What is ADHD?
The Current Clinical View

A disorder of age-inappropriate behavior in two domains of neuropsychological development:

I. **Hyperactivity-Impulsivity** (Poor Inhibition)
   - Impaired verbal and motor inhibition
   - Impulsive decision making; cannot wait or defer gratification
   - Greater disregard of future (delayed) consequences
   - Excessive task-irrelevant movement and verbal behavior
     - Fidgeting, squirming, running, climbing, touching
   - NOTE: Restlessness decreases with age, becoming more internal or subjective by adulthood
II. Inattention

- But there are at least 6 types of attention:
  - Arousal, alertness, selective, divided, span of apprehension, & persistence.
- Not all are impaired. What is?
  - Poor persistence toward goals or tasks
  - Impaired resistance to responding to distractions
  - Deficient task re-engagement following disruptions
  - Impaired working memory (remembering so as to do)
DSM-IV Criteria for ADHD

- Manifests 6+ symptoms of either inattention or hyperactive-impulsive behavior
- Symptoms are developmentally inappropriate
- Have existed for at least 6 months
- Occur across settings (2 or more)
- Result in impairment in major life activities
- Developed by age 7 years
- Are not best explained by another disorder, e.g. Severe MR, PDD, Psychosis
- 3 Types: Inattentive, Hyperactive, or Combined
Inattention Symptoms (DSM-IV)

- fails to give close attention to details
- difficulty sustaining attention
- does not seem to listen
- does not follow through on instructions
- difficulty organizing tasks or activities
- avoids tasks requiring sustained mental effort
- loses things necessary for tasks
- easily distracted
- forgetful in daily activities

Symptoms must occur “Often” or more frequently
Hyperactive-Impulsive Symptoms

- fidgets with hands or feet or squirms in seat
- leaves seat in classroom inappropriately
- runs about or climbs excessively
- has difficulty playing quietly
- is “on the go” or “driven by a motor”
- talks excessively
- blurts out answers before questions are completed
- has difficulty awaiting turn
- interrupts or intrudes on others

Symptoms must occur “Often” or more frequently
Issues for DSM5

- Inattention list may be mislabeled
  - Broaden to include poor working memory (and possibly larger domain of executive functions)

- Symptoms of impulsiveness or poor inhibition and chiefly verbal; need to add poor impulse control (DSM5 proposes to do so)

- Symptoms and wording are not appropriate past childhood
  - Need more items for adult stage of disorder
  - DSM5 proposes to add parenthetical clarifications for adults to existing symptoms

- Symptoms of emotional impulsiveness and poor emotional self-regulation are important central features but receive no mention
What is Emotional Self-Regulation?

1. Ability to inhibit inappropriate behavior related to strong negative or positive emotion (response suppression)
2. Self-soothe and down-regulate physiological arousal related to #1 above
3. Refocus attention from the emotionally provocative events (distraction & reappraisal)
4. Organize emotions for coordinated action in the service of goals and long-term welfare

If Emotional Self-Regulation is Deficient in ADHD, What Would We Expect?

• Emotional impulsiveness (EI) – Part of Poor Inhibition
  – Poor inhibition of inappropriate behavior related to strong emotions (weak expressive suppression)
  – Low frustration tolerance, impatient
  – Quick to anger and become hostile
  – Greater emotional excitability, reactivity, & raw expression

• Difficulties self-regulating (moderating) emotional reactions to evocative events (DESR)
  – Deficient in effortful, cognitive “top-down” regulation of induced emotions (self-soothing, refocusing attention, distraction, etc.)
  – Difficulties inducing positive, more acceptable mood states (i.e., cognitive re-appraisal, proactive situation selection/modification)

• Impaired self-motivation and activation (arousal) when needed to support goal-directed action

More Issues for DSM5

• Symptom cutoffs (6 of 9) are also not appropriate past childhood
  – May have to adjust thresholds down to 4 of 9 if > age 17 and higher than 6 if < 4 yrs
  – DSM5 proposes to use a threshold of 4 for adults

