

# The Etiology and Diagnosis of AD/HD

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SACRAMENTO  
STATE

# Introduction to AD/HD

- A neurobiological disorder that affects 3 to 7 percent of the general population (2.5 million school-age children).
- The exact cause of AD/HD is not known.
- Genetic, environmental, and neurological factors likely play a primary causal role.
- No single procedure will reliably diagnosis AD/HD.
- A variety of conditions may co-exist with and/or cause AD/HD symptoms.
- Diagnosis is time consuming.
  - Multi-procedure.
  - Multi-source.
  - Multi-disciplinary.



# Workshop Outline

- Introduction to AD/HD
  - AD/HD Symptoms and Associated Features
  - Prevalence
  - Legal Issues
- Etiology of AD/HD
- AD/HD Diagnostic Criteria
- “AD/HD-like” Behaviors
- Diagnostic Procedures
  - Rating Scales
  - Interviews
  - Observations
  - Laboratory & Psycho-educational Testing
  - Medical Examinations
  - Review of School Records



# AD/HD Symptoms

- Diagnosis requires...
  - Six or more of nine symptoms of inattention.
  - Six or more of nine symptom of hyperactivity and impulsivity



# Symptoms of Inattention

- Fails to give close attention to details/make careless mistakes.
- Difficulty sustaining attention.
- Does not seem to listen.
- Lack of follow through.
- Difficulty organizing tasks and activities.
- Avoids/dislikes tasks requiring sustained mental effort.
- Loses things.
- Easily distracted.
- Forgetful.



# Symptoms of Hyperactivity/Impulsivity

- Fidgets with hands or feet.
- Difficulty remaining seated.
- Runs about/climbs excessively.
- Difficulty playing quietly.
- On the go. “Driven by a motor.”
- Talks excessively.
- Blurts out answers before questions are asked.
- Difficulty awaiting turn.
- Interrupts or intrudes on others.



# Associated Features

- Vary according to age and development, but may include...
  - Low frustration tolerance
  - Temper outbursts
  - Bossiness
  - Stubbornness
  - Excessive and frequent insistence that request be met
  - Mood lability
  - Demoralization
  - Dysphoria
  - Rejection by peers
  - Poor self esteem

Source: DMS IV-TR (APA, 2000)



# Associated Features

- May also include
  - Impaired academic achievement (especially among the predominantly inattentive type)
  - Peer rejection (especially among the hyperactive/impulsive type)
  - Poor achievement motivation
  - Family discord
  - Negative parent-child interactions

Source: DMS IV-TR (APA, 2000)





