The History of ADHD
Hippocrates described patients with "quickened responses to sensory experience, but also less tenaciousness because the soul moves on quickly to the next impression".
- Condition attributed to an "overbalance of fire over water".
- Remedy: "barley rather than wheat bread, fish rather than meat, water drinks, and many natural and diverse physical activities."

Shakespeare referred to a "malady of attention" in one of his characters in King Henry VIII.

Heinrich Hoffman, a German physician, penned the poem "Fidgety Phil".

William James, in his Principles of Psychology text (1890), described a normal variant of character which he called the "Explosive Will":
- "... impulses seem to discharge so promptly onto movements that inhibitions get no time to arise. These are the 'dare-devil' and 'mercurial temperaments, overflowing with animation, and fizzling with talk" (p.800).
English physician George Still (1902) reported on a group of children in his clinical practice whom he defined as having a deficit in “volitional inhibition” or a “defect in moral control” over their behavior.

- Their behavior was described as aggressive, passionate, lawless, inattentive, impulsive, and overactive.
- An over-representation of male subjects (3:1).
- An aggregation of alcoholism, criminal conduct, and depression among the biological relatives.
- A familial predisposition to the disorder – hereditary.
Minimal Brain Damage/Dysfunction

Interest in children with similar characteristics arose in North America around the time of the encephalitis epidemic of 1917-1918.

- Children surviving these brain infections were noted to have many behavioral problems similar to ADHD.
- These cases and others known to have arisen from birth trauma, head injury, toxin exposure, and infections gave rise to the concept of a brain-injured child syndrome (Straus & Lehtinen, 1947).
The brain-injured child syndrome eventually was applied to children manifesting these same behavior features but without evidence of brain damage or retardation.

This concept would later evolve into the concept ‘minimal brain damage’, and eventually ‘minimal brain dysfunction’ (MBD), owing to the dearth of evidence of brain injury in most cases (Dolphin & Cruickshank, 1951; Strauus & Kephardt, 1955).
During the 1950’s, greater attention was paid to the specific behaviors of hyperactivity and impulsivity resulting in the label “hyperkinetic impulse disorder.” The disorder was attributed to poor thalamic filtering of stimuli entering the brain (Laufer, Denhoff, & Solomons, 1957) and eventually termed the “hyperactive child syndrome” (Chess, 1960).

The influence of psychoanalytic thought at the time held sway when the DSM-II appeared and all childhood disorders were described as “reactions” – the hyperactive child syndrome became “hyperkinetic reaction of childhood” (DSM-II, 1968).
Hyperkinetic Reaction of Childhood
DSM-II (1968)

Characterized by overactivity, restlessness, distractibility and short attention span, especially in young children; the behavior usually diminishes in adolescence.

- Definition included problems of attention and distractibility along with those of hyperactivity/restlessness.
- The condition was assumed to be developmentally benign and not caused by brain damage - resulting in a departure from European thinking.
By the 1970s, research emphasizing the importance of problems with sustained attention and impulse control in addition to hyperactivity was emphasized (Douglas, 1972).

Douglas (1980; 1983) theorized that the disorder was comprised of four major deficits:

- The investment, organization, and maintenance of attention and effort.
- The ability to inhibit impulsive behavior.
- The ability to modulate arousal levels to meet situational demands.
- An unusually strong inclination to seek immediate reinforcement.
Douglas’s work coupled with numerous studies of attention, impulsiveness, and other cognitive sequelae resulted in the DSM-III (1980) moniker, Attention Deficit Disorder (ADD).

- Psychoanalytic perspective discarded.
- Cognitive-developmental nature emphasized.
- Symptom lists, cutoff scores recommended.
- Polythetic categorization scheme (3 major symptom groupings required for a diagnosis).
- Distinction between “with” and “without” hyperactivity.
Attention-Deficit/Hyperactivity Disorder (DSM-III-R; 1987)

Hyperactivity and impulsivity

Needed to:
- Differentiate the disorder from other conditions, and
- Predict developmental risks (Weiss & Hechtman, 1993).