• Cutoffs are based mainly on boys (3:1)
  – Need equal representation of females in DSM5 trial
  – May be lower for girls; for now use rating scales

• Duration may be too short for preschoolers:
  – try 1 year or more

• Developmental deviance undefined
  – use 93 percentile (+1.5 SDs above normal mean)
More Issues for DSM5

• Requires cross-setting occurrence of symptoms that implies need for parent-teacher agreement
  – Instead, blend reports of both and use history of cross setting impairment

• No requirement for corroboration by others
  – Yet that is essential when evaluating teens and young adults up to late 20s-early 30s due to under-reporting of symptoms
  – DSM5 may recommend such corroboration (???)

• Impairment is undefined (use average person standard)

• Age of onset of 7 years lacks validity
  – use childhood onset – approximately 16 years
Best New Symptoms for Adults

1. Is often easily distracted by extraneous stimuli (DSM-IV)
2. Often make decisions impulsively (EF)
3. Often has difficulty stopping my activities or behavior when I should do so (EF)
4. Often starts a project or task without reading or listening to directions carefully (EF)
5. Often shows poor follow through on promises or commitments I may make to others (EF)
6. Often has trouble doing things in their proper order or sequence (EF)
7. Often more likely to drive a motor vehicle much faster than others (Excessive speeding)(EF) [For non-drivers, substitute this item: “Often have difficulty engaging in leisure activities or doing fun things quietly.”]
8. Often has difficulty sustaining attention in tasks or play activities (DSM – optional)
9. Often has difficulty organizing tasks and activities (DSM – optional)

Cutoff would be either 4 of first 7 or 6 of all 9 items above
Onset of symptoms producing impairment in childhood to adolescence (< 16)

Problems with DSM-IV Subtypes

• Developmentally unstable resulting in cross-contamination
  – Hyperactivity arises early – Preschoolers are likely to be in the Hyperactive-Impulsive Type
  – Inattention arises 2-3 years later – School age children are likely to be in the Combined Type. 90% of HI Type evolve into Combined Types
  – Hyperactivity declines markedly with age – By late adolescence or young adulthood, many Combined Types are now Inattentive Types
More Subtyping Problems

- Diagnostic thresholds result in cases that are just 1 symptom below Combined Type get classified as I- or HI-Types – Just mild C-Types

- Behavior genetic studies of entire populations show ADHD is a single dimensional phenotype that varies in severity across humans. Where two dimensions are found, they are highly correlated and genetic contribution is shared or common between them. A small amount of variation in each dimension is due to unique genetic effects
DSM Subtypes vs. Research-Based Subtypes

DSM subtype

Inattentive

Formerly Combined Types
- View as always Combined Types

Sub-threshold Combined Types
- View as milder Combined Types

Sluggish Cognitive Tempo
- View as qualitatively different type or distinct disorder

30-50%
SCT Symptoms on Rating Scales

• Daydreaming excessively
• Trouble staying alert or awake in boring situations
• Easily confused
• Spacey or “in a fog”; Mind seems to be elsewhere
• Stares a lot
• Lethargic, more tired than others
• Underactive or have less energy than others
• Slow moving or sluggish
• Doesn’t seem to understand or process information as quickly or accurately as others
• Apathetic or withdrawn; less engaged in activities
• Gets lost in thought
• Slow to complete tasks; needs more time than others
• Lacks initiative to complete work or effort fades quickly
ADHD - Inattentive Type (SCT subset)

- Most symptoms of Sluggish Cognitive Tempo (SCT) are not typical of C-Type\(^1,2\)
- SCT Symptoms form 2 dimensions of daydreamy-sleepy and slow moving in factor analysis. The former are the more diagnostic from ADHD\(^2\)
- Slow, Error Prone Response Style & Processing
  - Less able to use relevant environmental cues in task responding\(^2,3\)
- Poor Focused or Selective Attention
  - Slower reaction times, more omission errors\(^1,4\)
  - Unlike ADHD-C type, sluggish style is cross-situational\(^4\)
  - May be related to excessive or pathological mind-wandering

