ADHD AND LEARNING: A Perfect Storm

Disclosures
- Dr. Tridas is a speaker for:
  - Tris Pharma
- Dr. Tridas is a consultant for:
  - Tris Pharma

The Developmental Web
- It is all about IMPAIRMENT
  - Symptoms
  - Syndromes
  - Diagnoses
ADHD

What it is and what is not!

Diagnostic Criteria for ADHD: DSM-5

- Persistent symptoms of inattention and/or impulsivity and hyperactivity
- Onset of symptoms before age 12 years
- Impairment in 2 or more settings (school, work, home)
- Evidence of clinically significant impairment in social, academic, or occupational functioning
- Symptoms not a result of other disorders
Inattention

- Inability to pay attention…
  - to the right thing (selectivity),
  - at the right time (timing),
  - for the appropriate amount of time (duration),
  - as in depth as needed (intensity)

Impulsivity

- Inability to sustain inhibition
  - Stop to…
    - Think about consequences
    - Formulate a plan
    - Think about previous experiences or rules
    - Block away distractions
    - Wait for…
    - Question to be finished
    - Turn

Hyperactivity

- Overactive
  - Can't stay seated
  - Runs rather than walking
  - Can't stay on line
  - Driven by a motor
  - Can't keep hands to self
- Fidgety
  - Can't sit still
- Talkative
**DSM-5 Inattention**

- Is careless
- Has difficulty sustaining attention in activity
- Does not listen
- Does not follow through with tasks
- Is disorganized
- Avoids/dislikes tasks requiring sustained mental effort
- Is forgetful in daily activities
- Is easily distracted
- Loses important items

**DSM-5 Impulsivity/Hyperactivity**

- **Impulsivity**
  - Blurs out answers
  - Cannot wait turn
  - Intrudes/interrupts others

- **Hyperactivity**
  - Squirms and fidgets
  - Cannot stay seated
  - Runs/climbs excessively
  - Cannot play/work quietly
  - Is on the go/driven by a motor
  - Talks excessively

**ADHD: DSM-5 Subtypes**

- ADHD Combined Presentation
  - Criteria are met for both inattention and impulsivity/hyperactivity (> 6 of each in children < 5 in adolescents and adults > 17 y/o)

- ADHD Predominantly Inattentive Presentation
  - Criteria met for inattention but not for impulsivity/hyperactivity (> 6 in children < 5 in adolescents and adults > 17 y/o)

- ADHD Predominantly Hyperactive-Impulsive Presentation
  - Criteria met for impulsivity/hyperactivity but not for inattention (> 6 in children < 5 in adolescents and adults > 17 y/o)
### Severity Criteria

<table>
<thead>
<tr>
<th>Severity</th>
<th>Description</th>
</tr>
</thead>
</table>
| Mild     | Only minimal number of symptoms  
          | Occupational and/or social impairment is mild |
| Moderate | Number of symptoms or functional impairment between mild and severe |
| Severe   | Many of the symptoms are severe  
          | Impairment is severe |

### AAP: Guidelines for ADHD Assessment

- Evaluate children who exhibit the following:
  - Inattention  
  - Hyperactivity  
  - Impulsivity  
  - Academic underachievement  
  - Behavioral problems  
- DSM-IV criteria
  - Evidence from parents/caretakers and teachers/school professionals of core symptoms of ADHD in school, home, and social settings  
- Assessment for co-existing conditions  
- Other diagnostic tests are not routinely indicated

### Impairment Caused by ADHD

- How does it present?  
- Impact on quality of life
Impairment – Functional Impact

- Academic
  - Affects productivity and accuracy of work
- Behavioral
  - Disruptive, non-compliant
- Social interaction
  - Socially unaware, in-your-face
- Health
  - High risk behaviors and habits
    - Smoking, SUD, motor vehicle accidents/citations

ADHD: Lifetime impairment

ADHD: Impact on Family

- Parents of children with ADHD experience higher levels of:
  - Stress
  - Self-blame
  - Social isolation
  - Depression
  - Marital discord

ADHD Affects Socialization

- Children are stigmatized by their behavior leading to peer rejection
- Lack of friendships
- Lower peer status

- Adolescents continue to demonstrate social problems
  - Poor participation in group activities
  - Few friends
  - Vulnerable to antisocial groups, drug abuse

Comorbidity Associated with ADHD

What else is going on?

