASD and ADHD
- mood problems
  - depression, mania
Non-medication treatments

• many dietary treatments seem to be effective in non-blind situations, but the effect disappears with blind raters
  • omega-3 fatty acid supplements produced small but significant symptom reduction
  • eliminating food colorings may be helpful for children with known food sensitivities (+/-)
  • other elimination diets (sugar, gluten, etc.) have not proved effective when assessed by blind raters
Non-medication treatments

- psychological treatments (attention training, memory training, theta-beta training, slow cortical potential training) seemed effective in early studies with non-blinded raters
- these effects were lost in blind ratings

Mindfulness training in ADHD

- small, well-designed study in the Netherlands
  - kids 8–12 yo
  - parents and kids had 8 weekly 90-min group sessions
- parents’ ratings of children’s symptoms decreased significantly
  - so did parents’ inattention and impulsivity!
- teacher ratings not changed (inattention improvement approached significance)

van der Oord S. and Bogels S. The Effectiveness of Mindfulness Training for Children with ADHD and Mindful Parenting for their Parents. J Child and Fam Studies Feb 2012, V 21, Issue 1, pp 139-147
ADHD and sleep problems

- around half of children diagnosed with ADHD have problems falling asleep and/or staying asleep
  - sleep hygiene - no screen time right before bed, regular routine, no access to electronics
  - * clonidine 0.1-0.2 mg qhs (off-label)
  - * melatonin (dietary supplement, not FDA-approved for this use)
Assessing treatment response

- observation
- patient, parent/guardian, teacher reports
- rating scales, report card
  - pre- and post-treatment Vanderbilt Teacher and Parent Rating Scales
  - Adult ADHD Symptom Rating Scale (ASRS)
## Vanderbilt ADHD Diagnostic Teacher Rating Scale

Name: ____________________________  Grade: ____________________________

Date of Birth: ______________  Teacher: ____________________________  School: ____________________________

Each rating should be considered in the context of what is appropriate for the age of the children you are rating.

<table>
<thead>
<tr>
<th>Frequency Code: 0 = Never; 1 = Occasionally; 2 = Often; 3 = Very Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fails to give attention to details or makes careless mistakes in schoolwork</td>
</tr>
<tr>
<td>2. Has difficulty sustaining attention to tasks or activities</td>
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<td>3. Does not seem to listen when spoken to directly</td>
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<td>4. Does not follow through on instruction and fails to finish schoolwork (not due to oppositional behavior or failure to understand)</td>
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<tr>
<td>5. Has difficulty organizing tasks and activities</td>
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<td>6. Avoids, dislikes, or is reluctant to engage in tasks that require sustaining mental effort</td>
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<td>7. Loses things necessary for tasks or activities (school assignments, pencils, or books)</td>
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<td>8. Is easily distracted by extraneous stimuli</td>
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<td>9. Is forgetful in daily activities</td>
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<tr>
<td>10. Fidgets with hands or feet or squirms in seat</td>
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<tr>
<td>11. Leaves seat in classroom or in other situations in which remaining seated is expected</td>
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<tr>
<td>12. Runs about or climbs excessively in situations in which remaining seated is expected</td>
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<tr>
<td>13. Has difficulty playing or engaging in leisure activities quietly</td>
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<td>14. Is &quot;on the go&quot; or often acts as if &quot;driven by a motor&quot;</td>
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<td>15. Talks excessively</td>
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<td>16. Blurs out answers before questions have been completed</td>
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<td>17. Has difficulty waiting in line</td>
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<td>18. Interrupts or intrudes on others (e.g., butts into conversations or games)</td>
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<td>19. Loses temper</td>
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<tr>
<td>20. Actively defies or refuses to comply with adults’ requests or rules</td>
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<tr>
<td>21. Is angry or resentful</td>
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<tr>
<td>22. Is spiteful and vindictive</td>
</tr>
<tr>
<td>23. Bullies, threatens, or intimidates others</td>
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<tr>
<td>24. Initiates physical fights</td>
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<td>25. Lies to obtain goods for favors or to avoid obligations (i.e., “cons” others)</td>
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<tr>
<td>26. Is physically cruel to people</td>
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<tr>
<td>27. Has stolen items of nontrivial value</td>
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<tr>
<td>28. Deliberately destroys others’ property</td>
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<tr>
<td>29. Is fearful, anxious, or worried</td>
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<tr>
<td>30. Is self-conscious or easily embarrassed</td>
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<tr>
<td>31. Is afraid to try new things for fear of making mistakes</td>
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<tr>
<td>32. Feels worthless or inferior</td>
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<tr>
<td>33. Blames self for problems, feels guilty</td>
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<tr>
<td>34. Feels lonely, unwanted, or unloved; complains that “no one loves him/her”</td>
</tr>
<tr>
<td>35. Is sad, unhappy, or depressed</td>
</tr>
</tbody>
</table>

### PERFORMANCE

<table>
<thead>
<tr>
<th></th>
<th>Problematic</th>
<th>Average</th>
<th>Above Average</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Academic Performance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Reading</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2. Mathematics</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3. Written expression</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><strong>Classroom Behavioral Performance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Relationships with peers</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2. Following directions/rules</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>3. Disrupting class</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4. Assignment completion</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>5. Organizational skills</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
## Adult ADHD Self-Report Scale (ASRS-v1.1) Symptom Checklist