ADHD Inattentive Type - SCT

• Socially Shy, reticent or withdrawn
• No motor inhibition problems or impulsiveness on cognitive testing in most studies\(^1,2\)
  – If anything, they are overly inhibited\(^4\)
• Little evidence for executive function deficits on tests.\(^3\)
• But some EF deficits are evident on EF ratings in daily life.
  – Self-organization & problem-solving are most severe deficits and are more so than in ADHD

More Distinguishing Features of SCT

- Comorbidity: Rarely show Aggression or ODD/CD
- Greater risk of anxiety symptoms
- Possibly greater risk for depression (?)
- Lower levels of parenting stress
- Greater parental concerns regarding school failure
- Equally impaired in educational performance
  - But ADHD is a productivity disorder while SCT is an accuracy disorder
  - Greater frequency of math disorders in SCT (?)
- Greater family history of anxiety and LD (?)
Recent large study of SCT in 1,800 U.S. Children 6-17 Yrs (Barkley, 2012)

- SCT forms two dimensions of symptoms distinct from the two ADHD dimensions
  - Daydreaming & Sluggish
  - Two dimensions correlate more with each other (.75) than with ADHD (.40 -.50)
- SCT symptoms increase slightly with age while ADHD (HI) symptoms decline or remain stable
- SCT symptoms only slightly more severe in males than females; ADHD is much more severe in males
More results on SCT children

• Cast as a disorder (category), SCT is not more common in males than females while ADHD is 2-3:1 (males to females)
• SCT is associated more than ADHD with lower parental education, lower household income, greater parental unemployment or disability status, and more parent divorce
• SCT children are older and may have a later age of onset of their symptoms
• Prevalence was 4.7% (93rd percentile or 3 of 12 symptoms plus impairment)
EF Ratings for SCT vs ADHD
(Barkley, 2012)
Contribution of SCT vs ADHD dimensions to EF deficits

• ADHD Inattention accounts for 49-77% of variance in all EF dimensions
• ADHD HI symptoms account for <1 to 6% of variance, mainly in Self-Restraint and Emotional Self-Regulation
• SCT accounts for less than 1% in each except Self-organization, where it is 5%
• ADHD is vastly more associated with EF deficits in daily life than is SCT
Impairment in SCT vs ADHD

* = SCT Worse than ADHD  ! = ADHD Worse than SCT

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**Legend**
- Controls
- ADHD Only
- SCT Only
- SCT+ADHD

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- Mother
- Father
- School Perf.
- Siblings
- Play - Neighbors
- Community
- Visiting Others
- Play - School
- Money
- Self-Care
- Doing Chores
- Homework
- Follow Rules
- Other Adults
- Sports

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*** = P < 0.001
Contributions of SCT vs ADHD to Impairments

- ADHD results in impairment in twice as many domains as does SCT (5-7 vs. 2-3)
- ADHD Inattention contributes 49% of variance to Home-School Impairment (SCT = 1%)
- ADHD HI symptoms contribute 35% of variance to Community-Leisure impairment (SCT = 6%)
- ADHD contributes 39% of variance to pervasiveness of impairment (# domains) whereas SCT is <3%
- ADHD is a far more impairing disorder than SCT producing more pervasive impairment as well
- ADHD children had greater percentage having teacher complaints of school problems (72-85%), had lower grade point averages, and were more likely to be retained (8-25%)
Overlap of SCT with ADHD

- 59% of SCT cases had any type of ADHD
  - 22% had I-Type
  - 8% had HI-Type
  - 30% had C-Type
- 39% of ADHD cases had SCT
  - 31% of I-Type
  - 27% of HI-Type
  - 55% of C-Type
Comorbidity in SCT in U.S. Children
(Barkley, 2012)