ADHD: Comorbid Conditions

- Oppositional defiant disorder
- Anxiety disorders
- Learning difficulties
- Mood disorders
- Conduct disorder
- Smoking
- Substance use disorder
- Language disorder

ADHD:  Comorbid Conditions
ADHD: Psychiatric Comorbid Conditions

- Psychiatric Comorbidities in a Developmental Clinic (70%)
  - ODD (46%)
  - Conduct Disorder (14%)
  - Depression (36%)
  - Anxiety (48%)

ADHD: Academic Comorbid Conditions

- Learning Disorders in a Developmental Clinic
  - Reading Disorder (26%-51%)
  - Math Disorder (18%-51%)
  - Academic Underachievement
    - 3 times as likely to repeat a grade
    - 2.7 times as likely to drop out

Behavioral Comorbidities with ADHD

- ADHD
- Oppositional Disorder (40-50%)
- Mood Disorder (5-25%)
- Anxiety Disorder (35%)
- ADHD Only (50%)
- Conduct (10%)

ADHD: Medical Comorbid Conditions

- Risk for substance abuse – 27% 
- Sleep Disorders (25%-50%)

ADHD: Adults

- Performance Limitations
  - Despite similar educational levels and IQ scores, non-medicated adults with ADHD display:
    - Significantly more academic difficulty in school
      (25% repeat a grade)
    - Lower levels of occupational advancement

Driving and ADHD

<table>
<thead>
<tr>
<th>Category</th>
<th>ADHD n=25</th>
<th>Control n=23</th>
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</thead>
<tbody>
<tr>
<td>Traffic violations</td>
<td>80%</td>
<td>50%</td>
</tr>
<tr>
<td>Speeding violations</td>
<td>100%</td>
<td>90%</td>
</tr>
<tr>
<td>Drunk driving</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>License suspended</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Driver-caused accidents</td>
<td>10%</td>
<td>0%</td>
</tr>
</tbody>
</table>

P = 0.004

P = 0.07

P = 0.01
Increased Smoking with ADHD

![Increased Smoking with ADHD graph]

Earlier Initiation of Smoking with ADHD

![Earlier Initiation of Smoking with ADHD graph]

Untreated ADHD and SUD

![Untreated ADHD and SUD graph]
Dyslexia: Definition

- One of several distinct learning disabilities
- Neurobiological in origin
- Symptoms
  - Poor decoding and spelling abilities
  - Problems with accurate and/or fluent word recognition
  - Inconsistent with age and/or cognitive ability
  - Inconsistent with educational experience
Dyslexia: Definition

- **Etiology**
  - Deficits in phonological processing

- **Unexpected**
  - In spite of typical instruction/opportunity to learn

- **Secondary Consequences**
  - Poor reading comprehension
  - Poor vocabulary and general knowledge development

The Brain and Listening: Co-articulation

- The ability to compress and overlap several phonemes into a single sound burst
  - Speech sounds are unsegmented
  - Allows sound to be compatible with the capacity of the auditory system (working memory)
    - 1 to 2 secs. (5 – 7 words before it leaves short term memory)

- **Brain**
  - Distinguishes speech from noise
  - Attends to meaning not specific sounds in words

The Brain and Phonology

- Illustration of brain regions involved in phonological processing and speech production
The Brain and Reading

Typical Readers

Dyslexic Readers

Dyslexic Reader

Typical Reader

Dyslexic Reader

Phonologic System

- Requires attention – arousal
- Each sound combines essential sensory features
  - Auditory
  - Visual
  - Kinesthetic
Working Memory

- Memory for intermediate results that must be held during thinking
- Memory system used for holding and manipulating information while various mental tasks are carried out.
- A system for temporarily storing and managing the information required to carry out complex cognitive tasks such as learning, reasoning, and comprehension.
- Working memory is the executive and attentional aspect of short-term memory involved in the interim integration, processing, disposal, and retrieval of information.