# Associated Features

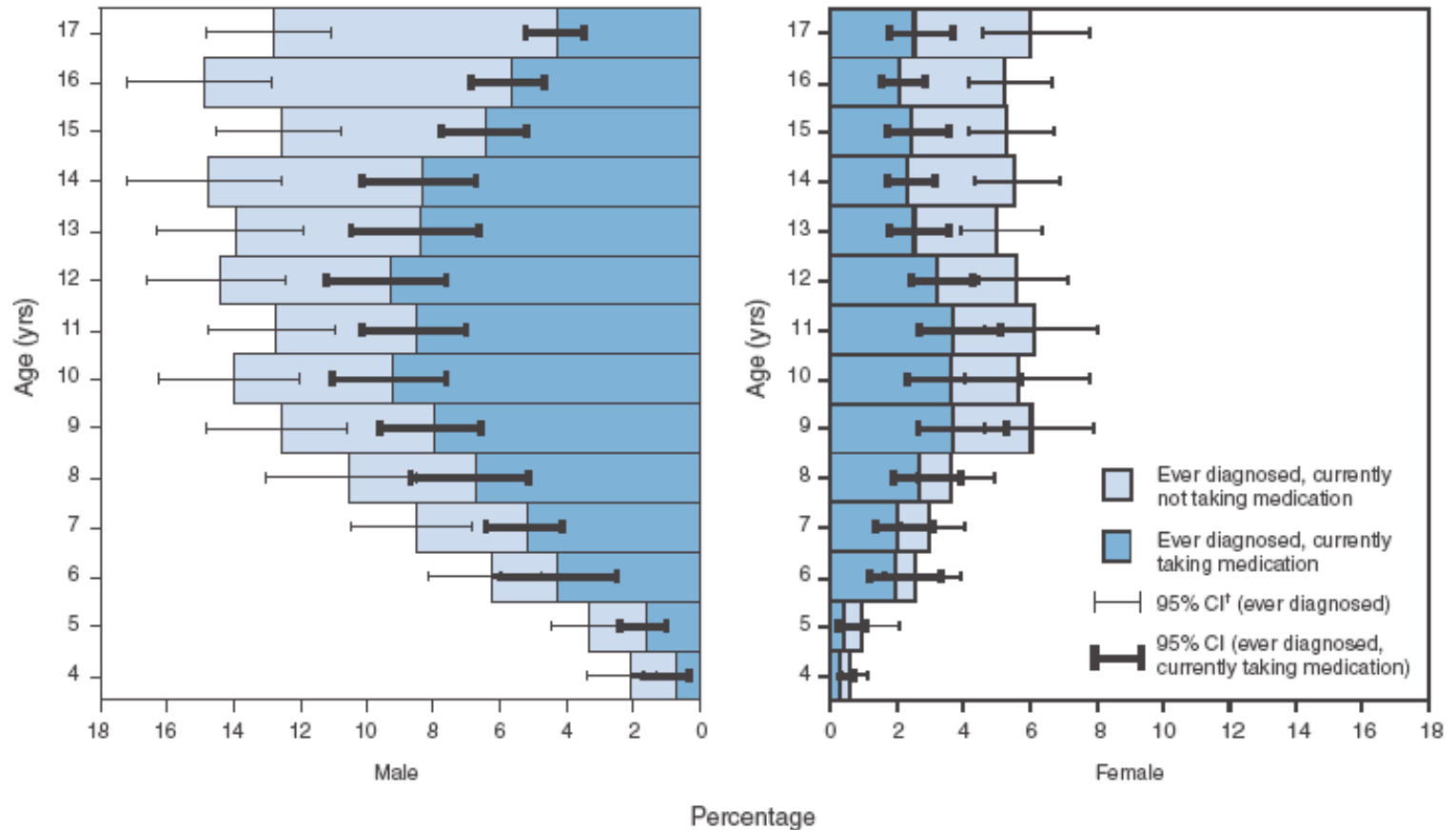
- “There are no laboratory tests, neurological assessments, or attentional assessments that have been established as diagnostic in the clinical assessment of AD/HD” (pp. 88-89).
- “There are no specific physical features associated with AD/HD, although minor physical anomalies (e.g., hypertelorism, highly arched palate, low-set ears) may occur at a higher rate than in the general population” (p. 89).

Source: DMS IV-TR (APA, 2000)