- No more likely to have ODD, reading, math, anxiety, or bipolar disorder than Control children while ADHD cases were more likely to have these.
- More likely than ADHD to be associated with depression disorders.
- Equally as likely as ADHD to be associated with motor, spelling, writing, & autistic spectrum disorders and general developmental delay.
- 50% of ADHD cases had prior diagnosis of it while 14% of SCT cases had diagnosis of ADHD.
- 53% of SCT kids free of comorbidity vs. 39% of ADHD Only and 25% of SCT+ADHD.
More on SCT (in adults)\(^1\)

- Later age of onset of symptoms
- No sex differences in general population
- Does not decline with age like ADHD
- 5.1% prevalence (using 5/9 symptoms plus impairment)
- A distinct disorder from ADHD; not a subtype
- Overlaps with ADHD
  - 54% of cases of ADHD have SCT, especially if diagnosed with the Predominantly Inattentive Type
  - 46% of SCT cases may have elevated ADHD symptoms, again mainly of ADHD inattention

Impairments in SCT vs. ADHD

What is the Nature of SCT?

- It appears to be a distinctly different form of inattention from that seen in ADHD but can be comorbid with ADHD (mostly inattentive type)
- Possibly a dysfunction of arousal?
- Possibly a disorder of the focus/execute or stabilize attention components?
- Possibly more related to social stressors?
- But is it a pathological case of mind wandering?
SCT as a Disorder of Mind Wandering?

- Mind wandering or daydreaming can be constructive under some circumstances when more routine goals are being largely automatically pursued – it is an efficient use of excess EF capacity (especially working memory) in which one focuses on other goals, problems, or concerns while engaged in a separate goal-directed action.

- When it is engaged in excessively, it can diminish the EF capacities needed for the primary goal-directed action and even interfere with the primary task or goal, slowing progress toward the goal or even preventing the goal from being attained or the task being completed in time.
Treatment Implications for SCT

• All research has been with children, not with adults
• All drug research was with methylphenidate and used ADD without H cases (or Inattentive Only) – not selected specifically for SCT
• Less Likely to Have a Clinically Impressive Response to Stimulants (based on a few studies; need more research)
  – (Barkley Study finds 65% improve modestly in symptom ratings but only 20% showed a good clinical response warranting continued medication)
• Better response to social skills training in children than ADHD cases
  – Up to 25% of ADHD cases become more aggressive in social skills groups due to peer deviancy training
  – Training works best for shy, withdrawn, anxious children
• Good (better?) response to joint home-school treatments
  – MTA study: anxious cases did the best in psychosocial treatment
  – Pfiffner (2007) study shows good response to home-school behavioral training and child training in social and organizational skills that is targeted at ADHD-I specific problems*

More SCT Treatment Considerations

• More responsive to cognitive therapy (??)
  – It doesn’t work for children with ADHD but if this is not ADHD then try it again?
  – It does work for anxiety disorders and depression

• Do adults respond to CBT focusing on EF deficits as well as do ADHD adults?
  – And do they need to be on medication like ADHD adults?
    Doubtful, as ADHD medications don’t seem as useful for SCT

• Consider atomoxetine (??) Why? It may treat anxiety in ADHD cases – SCT cases are more likely to have anxiety

• Consider modafinil (anti-narcoleptic) (??) Why? Is SCT a disorder of arousal?

• If SCT is ruminative or related to OCD, consider clomipramine or fluvoxamine used to treat OCD (??)
Conclusions

- ADHD is a chronic disorder of inhibition, inattention, and poor self-regulation (EF)
- DSM5 needs to make a number of adjustments to increase rigor or accuracy of diagnosis
- SCT (ADD) seems to be a different disorder from ADHD and not a subtype of it
- Both disorders can be comorbid and are impairing though they may differ in which major life activities they create the greatest impairment
- ADHD can be distinguished from other disorders based on its childhood onset, chronic course, pervasive impact on EF domains, and unremitting and pervasively impairing nature
The Nature of ADHD:
The Executive Functions and Self-Regulation

Russell A. Barkley, Ph.D.
Clinical Professor of Psychiatry
Medical University of South Carolina
Charleston, SC

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Sources:

Email: drbarkley@russellbarkley.org
Website: russellbarkley.org
Does ADHD = EFDD???