Monothetic categorization scheme (14 symptoms - 1 list)
ADD without hyperactivity replaced with undifferentiated Attention Deficit Disorder based on insufficient research.
Attention-Deficit/Hyperactivity Disorder (DSM-IV, 1994)

Three (3) subtypes of ADHD (predominantly inattention; predominantly hyperactivity-impulsive; and combine type).

- **Hyperactivity-Impulsive Type** appears to be a developmental precursor to the **combined type**.
- **Hyperactive-Impulsive Type** was comprised primarily of preschool children (DSM-IV field trials).
- **Combined Type** and **Inattentive Type** were comprised primarily of school-age children.

The **Hyperactive-Impulsive** behavior pattern seems to emerge first in development during the preschool years, whereas symptoms of “inattention” associated with it appear to have their onset several years later (Loeber et al., 1992; Hart et al., 1995).
Attention-Deficit/Hyperactivity Disorder (DSM-IV, 1994)

Research began demonstrating that deficits were not limited to the attentional domain.

- Problems with motivation and insensitivity to response consequences were emphasized (poor performance under partial reward and extinction - Douglas, 1980s).
- Deficient “rule governed” behavior was hypothesized by Barkley (1981; 1989).
- Information processing paradigms failed to demonstrate that poor performance was due to attentional difficulties vs motivation and response inhibition (Sergeant, 1988).
- Factor analytic studies failed to differentiate hyperactivity and impulsivity domains (loaded together as 1 factor).
Nomenclature

493 BC  Overbalance of fire over water (Hippocrates)
1890   Explosive Will (James)
1902   Volitional Inhibition
       Deficit in Moral Control (Still)
c. 1918 Brain Injured Child Syndrome (Strauss & Lehtinen)
1940s  Minimal Brain Damage (Dolphin & Cruikshank)
       Minimal Brain Dysfunction (Strauss & Kephardt)
1950s  Hyperkinetic Impulse Disorder (Laufer, Denhoff, & Solomons)
1960   Hyperactive Child Syndrome (Chess)
1968   Hyperkinetic Reaction of Childhood (DSM-II)
1980   Attention Deficit Disorder (DSM-III)
1987   Attention-Deficit/Hyperactivity Disorder (DSM-III-R, DSM-IV, DSM-IV-TR)
## Evolution of the DSM

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Attention-Deficit/Hyperactivity Disorder (DSM-IV, 1994) continued

- Types of problems with “inattention” seen in the Inattentive Type appear to have their onset even later than those associated with hyperactive-impulsive behavior (Barkley, 1996).

- Implications:
  - Attentional impairment associated with the Predominantly Inattentive Type may be different from those seen in the other two types.
  - Inattentive Type symptoms: daydreaming, spacing out, in a fog, easily confused, staring frequently, lethargic, hypoactive, and passive. [DAMP: developmentally delayed attention, motor and perceptual abilities]
  - Inattentive Type also appears to have deficits in speed of information processing & focused or selective attention (Goodyear & Hynd, 1992; Lahey & Carlson, 1992).
  - Combined Type deficits are characterized as consisting of sustained attention (persistence) and distractibility difficulties.
Implications (Continued):

Current clinical view of ADHD may be clustering two qualitatively different disorders into a single set of disorder.

Children with ADHD Combined Type who move into the Inattentive Type (owing to developmental reduction in hyperactivity) as they get older are not actually changing types of ADHD; Their attentional problems should still be distinct (poor persistence, distractibility) from those seen in the Inattentive Type.
DSM-IV Criteria:
6 of 9 Inattention Symptoms

- 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
DSM-IV Criteria: 6 of 9 Hyperactive-Impulsive

- 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
Other DSM-IV Criteria

- Developmentally Inappropriate Levels
- Duration of 6 Months
- Cross-setting Occurrence of Symptoms
- Impairment in Major Life Activities
- Onset of Symptoms/Impairment by 7
- Exclusions: Severe MR, PDD, Psychosis
- Subtyping into Inattentive, Hyperactive, or Combined Types
DSM-5 Changes