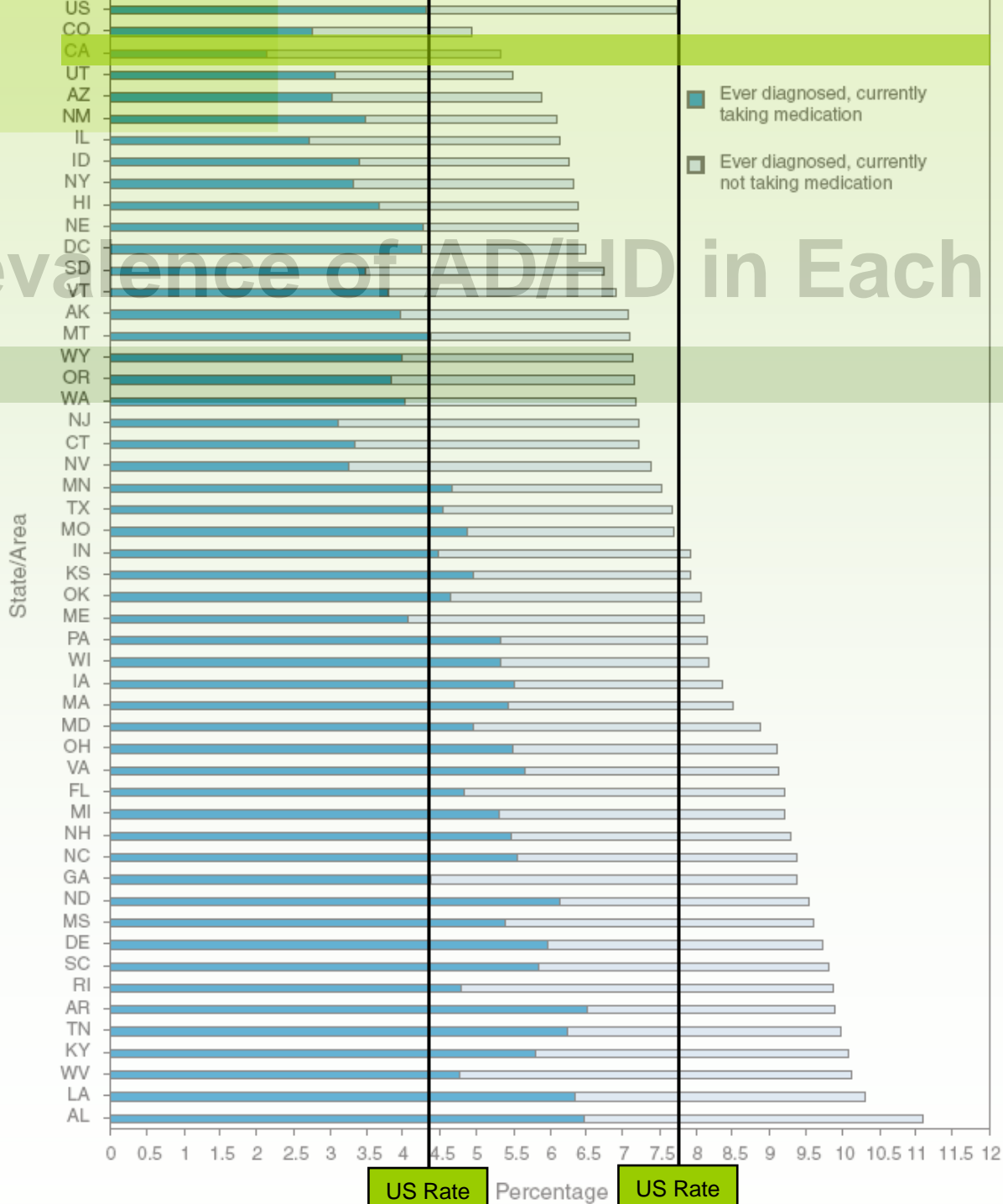


# Prevalence of AD/HD in the USA

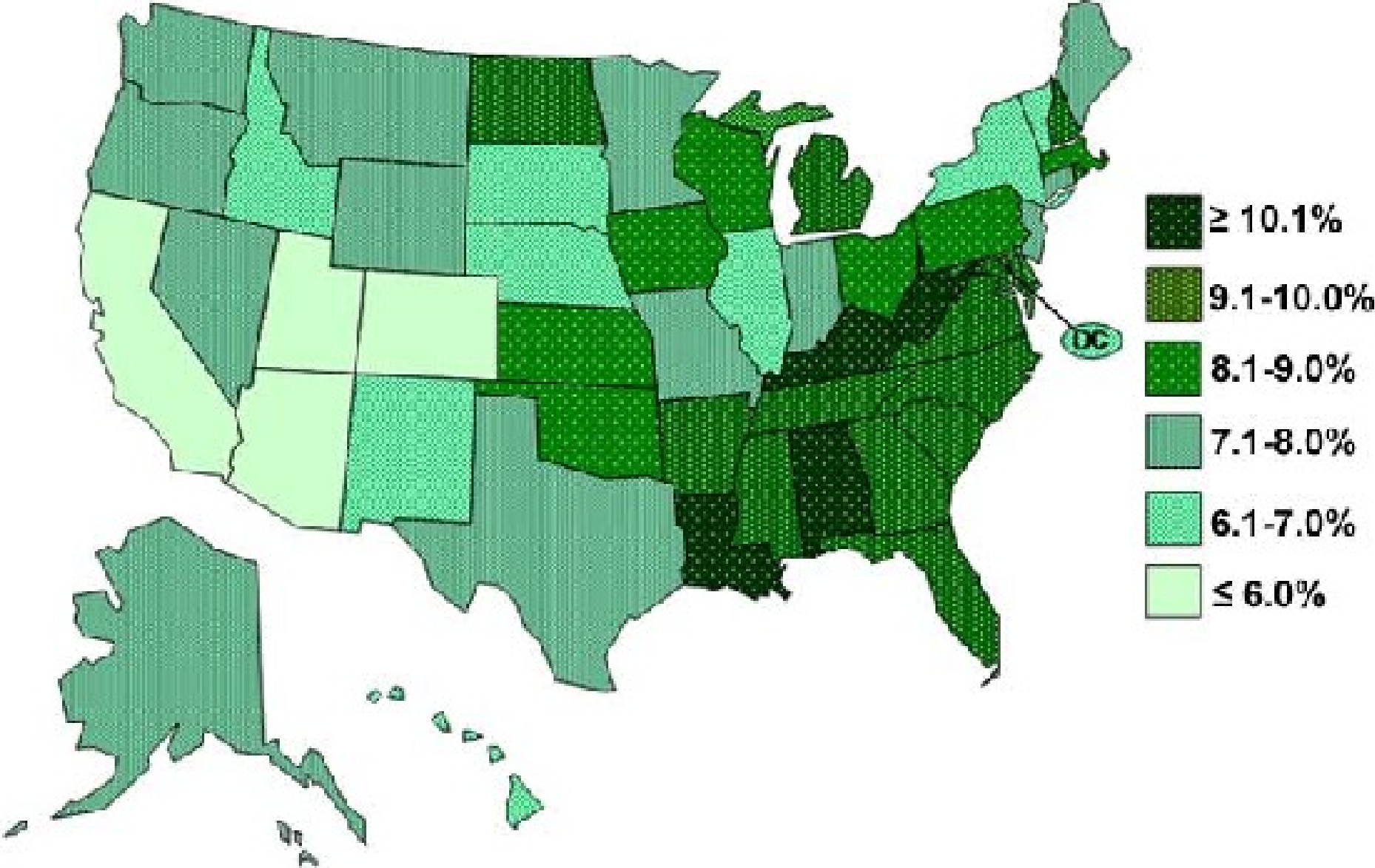
FIGURE 1. Percentage of children aged 4–17 years ever diagnosed with ADHD,\* by age, sex, and medication treatment status — United States, 2003