(Executive Function Deficit Disorder)
The Prefontal Cortical Networks Involved in EF Are Also the Networks Implicated in Self-Regulation and in ADHD

- **The frontal-striatal circuit**: Associated with deficits in response suppression, freedom from distraction, working memory, organization, and planning, known as the “cool” or “what” EF network.

- **The frontal-cerebellar circuit**: Associated with motor coordination deficits, and problems with the timing and timeliness of behavior, known as the “when” EF network.

- **The frontal-limbic circuit**: Associated with symptoms of emotional dyscontrol, motivation deficits, hyperactivity-impulsivity, and proneness to aggression, known as the “hot” or “why” EF network.


Most Common EF Components

• Inhibition and interference control
• Self-Awareness and self-monitoring
• Nonverbal working memory
• Verbal working memory
• Planning and problem-solving
• Anticipation and preparation to act
• Self-Regulation across time
• Emotional Self-Control
How Does ADHD Fit Into EF?

EF Comprises 2 Broadband Domains

**Inhibition:**
- Motor,
- Verbal,
- Cognitive & Emotional

**Meta-Cognition:**
- Nonverbal WM
- Verbal WM
- Planning/Problem-solving
- Emotional self-regulation

Where does ADHD fit into them?

Hyperactivity-Impulsivity

Inattention
Building a Theory of EF and ADHD: Linking Inhibition, Self-Control, and the Executive Functions
Building Blocks of A Theory

• Start with a theory of normal
• Inhibition creates the foundation for self-regulation and EF
• Inhibition comprises three related processes:
  1. Inhibiting the prepotent or dominant response (motor, verbal, cognitive, & emotion)
  2. Interrupting ongoing behavior
  3. Interference control: Protecting the EFs from distraction
What is Self-Regulation?

Self-regulation can be defined as:

1. Any action a person directs toward one’s self (a behavior-to-the-self)
2. So as to change their own subsequent behavior from what they otherwise would have done
3. In order to change the likelihood of a future consequence

You cannot direct an action at yourself without inhibiting your responses to the ongoing environment – they are mutually exclusive
What is EF?

• An executive function can be defined as a major type of action-to-the-self (a type of self-regulation)
• There are 6-7 major types of EFs:
  – Self-Awareness (meta-cognition)
  – Inhibition and interference Control
  – Nonverbal and verbal working memory
  – Emotional - motivational self-regulation
  – Planning and problem-solving
• All can be redefined as actions-to-the-self
• Each likely develops by behavior being turned on the self and then internalized (privatized, inhibited)
• They likely develop in a step-wise hierarchy - Each needs the earlier ones to function well
Inhibition

Sensing to the Self
Self-Speech
Emotion to the Self
Play to the Self

Motor Control
The Two-Level View of Self-Regulation

EF Level

Self-Awareness & Monitoring

Inhibition
Working Memory
Emotion Regulation
Planning

Situation → Attention → Appraisal → Response

Feedback Loop

4 Stages at the Automatic Level of Human Action
The EFs Create Four Developmental Transitions in What is Controlling Behavior

- External → Mental (private or internal)
- Others → Self
- Temporal now → Anticipated future
- Immediate → Delayed gratification
  (Decreased Temporal Discounting of Delayed Consequences)
Anterior-posterior (rostral-caudal) hierarchy of cognitive control of behavior

Self-Regulatory Strength is a Limited Resource Pool

S-R Fuel Tank (Willpower)

- Inhibition & Self-Restraint
- Self-Management to Time (NV-WM)
- Self-Organization & Problem-Solving (V-WM)
- Emotional Self-Regulation
- Self-Motivation

The pool increases in capacity with maturation.

Use of EF/SR reduces the pool temporarily.