- Now listed under ‘Neurodevelopmental Disorder
- Symptoms have persisted for a minimum of 6 months, are inconsistent with developmental level, and must impair social & academic/occupational activities
- Symptoms are not solely a manifestation of oppositional behavior, defiance, hostility, or failure to understand tasks or instructions.
- For older adolescents, at least 5 symptoms must be present.
- Several symptoms were present before 12 years of age
- Symptoms do not occur exclusively during the course of schizophrenia or another psychotic disorder & are not better explained by another mental disorder.
- Specifiers: in partial remission; severity level: mild, moderate, severe
ADHD - Inattentive Type

- Daydreaming/Spacey/Stares
- Slow Information Processing
- Hypoactive/Lethargic/Sluggish
- Easily Confused, Mentally “Foggy”
- Poor Focused/Selective Attention
- Erratic Retrieval - Long-Term Memory
- Socially Reticent/Uninvolved
ADHD Inattentive Type (2)

- Rarely Aggressive or ODD/CD
- Not Impulsive (By Definition)
- Less Likely to Have a Clinically Impressive Response to Stimulants (65% improve but only 20% show clinical response)
- Possibly Greater Family History of Anxiety Disorders and LD (?)
Inattentive Type is a New Disorder

- Focus on sluggish cognitive tempo
- Will not have same course and risks
- Probably requires different interventions
- Need to distinguish it from:
  - Sub-threshold Combined Type
  - Central Auditory Processing Disorder
  - Situational Stress Events or PTSD
  - Schizophrenic Spectrum Disorders
  - Learning Disabilities
  - Anxiety Disorders or Depression
  - Substance Use/Abuse Disorder
Prevalence (United States)

- Varies by gender, age, social class, & urban-rural (population density)
- 1-3% of children (DSM-III or III-R)
- 2-8% of children (DSM-IV) (Mean 3-5%)
- 4.7% of adult population (DSM-IV - All Types) (3.4% Combined/Hyper. Types)
- 5.0% (DSM-5)
- 3:1 males:females (community samples)
  - 5:1 to 9:1 (clinical samples)
Prevalence (Internationally)

- Canada (Montreal): 3.8-9.4% kids (DSM-III-R)
- Australia: 3.4% of kids (DSM-III-R)
- New Zealand: 6.7% kids, 2-3% teens (DSM-III-R)
- Germany: 4.2% children (ICD-9)
- India: 5-29% children (DSM-III)
- China: 6-9% children (DSM-III-R)
- Netherlands: 1.3% teens (DSM-III-R)
- Puerto Rico: 9.5% child & teens (DSM-III)
- Japan: 7.7% children (DSM-III-R ratings)
- Colombia: 2-13% (DSM-IV ratings)
- Brazil: 5.8% of 12-14 year olds (DSM-IV)
Comorbid DSM-IV Disorders

As assessed by DSM-based structured interviews (e.g. Kiddie SADS, DISC-P)

- Oppositional Defiant Disorder (40-67%)
- Conduct Disorder (20-56%)
- Delinquent/Antisocial Activities (18-30%)
- Anxiety Disorders (10-40%; partly referral bias!)
  - Related more to poor emotion regulation than to fear
- Major Depression (0-45%; 27% by age 20)
- Bipolar Disorder (0-27%)
  - Not documented in any follow-up studies to date
Childhood Developmental Risks

- **Language Disorders** (Expressive: 10-54%)
  Pragmatic deficits in 60% (Language tests)

- **Central Auditory Processing Disorder** (45-75%)
  (Audiological examination and language processing tests)

- **Developmental Coordination Disorder** (50+%)  
  (Motor development tests, e.g. Lincoln-Oseretsky)

- **Reduced Physical Fitness, Strength, & Stamina** (Standard physical fitness tests)

- **Accident Proneness** (parental reports)
  - 1.5 to 4x risk of injuries (non-head) (28 vs. 6% in Worcester 4-6 year olds) (greater in ODD subset)
  - 3x risk for accidental poisonings (23 vs. 7.7% of clinic referrals; 7.3 vs. 2.3% in community)
Childhood Academic Impairments

Evaluated using teacher reports, academic achievement tests (e.g., WRAT, Woodcock), and IQ tests (WISC, Woodcock, Peabody)