Requirements

- Simultaneous storage and processing of information
- Goal oriented
- Active monitoring or manipulation of information or behaviors
- In the face of interfering processes and distractions
Working Memory: Size Matters

Four subcomponents:
- Central executive
  - Attentionally-limited control system
  - Regulates the three other components
- Visuospatial sketch pad
- Phonological loop
- Episodic Buffer
Memory: Short, Working, Long-Term

Reading Formula

\[(D \times F) + C = \text{Reading}\]

- \(D\) = Decoding
- \(F\) = Fluency
- \(C\) = Comprehension

Impact on quality of life

Impact on quality of life

Impairment Caused by Dyslexia

Impact on quality of life
Clinical Impact of Dyslexia

- 5th grade reader
  - 10th percentile
    - 50,000 words/year
    - 600,000 words/year
  - 50th percentile
    - 1 x more practice/year
  - 90th percentile
    - 2,357,000
    - 46 x more practice per year

Clinical Impact of Dyslexia

- Decrease vocabulary development
- Poor spelling
- Poor reading comprehension
- Increased dropout rates

Anxiety
Characteristics of Anxiety

- **Symptoms**
  - Subjective
    - Discomfort, fear, dread
  - Overt Behaviors
    - Avoidance, withdrawal
  - Physiological responses
    - Sweating, nausea, arousal, shaking
- **Fears/Phobias**
  - Specific reaction to a specific situation
  - Anxiety
  - General apprehension or discomfort to a vague situation

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Anxiety Symptoms

- Negative, unrealistic thinking
  - The half empty glass of water.
- Worry excessively about many things
  - What if...
- Fret over unimportant things
  - Selectively pay attention to physical symptoms
- Misinterpret symptoms and events in a negative way
  - Feel they are going crazy when having a panic attack

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Social Withdrawal

- A main component of several disorders
- Unrealistic self-appraisal of social performance
- Lack of interest in social interaction
- May be complicated by excessive fear
- May involve a deficit in social approach behavior
### Somatization
- Often associated with anxiety disorders
- Oversensitivity to physiological cues
- Common complaints
  - Lack of energy
  - Stomach aches
  - Nausea
  - Headaches
  - Pain in eyes, limbs, joints
  - Tingling/numbness

### Anxiety – Definition
- Daily, excessive, persistent worries without logical basis
- Restlessness
- Somatization – tiredness, shakiness, muscle tension, dry mouth, palpitations, shortness of breath, trouble swallowing, nausea, diarrhea
- Panic symptoms that lead to worrying about future attacks
- Hypervigilance, on edge, irritable
- Concentration difficulties
- Trouble with sleep onset and/or maintenance
- Avoidance of situations that may trigger anxiety/panic
- Lacks confidence in ability to cope with new situations
- Needs reassurance from significant others being present

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### DSM 5 Anxiety Disorders
- Separation Anxiety Disorder
- Selective Mutism
- Specific Phobia
- Social Anxiety Disorder
- Panic Disorder
- Agoraphobia
- Generalized Anxiety Disorder
- Anxiety Due to Another Medical Condition
- Obsessive-Compulsive Disorders
- Post Traumatic Stress Disorder
Anxiety Prevalence

- Affects 20% of children and adolescents at some point in their lives
- 3-4% of children have a diagnosis of anxiety
- 20-35% of children with ADHD have comorbid anxiety disorders

Impact on quality of life

Impact Caused by Anxiety

Anxiety Related Impairment

- Academic
  - Decrease production/shut down/avoidance
  - Avoidance leads to lack of practice and ultimately poor skill mastery/fluency
  - Decrease concentration/focus, mental energy
  - Decrease comprehension
  - Working memory
  - Retrieval fluency
  - Processing speed