So Does: Stress, Alcohol, Drug Use, & Illness
The Brain as a Knowledge vs. Performance Device

ADHD

Performance Knowledge
Understanding ADHD

It’s a Disorder of:

• Performance, not skill
• Doing what you know, not knowing what to do
• The when and where, not the how or what
• Using your past at the “point of performance”

The point of performance is the place and time in your natural settings where you should use what you know (but may not)
Understanding ADHD

• ADHD disrupts all of the EF/SR system thereby creating a disorder of self-regulation across time
• ADHD can be considered as “Time Blindness” or a “Temporal Neglect Syndrome” (Myopia to the Future)
• It adversely affects the capacity to hierarchically organize behavior across time to anticipate the future and to pursue one’s long-term goals and self-interests (welfare and happiness)
• It’s not an Attention Deficit but an Intention Deficit (Inattention to mental events & the future)
Anterior-posterior (rostral-caudal) hierarchy of cognitive control of behavior

Reliance on Cultural Methods and Products

Social Complexity: Interactions & Networks

Increased Valuing of Delayed Outcomes

Extended Space Horizon

Increased Behavioral Complexity/Hierarchies

Neurological Maturation

Implications for Treatment

• Teaching skills is inadequate
• The key is to design prosthetic environments around the individual to compensate for their EF deficits
• Therefore, effective treatments are always those at the “point-of-performance”
• The EF deficits are neuro-genetic in origin
• Therefore, medications may be essential for most (but not all) cases – meds are neuro-genetic therapies
• But some evidence suggests some EFs may also be partly responsive to direct training
• While ADHD creates a diminished capacity: Does this excuse accountability?
  – (No! The problem is with time and timing, not with consequences)
More Treatment Implications

• Behavioral treatment is essential for restructuring natural settings to assist the EFs
  – They provide artificial prosthetic cues to substitute for the working memory deficits (signs, lists, cards, charts, posters)
  – They provide artificial prosthetic consequences in the large time gaps between consequences (accountability) (i.e., tokens, points, etc.)
  – But their effects do not generalize or endure after removal because they primarily address the motivational deficits in ADHD

• The compassion and willingness of others to make accommodations are vital to success

• A chronic disability perspective is most useful
How can we compensate for EF deficits?
By reverse engineering the EF system

• Externalize important information at key points of performance
• Externalize time and time periods related to tasks and important deadlines
• Break up lengthy tasks or ones spanning long periods of time into many small steps
• Externalize sources of motivation
• Externalize mental problem-solving
• Replenish the SR Resource Pool (Willpower)
• Practice incorporating the 5 strategies for emotional regulation in daily life activities
Replenishing the EF/SR Resource Pool

S-R Fuel Tank (Willpower)

Greater Rewards and Positive Emotions

Statements of Self-Efficacy and Encouragement

10 minute breaks between EF/SR tasks

3+ minutes of relaxation or meditation

Visualizing and talking about future rewards before and during SR demanding tasks

Routine physical exercise; Also Glucose ingestion

Regular limited practice using EF/SR and the Willpower Pool can increase later pool capacity. However, the capacity may eventually diminish once practice is terminated.

Treatment Package

• I. Evaluation (Diagnosis)
• II. Education (Counseling)
• III. Medication
• IV. Modification (behavior)
• V. Accommodations
  – at home
  – in school
  – in the community
Promising or Experimental Child Treatment Programs
Experimental Psychosocial Treatments

• **EEG Biofeedback/Neurofeedback**\(^1-2\)
  - Issues – Inconsistent Results, High Cost, Uncertain durability of effects after treatment termination
  - Is EEG feedback the mediator of effects?