- Poor School Performance (90%+)
  - (reduced productivity is greatest problem)
- Low Academic Achievement (10-15 pt. deficit)
- Low Average Intelligence (7-10 point deficit)
- Learning Disabilities (24-70%)
  - Reading (15-30%; 21% in Barkley, 1990)
  - Spelling (26% in Barkley, 1990)
  - Math (10-60%; 28% in Barkley, 1990)
  - Handwriting (common but % unspecified)
Social-Emotional Impairments

Assessed via parent ratings, peer sociometrics, and videotaped interactions of ADHD children with others

- Increased parent-child conflict & stress
  - especially ODD/CD subgroup

- Peer Relationship Problems (50%+)
  - Less sharing, cooperation, turn-taking
  - More talking, commanding, intrusive, hostile
  - Most serious in ODD/CD subgroup

- Poor Emotional Control
  - More anger, frustration, hostility (ODD/CD)
  - Less self-regulation of emotional states

TOSCA = TEST OF SCHOLASTIC ABILITIES
Persistence of Disorder

Evaluated via structured interviews (DSM-based)

- Symptoms Decrease (graph)
- Adolescence: (Based on parent reports)
  - 50% persistence to adolescence (1970-80s)
  - 70-80% in modern DSM studies (1990s onward)
- Young Adulthood (age 20-26) (Barkley et al. in press)
  - Depends on who you ask (self vs. parents)
  - 3-8% Full disorder (self-report using DSM3R)
  - 46% Full disorder (parent reports using DSM3R)
  - 12% - Using 98th percentile (+ 2SDs; self-report)
  - 66% - Using 98th percentile (parent report)
- Parent reports correlate more highly with various domains of major life activities than do self reports
Psychiatric Disorders (age 20-26)

- ODD (12%+ by self-report) (Not Significant)
- Conduct Disorder (26%+ by self-report)^*
- Depression (27%)^ (not found in other studies)
- Substance Use/Abuse Disorders (10-24%)^*
  - Greater Use of Alcohol, Tobacco, and Marijuana
  - Milwaukee Study: Not different from controls due to elevated drug use among controls
- Personality Disorders:
  - Antisocial (11-21%)^*
  - Passive Aggr. (18%)^*
  - Histrionic (12%)^*
  - Borderline (14%)^*
- *=greater risk if elevated child conduct problems
- ^=greater risk if CD at adulthood
Educational Outcomes (ages 20-25)

Assessed by self-report and high school transcripts:
- More grade retention (25-45%; MKE: 42 vs. 13)
- More are suspended (40-60%; MKE: 60 vs. 19)
- Greater expulsion rate (10-18%; MKE: 14 vs. 6)
- Higher drop out rate (30-40%; MKE 32 vs 0)
- Lower Class Ranking (MKE: 69% vs. 50%)
- Lower GPA (MKE: 1.7 vs. 2.6)
- Fewer enter college (MKE: 22 vs. 77%)
- Lower college graduate rate (5 vs. 35%)

MKE = Milwaukee Young Adult Outcome Study
Employment Problems

- More likely to be fired
  - (MKE: 55 vs. 23%; Mean 1.1 vs. 0.3 jobs)
- Change jobs more often (MKE: 2.7 vs. 1.3 over 2-8 years since leaving high school)
- More ADHD/ODD symptoms on the job
  - As rated by current supervisors (MKE)
- Lower work performance ratings
  - As reported by current supervisors (MKE)
- Lower social class (SES) (Hollingshead System)
- By 30s, 35% self-employed (NY Study)
Motor Vehicle Driving Risks

Assessed via self-report, driving records, lab testing, driving simulators, and BTW tests (Barkley studies)

- Poorer steering, more false braking, and slower reaction times to significant events
- Rated as using fewer safe driving habits
- More likely to drive before licensing
- More accidents (and more at faults) (2-3 vs. 0-2)
  - % with 2+ crashes: 40 vs. 6
  - % with 3+ crashes: 26 vs 9
- More citations (Speeding - mean 4-5 vs. 1-2)
- Worse accidents ($4200-5000 vs $1600-2200)
  - (% having a crash with injuries: 60 vs 17%)
- More Suspensions/Revocations (Mean 2.2 vs 0.7)
  - (% suspended: 22-24 vs. 4-5%)
Sexual-Reproductive Risks