# Prevalence of AD/HD in Each State



**Percent of Youth 4-17 ever diagnosed with Attention-Deficit/Hyperactivity Disorder**  
**National Survey of Children's Health, 2003**



State	Diagnosed	State	Diagnosed	State	Diagnosed
US	7.74	Louisiana	10.31	Oklahoma	8.11
Alabama	11.09	Maine	7.92	Oregon	7.15
Alaska	7.07	Maryland	9.11	Pennsylvania	8.17
Arkansas	9.88	Massachusetts	8.51	Rhode Island	9.81
Arizona	5.89	Michigan	9.21	South Carolina	9.98
California	5.34	Minnesota	7.53	South Dakota	6.49
Colorado	4.95	Mississippi	9.59	Tennessee	9.87
Connecticut	7.38	Missouri	7.67	Texas	7.69
Delaware	9.74	Montana	7.09	Utah	5.49
Florida	9.21	Nebraska	6.39	Vermont	6.9
Georgia	9.37	Nevada	7.22	Virginia	9.28
Hawaii	6.14	New Hampshire	9.14	Washington	7.18
Idaho	6.38	New Jersey	7.22	Wash., DC	6.74
Illinois	6.32	New Mexico	6.1	West Virginia	10.08
Indiana	7.93	New York	6.27	Wisconsin	8.06
Iowa	8.35	North Carolina	9.54	Wyoming	7.13
Kansas	8.14	North Dakota	9.39		
Kentucky	10.12	Ohio	8.88		

**TABLE. Weighted prevalence estimates of ADHD\* ever diagnosed and current medication treatment for ADHD among children aged 4–17 years,† by sex and sociodemographic characteristics — United States, 2003**