• **Training working memory**\(^3-4\) (CogMed)
  - Results are mixed. Effects on other WM tests are evident; effects on parent ratings are more likely than on teacher ratings of school behavior
  - But other approaches exist: Nintendo with Brain Age game, Lumosity.com, mybraintrainer.com, e-mindfitness.com, happyneuron.com, positscience.com

• **Computer Attention Training and Computer Assisted Instruction (reading, math)**\(^5\)
  - Results are mixed. More effects on other tests and parent ratings. Inconsistent effects on teacher ratings

“Challenging Horizons”
After-school program for teens

• 2 days per week for 2 hours each at school

• Uses groups and 1:1 delivery
  – Therapists are paraprofessionals – M.A. level

• Program includes:
  – Academic tutoring & homework assistance
  – Organizational, study and self-monitoring skills
  – Social skills training
  – Recreational skills and deportment
    • Encouraged generalization of social skills
  – Group level token system for behavior control
  – Consult with teachers on behavior management methods
  – Parent education and training
    • 3 sessions/2 hrs. each
Results - Challenging Horizons

• Treatment precludes worsening of adjustment over time evident in untreated students
  – Treatment reduces & forestalls failure events
• Reduces ADHD symptoms at school
• Improves academic performance
• Improves internalizing symptoms
  – But not delinquent or conduct disorder behavior
• Boosts medication effects
• High parent/teacher acceptability and satisfaction
• Less costly than clinic-based services
• Greater teen participation in treatment

Molina, B. S. et al. (2008). *Journal of Attention Disorders, 12*(3), 207-217. molinab@upmc.edu
More Experimental Programs

• Time management and organization training for children for both home and school (Abikoff, NYU Medical School)

• Training parents as friendship coaches for children’s social skills - Mikami et al. (2010). *Journal of Abnormal Child Psychology, 38*, 737-749.

• Omega-3/6 fatty acids (fish oil) as supplements to standard therapies????
  – Few studies, low scientific rigor
  – Mixed results: 25% response rate in Gothenberg study; Most responders were of the Inattentive Type
  – Omega-6 long chain might be more effective
New Cognitive Behavioral Therapies for Adult ADHD
Ramsay and Rostain’s Integrated Approach to CBT for ADHD

- Patients are strongly encouraged to be on ADHD medication
- Traditional CBT focus on thoughts, images, and beliefs and their self-modification to achieve behavior change and symptomatic control
- Identifies and changes common cognitive schemas and core beliefs often seen in adults with ADHD
  - Self-mistrust, failure, incompetence, inadequacies, instability
- Identifies common cognitive distortions associated with ADHD that require cognitive reframing
  - Overgeneralization, magical thinking, comparative thinking (peers), fairness fallacy, all-or-nothing, mind-reading, inappropriate blaming
- Utilizes cognitive modification, personal experimentation, and skill practice and homework
- Conveys executive function skills such as time management, self-organization, problem-solving, planning, environmental re-engineering, and assertiveness training.

Safren’s Cognitive Behavioral Training

- Patients must be on ADHD medication to participate
- Individual therapy involving 3 core modules
  - Education about ADHD; planning and organizing (4 sessions)
  - Learning to reduce distractibility (3 sessions)
    - Break tasks down into smaller quotas, use timers, record distractors
  - Cognitive restructuring – learning adaptive thinking during stress
    - Based on Beck’s model of CBT
- Optional modules for patients having these problems:
  - Procrastination
  - Anger and frustration management
  - Communication skills

Solanto’s Cognitive Behavioral Training of Executive Functioning

- Patients do not have to be on ADHD medication to participate
- Initial session is for orientation to behavioral and CBT methods and the expectations for receiving therapy (attendance, punctuality, confidentiality, etc.)
- Individual Therapy Sessions 2-6: Time Management
  - Time awareness
  - Facilitation of task initiation and Self-reward
  - Scheduling, prioritizing
  - Maintaining motivation using visual imagery of goal and rewards
  - Review of CBT methods for addressing internalizing symptoms
- Sessions 7-9: Implementing Self-Organizing Systems
  - Using lists, charts, calendars, and other organizational devices
  - Creating filing systems, in and out boxes for tasks, sorting work by priority, etc.
- Sessions 10-11: Planning
  - Taking a goal and implementing a plan to achieve it
- Session 12: Review of methods, emphasis on practice, reinforce progress

Approved ADHD Medications in the U.S.