Assessed via self-reports: (MKE study)

- Begin Sexual Activity Earlier (15 vs 16 yrs.)
- More Sexual Partners (18.6 vs. 6.5)
- Less Time with Each Partner
- Less Likely to Employ Contraception
- Greater Risk of Teen Pregnancy (38 vs. 4%)
- Ratio for Number of Births (42:1)
  - 54% Do Not Have Custody of Offspring
- Higher Risk for STDs (16 vs. 4%)
Etiologies: Food Allergies & Miscellaneous Factors

- **Sugar** (Disproven)
- **Hyper/hypoglycemia** (No evidence)
- **Food Allergies** (Largely Disproven)
  - Possibly 5% of ADHD Preschoolers react adversely to high doses of food additives
- **Side Effects of Anticonvulsants** (10-35%)
  - mainly to phenobarbital and dilantin
- **Thyroid abnormalities** (unlikely)
  - Rare in children
  - Evidence is conflicting
Etiologies - Psychosocial

- Excessive TV/Videogames (No evidence)
- Cultural Tempo Fast-Paced (No evidence)
- Family Stressors (Linked to ODD/CD/MDD)
- Poor Child Management (Linked to ODD/CD)
- Low Self-Esteem (A late occurring consequence)
- Learning Disabilities (Comorbid not causal)
- Intolerant Teachers/Parents (No evidence; most distress is reactive to child’s behavioral problems)
Etiologies - Heredity/Genetics

- **Family Aggregation of Disorder:**
  - 25-35% of siblings - 55-92% of identical twins
  - 15-20% of mothers - 25-30% of fathers
  - If parent is ADHD, 20-54% of offspring

- **Twin Studies of Heritability:**
  - Heritability = 57-97% (Mean 80%+; 95%+ if DSM)
  - Shared Environment = 0-6% (Not significant)
  - Unique Environment = 15-20%

- **Molecular Genetics** (DRD4, DAT1, DBH?)
A Current Theory of ADHD

- A deficit in response inhibition
- That disrupts 4 executive functions
  - Sensing to the self (nonverbal working memory)
  - Self-speech (verbal working memory)
  - Self-management of emotion/motivation
  - Self-play – Mental planning-problem solving
- Impairing self-regulation across time to maximize delayed social consequences
- Making ADHD a form of time blindness or myopia to the future – an intention deficit
Behavioral Inhibition
Inhibit prepotent response
Stop and ongoing response
Interference control

Motor control/fluency/syntax
Inhibiting task irrelevant responses
Executing goal-directed response
Execution of novel/complex motor sequences
Goal-directed persistence
Sensitivity to response feedback
Task re-engagement following disruption
Control of behavior by internally represented information

Working Memory
Holding events in mind
Manipulating or acting on events
Initiation of complex behavior sequences
Retrospective function (hindsight)
Prospective function (forethought)
Anticipatory set
Sense of time
Cross-temporal organization of behavior

Self-regulation of affect/motivation/arousal
Emotional self-control
Objectivity/social perspective taking
Self-regulation of drive and motivation
Regulation of arousal in the service of goal-directed action

Internalization of speech
Description and reflection
Rule-governed behavior
Problem solving/self-questioning
Generation of rules and meta-rules
Moral reasoning

Reconstitution
Analysis and synthesis of behavior
Verbal fluency/behavioral fluency
Goal-directed behavioral creativity
Behavioral simulations
Syntax of behavior

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Control of behavior by internally represented information
Behavioral Inhibition and the Stop Signal Paradigm

SSRT = MRT – SSD

SSRT = Stop Signal Reaction Time
MRT = Mean Reaction Time
SSD = Stop Signal Delay
Behavioral Inhibition and the Stop Signal Paradigm

SSRT = MRT – SSD

SSRT = Stop Signal Reaction Time
MRT = Mean Reaction Time
SSD = Stop Signal Delay
Go to ADHD slides #2