- Behavioral
  - Low self esteem
  - Irritable/Aggressive

Anxiety Related Impairment

- Social Interaction
  - Isolation and withdrawal
  - Inflexibility/Irritability

- Health
  - Somatization/Sleep disturbances
  - Substance use disorders
  - Suicidality/Substance use and abuse

Management

The Developmental Web

The Developmental Web
Environmental Management

HOME

SCHOOL

Management of ADHD

Focus on Impairment

Multimodal Management of ADHD

- Medication Management
  - Stimulants
  - Non Stimulants
  - Psychosocial Interventions
    - Parent Training
    - School Based Interventions
    - Child Based Interventions
**ADHD Medication Management**

- **Stimulants**
  - dl-methylphenidate
  - dl-amphetamine
- **Non Stimulants**
  - SNRI (atomoxetine)
  - α-2A agonist (guanfacine)
  - α-2C agonist (clonodine)

**Functional & Structural Difference in ADHD**

PET Scans of Adult Brains

- Normal Controls vs ADHD

**Neurotransmitters in ADHD**

- Blocking alpha – 2/A/B receptors
Stimulants and SNRIs in ADHD

- Increase dopamine & NE production
- Block dopamine and NE reuptake

Alpha-2 Agonists in ADHD

Proposed Effect of Stimulants and Atomoxetine

- Increase Neurotransmitter Production
  - DA – NE
- Decrease Neurotransmitter Reuptake
  - DA – NE
Stimulant Medications

- **Side Effects**
  - Insomnia (50-60%)
  - Anorexia (50-60%)
  - Irritability (30%)
  - Headache
  - Stomachache
  - Nausea
  - Tics

Atomoxetine

- **Side Effects**
  - Anorexia
  - Dizziness
  - Dyspepsia
  - Dermatitis
  - Constipation
  - Mood Swings
  - Transient elevation of liver enzymes
  - Suicidality
  - Dry mouth
  - Sexual dysfunction

Alpha – 2 Agonists

- **Side effects**
  - Sedation
  - Fatigue
  - Dizziness
  - Low blood pressure
  - Low heart rate
  - Stomach aches
  - Insomnia (guanfacine)
**Medications: Duration of Action**

<table>
<thead>
<tr>
<th>Type</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Short Acting</td>
<td>4 hours</td>
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<tr>
<td>Intermediate Acting</td>
<td>6 – 8 hours</td>
</tr>
<tr>
<td>Long Acting</td>
<td>8 – 12 hours</td>
</tr>
<tr>
<td>Non-Stimulants</td>
<td>24 hours</td>
</tr>
</tbody>
</table>

**Medications**

<table>
<thead>
<tr>
<th>Duration of Action</th>
<th>Name Brand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-Acting</td>
<td>Ritalin, Dexedrine, DexerStat, Focalin, Methylin (Tablet, Chewable &amp; Liquid)</td>
</tr>
<tr>
<td>Intermediate-Acting</td>
<td>Ritalin ER, Metadate ER, Adderall, Ritalin LA, Metadate-CD, Methylin ER, Focalin XR</td>
</tr>
<tr>
<td>Long-Acting</td>
<td>Dexedrine Spansules, Adderall-XR, Concerta, Daytrana, Vyvanse, Quillivant</td>
</tr>
<tr>
<td>Non-Stimulants</td>
<td>Straterra, Intuniv, Kapvay</td>
</tr>
</tbody>
</table>

**In Summary**

- Identify target symptoms & impairment
- Decide the hours of desired medication coverage
  - 4 - 8 – 12 – 24 hours
- Decide type of medication
  - Stimulant (4 - 8 - 12 - 16 hours)
  - Non-Stimulant (24 hours)
- Follow up and monitoring
  - Clinical response (Target symptoms & impairment)
  - Tolerability (Side effects)
Behavior Modification

- Training the adults to change the way that they deal with the child so that the child will change the way that they respond to the adult.
- Control is external to the child.