Characteristic	Reported ADHD diagnosis						Currently taking medication for ADHD					
	Male		Female		Total		Male		Female		Total	
	%	95% CI‡	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
<b>National prevalence¶</b>	11.0	(10.4–11.5)	4.4	(4.1–4.8)	7.8	(7.4–8.1)	6.2	(5.8–6.6)	2.4	(2.2–2.7)	4.3	(4.1–4.6)
<b>Age group (yrs)</b>												
4–8	6.0	(5.3–6.7)	2.1	(1.7–2.5)	4.1	(3.7–4.5)	3.6	(3.1–4.2)	1.5	(1.2–1.8)	2.6	(2.3–2.9)
9–12	13.5	(12.5–14.5)	5.9	(5.1–6.7)	9.7	(9.1–10.4)	8.8	(8.0–9.6)	3.6	(3.0–4.3)	6.2	(5.7–6.7)
13–17	13.8	(12.9–14.8)	5.4	(4.9–6.0)	9.7	(9.2–10.3)	6.7	(6.1–7.4)	2.4	(2.0–2.8)	4.6	(4.2–5.0)
<b>Highest education in family</b>												
Less than high school	9.5	(7.5–11.8)	3.3	(2.3–4.8)	6.5	(5.3–7.9)	4.6	(3.3–6.4)	2.0	(1.2–3.4)	3.4	(2.6–4.4)
High school graduate	12.9	(11.8–14.1)	4.2	(3.6–5.0)	8.6	(7.9–9.3)	6.8	(6.1–7.7)	2.3	(1.9–2.9)	4.6	(4.1–5.1)
More than high school	10.4	(9.8–11.0)	4.6	(4.2–5.1)	7.6	(7.2–8.0)	6.1	(5.7–6.6)	2.5	(2.2–2.8)	4.4	(4.1–4.6)
<b>Race</b>												
White	12.0	(11.4–12.6)	5.0	(4.6–5.4)	8.6	(8.2–9.0)	7.1	(6.6–7.6)	2.8	(2.5–3.2)	5.0	(4.7–5.3)
Black	12.0	(10.4–13.8)	3.6	(2.7–4.6)	7.7	(6.8–8.7)	6.0	(4.9–7.4)	1.5	(1.1–2.1)	3.7	(3.1–4.5)
Multiracial	13.5	(10.1–17.9)	5.8	(4.1–8.2)	9.7	(7.7–12.2)	6.5	(4.8–8.7)	3.0	(1.7–5.3)	4.8	(3.6–6.2)
Other	6.6	(4.6–9.2)	2.3	(1.0–5.0)	4.5	(3.3–6.2)	3.0	(1.9–4.7)	1.3	(0.4–4.6)	2.2	(1.4–3.6)
<b>Ethnicity</b>												
Hispanic	4.8	(3.9–5.9)	2.5	(1.8–3.4)	3.7	(3.1–4.4)	2.1	(1.6–2.7)	1.0	(0.6–1.7)	1.6	(1.3–2.0)
Non-Hispanic	12.2	(11.6–12.8)	4.8	(4.4–5.2)	8.6	(8.2–8.9)	7.0	(6.6–7.5)	2.7	(2.4–3.0)	4.9	(4.6–5.2)
<b>Primary language in home</b>												
English	12.3	(11.7–12.8)	4.9	(4.5–5.3)	8.6	(8.3–9.0)	7.0	(6.6–7.4)	2.7	(2.4–3.0)	4.9	(4.6–5.2)
Other	1.6	(1.1–2.2)	0.9	(0.5–1.8)	1.3	(0.9–1.7)	0.5	(0.3–0.8)	—**	—	0.3	(0.2–0.5)
<b>Poverty††</b>												
<100%	14.8	(13.1–16.8)	4.2	(3.4–5.1)	9.6	(8.6–10.7)	7.4	(6.2–8.8)	2.1	(1.6–2.8)	4.8	(4.1–5.6)
100%–199%	11.2	(10.0–12.5)	4.7	(4.0–5.6)	8.0	(7.3–8.8)	6.6	(5.6–7.6)	2.8	(2.2–3.5)	4.7	(4.1–5.3)
≥200%	10.2	(9.7–10.8)	4.5	(4.0–5.0)	7.4	(7.1–7.8)	6.1	(5.7–6.6)	2.5	(2.1–2.9)	4.3	(4.1–4.6)
<b>Any health-care coverage</b>												
Yes	11.4	(10.9–12.0)	4.5	(4.2–4.9)	8.1	(7.7–8.4)	6.7	(6.3–7.1)	2.5	(2.3–2.8)	4.6	(4.4–4.9)
No	6.5	(5.1–8.2)	3.2	(2.3–4.4)	4.9	(4.0–5.9)	1.7	(1.3–2.4)	1.3	(0.7–2.1)	1.5	(1.1–2.0)

\* Attention-deficit/hyperactivity disorder.

† Estimates do not include children aged 2–3 years with reported ADHD diagnosis (n = 32) because small sample size yields substantial (>30%) relative standard errors.

‡ Confidence interval.

¶ Sociodemographic estimates included data from 46,104 males and 43,680 females aged 4–17 years for a total of 89,784.

\*\* Relative standard error >30%.

†† Federal poverty level.

# Prevalence of AD/HD Worldwide

- International data
  - Worldwide prevalence ranges from 3 to 9%
  - Differences are typically attributed to different AD/HD criteria

Country	Rate
New Zealand	6.7
Spain	8.0
Germany	9.6
Puerto Rico	9.5-16.1
Netherlands	7.8
London, GB	1.7
Manheim, GR	4.2
Brazil	5.8
Ontario, CD	6.3



# Legal Issues and AD/HD

- Federal Law and Regulation
  - September 16, 1991, Joint Policy Memorandum
    - Office of Special Education and Rehabilitation Services
    - Office for Civil Rights
  - “Children with ADD who require special education ... are presently eligible under the IDEA categories of “other health impairment,” “specific learning disability,” or “serious emotional disturbance.”
  - “...children who do not require special education ... may nevertheless be covered by the Section 504 regulations if their ADD substantially limits a major life activity, such as learning.”