<table>
<thead>
<tr>
<th>Patient Name</th>
<th>Today's Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please answer the questions below, rating yourself on each of the criteria shown using the scale on the right side of the page. As you answer each question, place an X in the box that best describes how you have felt and conducted yourself over the past 6 months. Please give this completed checklist to your healthcare professional to discuss during today’s appointment.</td>
<td>Never</td>
</tr>
<tr>
<td>1. How often do you have trouble wrapping up the final details of a project, once the challenging parts have been done?</td>
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<tr>
<td>2. How often do you have difficulty getting things in order when you have to do a task that requires organization?</td>
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<tr>
<td>3. How often do you have problems remembering appointments or obligations?</td>
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<tr>
<td>4. When you have a task that requires a lot of thought, how often do you avoid or delay getting started?</td>
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<tr>
<td>5. How often do you fidget or squirm with your hands or feet when you have to sit down for a long time?</td>
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<tr>
<td>6. How often do you feel overly active and compelled to do things, like you were driven by a motor?</td>
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<tr>
<td>7. How often do you make careless mistakes when you have to work on a boring or difficult project?</td>
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<tr>
<td>8. How often do you have difficulty keeping your attention when you are doing boring or repetitive work?</td>
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<tr>
<td>9. How often do you have difficulty concentrating on what people say to you, even when they are speaking to you directly?</td>
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<tr>
<td>10. How often do you misplace or have difficulty finding things at home or at work?</td>
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<tr>
<td>11. How often are you distracted by activity or noise around you?</td>
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<tr>
<td>12. How often do you leave your seat in meetings or other situations in which you are expected to remain seated?</td>
<td></td>
</tr>
<tr>
<td>13. How often do you feel restless or fidgety?</td>
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<tr>
<td>14. How often do you have difficulty unwinding and relaxing when you have time to yourself?</td>
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</tr>
<tr>
<td>15. How often do you find yourself talking too much when you are in social situations?</td>
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<tr>
<td>16. When you’re in a conversation, how often do you find yourself finishing the sentences of the people you are talking to, before they can finish them themselves?</td>
<td></td>
</tr>
<tr>
<td>17. How often do you have difficulty waiting your turn in situations when turn taking is required?</td>
<td></td>
</tr>
<tr>
<td>18. How often do you interrupt others when they are busy?</td>
<td></td>
</tr>
</tbody>
</table>

**Part A**

**Part B**
ADHD and school accommodations

• ADHD is not a learning disability, but kids with ADHD are more likely to have LD’s
  • 5% of kids without ADHD have LD
  • 46% of kids with ADHD have LD

• if kids are still struggling academically once ADHD treatment is optimized,
  • ask for psychoeducational evaluation
  • know your IDEA

Larson K et al. Patterns of Comorbidity, Functioning, and Service Use for US Children With ADHD. Pediatrics, February 2011
Individuals with Disabilities Education Act (IDEA)

• a federal law, applies to all US public schools

• parent/guardian or provider can request a psychoeducational evaluation

  • need to make request IN WRITING

  • school has 60 days from written request to complete the evaluation or provide written notice explaining why they do not feel it necessary

• this decision can be appealed
Dear (name of school principal),

I am writing this letter on behalf of (child’s name and date of birth), with the agreement of (parent/guardian), (name).

This is a request that (child’s name) be evaluated to determine if (he/she) has a specific learning problem that would benefit from Special Educational services.

(you may include specific reasons here, such as: persistent difficulties in one subject area, or a lack of improvement despite optimal treatment for ADHD, or not working at or near grade level but being promoted anyway, etc. Depending on how much information the parent/guardian feels comfortable sharing, you may want to include information re: medical history or fetal substance exposure).

Thank you for your attention to this and for your efforts on behalf of (child’s name). We look forward to the findings of this evaluation within 60 days as required by Arizona law. Please consider this letter as both a request for, and a consent to, evaluation of (child’s name).

Sincerely,

_________________________
(your name)
(position)

_________________________
(parent/guardian name)
(“parent” or “guardian”)
ADHD and school accommodations

- Kids with ADHD who do not have LD may still benefit from 504 accommodations
  - Limit distraction (seating)
  - Help with HW ‘agendas’
  - Allow longer time for certain assignments
  - Reduce number of problems on HW or timed activities

Larson K et al. Patterns of Comorbidity, Functioning, and Service Use for US Children With ADHD Pediatrics February 2011
Summary

• medications that increase PFC activity improve executive functions for people with ADHD
  • treatment with medication does not increase the risk of substance abuse

• even with treatment, most people with ADHD still have residual symptoms
  • long-term outcome differences
Summary

• many kids with ADHD have good hands-on, visual-spatial skills
  • engineering, art, athletics
  • identify and build on strengths!!

• address self-esteem issues
  • “I’m always messing up, why did I say that, I really meant to remember that, other kids think I’m weird, how did I get myself into this…”
  • it’s not an excuse, but IS a reason why some things are harder
Questions