Core Principles for Behavior Management

- Immediacy of Consequences
- Frequency of Consequences
- Saliency of Consequences
- Frequent Changes in Rewards
- Act, Don’t Yakk
- Positives Before Negatives
- Anticipate Problems
- Pick Your Fights - Prioritize
- Expect Variability
- Practice Forgiveness

Management of Dyslexia

Educational Remediation
Research Based Reading Instruction

- Essential Components – National Reading Panel
  - Phonemic awareness
    - Recognize, remember and manipulate individual sounds
  - Phonics and word recognition
    - Sound – symbol relationship, word meaning
  - Reading Fluency
    - Read with sufficient speed and accuracy to support comprehension
  - Vocabulary development
    - Individual word meanings
  - Reading comprehension
    - Verbal reasoning, background knowledge, comprehension strategies

Reading Instruction

- Other components
  - Basic writing skills
    - Compose English with accuracy, fluency and clarity of expression
  - Comprehending and using language
    - The ability to listen and understand the meaning of what someone is saying

Effective Reading Instruction

- Explicit
  - Clearly and directly explained not left to discovery
- Systematic
  - The speech sounds, spelling patterns, sentence structures, text genre and language conventions
- Cumulative
  - Continued review one skill builds on another
- Sequential and Incremental
  - Manageable steps
- Data driven
  - Emphasis, speed of instruction and support are determined by student’s progress
Effective Reading Instruction – The 4 I’s

- Informed methodology
- Informed instructor
- Intensity and fidelity
- Involved administrators

Adapted from Emerson Dickman, SWIDA April 2012

Dyslexia: Management

- Critical to start before 3rd grade
- It is very difficult to remediate after 4th grade
- Educational focus changes from skills to content
  - From learning to read to reading to learn

What we are doing in our schools is not working!

NAEP 1992 - 2011
**Dyslexia: Management**

- Before Remediation
- After Remediation

| Dyslexia-specific brain activation profile becomes normal following successful remedial training |

**Dyslexia Management: IDA Recommendations**

- Knowledge and Practice Standards for Teachers of Reading
  - Applicable for all teachers of reading
  - What they need to know and do to teach all students to read proficiently
  - Two strands
    - Classroom educators
    - Dyslexia specialists
  - Provides the foundation for teacher certification examination
  - https://dyslexiaida.org/knowledge-and-practices/

**Management of Anxiety**
Cognitive – Behavior Therapy

- Training the child
  - Change the way he/she thinks about how he/she feels.
  - Increases self control
  - Requires adult support


Cognitive – Behavior Therapy

- Systematic Desensitization
- Relaxation training
- Development of anxiety hierarchy
- Desensitization proper (graded exposure)
- Self-Control Training (older children and adolescents)
  - Monitor thoughts, activities and feelings
  - Attend to consequences in a realistic and effective manner
- Self-Instructional Training
  - Alter maladaptive thoughts and behaviors through scripted talk
- Transfer Control Training (older children and adolescents)
  - Reduce symptoms by increasing exposure and transfer control from therapist to patient
- Social Skills Training


Medication Management

- SSRI
- Tricyclic antidepressants
- Benzodiazepines
- Antihistamines
- Antipsychotics
Controversial Therapies

I researched it on the internet...
My neighbor told me about it ...
It's natural

What To Look For

- If it sounds too good, it probably is
- Beware of the word NATURAL
  - It is simply marketing
  - Hemlock, arsenic, tobacco, marijuana and many other toxic substances are natural
- Difference between safe and dangerous
  - Dose
  - Route of administration
  - Speed of administration

Evidenced Based Treatments

- Formulate a theory
- Design an experiment with control subjects
- Analyze the data
- Publish results
- Replicate findings
- Then it becomes the standard of care
It is not your fault...  
But it is your problem...