- Stimulants
  - Methylphenidate (1957):
  - Amphetamine (1930s)
- Guanfacine XR (2009)
Stimulant Medications

• Most well-studied drugs in psychiatry
  – Used 40+ yrs; 350+ studies; thousands of cases
• Stimulants (Response rates 75-80%)
  – Methylphenidate
  – Amphetamines
• Trying all stimulants - 90%+ response rate
• What’s new?
  – Extended release delivery systems
    • The 5 Ps - Pills, pumps, pellets, patches, pro-drug

OROS: An Better Delivery System

- OROS technology
- Creates an osmotic pump
- Activated by water absorption in the stomach and intestinal track
- Pressure delivers a continuous flow of liquid methylphenidate
- Lasts 10-12+ hours
- Same effects and side effects as regular methylphenidate
MPH OROS

- IR MPH 10 mg tid (n=15)
- OROS MPH® 36 mg qd (n=15)

Outer Coat of Medicine
(22% Immediate Release)
Pulse Delivery System
(Diffucaps, Microtrol, SODAS)
DOT Matrix Transdermal Technology

- Methylphenidate is mixed with adhesive
What Is lisdexamfetamine?

- A long-acting, prodrug stimulant (lisdexamfetamine)
- Once-daily medication indicated for the treatment of ADHD
  - The efficacy and tolerability were evaluated in children aged 6 to 12 years
- Capsules available in multiple dosage strengths
  - 30 mg
  - 50 mg
  - 70 mg
- Can be taken with or without food
- Can be dissolved in water
Chemical Structure of Lisdexamfetamine

- a prodrug that is therapeutically inactive until it is converted to active $d$-amphetamine in the body
Lisdexamphetamine: Efficacy

- Provided significant reductions in ADHD symptoms at all doses (30, 50, or 70 mg/d)
- Provided extended duration of response throughout the day including at approximately 6 PM
- Significantly improved math test scores up to 12+ hours
- 70% of patients were much/very much improved

Atomoxetine

- Exclusive noradrenergic reuptake inhibitor
- Unscheduled (not Schedule II); no abuse potential
- Approved in US January 2003 by FDA; tested in more than 6,000 cases worldwide
- Used with more than 4.5 million patients to date
- Effective for kids, teens, and adults with ADHD
- Equal efficacy with methylphenidate for new, medication naïve cases; slightly lower success rates in children previously on stimulants
  - But effect sizes are somewhat smaller .6-.8 vs. .7-1.0
- 75%+ positive response rate in new cases, 55% in previous stimulant treated cases
- Sustained response demonstrated for up to 3 years
- Increasing improvement with time on drug
- Can be given once daily (in AM) or split (AM/PM)
- Provides 24 hour treatment coverage for ADHD symptoms

Guanfacine XR

- Alpha2a agonist previously used in IR form as antihypertensive
- XR form FDA approved for use with ADHD in late 2009
  - Tablets, 1-4 mg, dosing no higher than 4 mg, don’t break or chew tablets
- Guanfacine XR improves both dimensions of ADHD symptoms and is better than guanfacine IR and clonidine for ADHD due to less sedation, less effects on cardiac functioning, safer if suddenly discontinued
- Effect sizes = .42-.54 (.01-.08mg/kg), .98 to 1.22 (.09-.17mg/kg)
  - Approximately 50-65% reduction in symptoms from baseline
- Can be combined with stimulants for broader coverage
- May be most optimal for inattention (working memory) and emotion regulation (& oppositional) deficits but does reduce both ADHD symptom dimensions significantly
- Alpha2a agonists work directly in the frontal cortex to fine tune and enhance neuronal signals
- Does not exacerbate pre-existing tics or anxiety
- Given once daily, effects continue throughout the day to the next morning. Can be given any time of day
- Given at bedtime, may improve sleep onset problems