# Legal Issues and AD/HD

- Federal Law and Regulation
  - April 29, 1993, [Policy Memorandum](#)
    - US Department of Education
    - Jeanette J. Lim, Acting Assistant Secretary for Civil Rights
    - Clarification of School Districts' Responsibilities to Evaluate Children with Attention Deficit Disorders (ADD)
    - Available
      - <http://www.nichcy.org/pubs/otherpub/doeadd2.htm>



# Legal Issues and AD/HD

- Federal Law and Regulation

- April 29, 1993, [Policy Memorandum](#)

- It recently has come to our attention that many school districts and parents appear to be misinterpreting a statement contained in the September 16, 1991, memorandum concerning "Clarification of Policy to Address the Needs of Children with Attention Deficit Disorders within General and/or Special Education." This statement, on page 6 of the memorandum, concerns the responsibility of local education agencies (LEAs) to evaluate children suspected of having ADD. The statement reads as follows:

"Under Section 504, if parents believe that their child is disabled by ADD, the LEA must evaluate the child to determine whether he or she has a disability as defined by Section 504."

A similar version of this statement is contained in the Questions and Answers Handout (Handout) on ADD, entitled "OCR Facts: Section 504 Coverage of Children with ADD." The Handout was attached to a model technical assistance (TA) presentation on ADD, disseminated to Regions on October 31, 1991, and is used as a TA resource.



# Legal Issues and AD/HD

- Federal Law and Regulation

- April 29, 1993, [Policy Memorandum](#) (continued)

- The intent of this statement was to reaffirm that children suspected of having ADD and believed (by the LEA) to need special education or related services would have to be evaluated by the LEA pursuant to Section 504. These children are afforded protection and rights as any other children with disabilities under Section 504. This statement was necessary since many school districts, prior to issuance of the September 21, 1991, memorandum, held the position that they were not obliged to evaluate any child suspected of having ADD since it was not a disability specifically listed in the Individuals with Disabilities Education Act.



# Legal Issues and AD/HD

- Federal Law and Regulation

- April 29, 1993, Policy Memorandum (continued)

- To our dismay, this statement has been interpreted to mean that school districts are required to evaluate every child suspected of having ADD, based solely on parental suspicion and demand. This was not the intent of the statement. Rather, under Section 504, if parents believe their child has a disability, whether by ADD or any other impairment, and the LEA has reason to believe the child needs special education or related services, the LEA must evaluate the child to determine whether he or she is disabled as defined by Section 504. If the LEA does not believe that the child needs special education or related services, and thus refuses to evaluate the child, the LEA must notify the parents of their due process rights.



# Legal Issues and AD/HD

- California Education Code Section 56339
  - (a) A pupil whose educational performance is adversely affected by a suspected or diagnosed attention deficit disorder or attention deficit hyperactivity disorder and demonstrates a need for special education and related services by meeting eligibility criteria specified in subdivision (f) or (i) of Section 3030 of Title 5 of the California Code of Regulations or Section 56337 and subdivision (j) of Section 3030 of Title 5 of the California Code of Regulations for the federal Individuals with Disabilities Education Act (20 U.S.C. Sec. 1400 and following) categories of "other health impairments," "serious emotional disturbance," or "specific learning disabilities," is entitled to special education and related services.



# Legal Issues and AD/HD

- California Education Code Section 56339
  - (b) If a pupil with an attention deficit disorder or attention deficit hyperactivity disorder is not found to be eligible for special education and related services pursuant to subdivision (a), the pupil's instructional program shall be provided in the regular education program.



# Legal Issues and AD/HD

- California Education Code Section 56339
  - (c) It is the intent of the Legislature that local educational agencies promote coordination between special education and regular education programs to ensure that all pupils, including those with attention deficit disorders or attention deficit hyperactivity disorders, receive appropriate instructional interventions.



# Legal Issues and AD/HD

- California Education Code Section 56339
  - (d) It is further the intent of the Legislature that regular education teachers and other personnel be trained to develop an awareness about attention deficit disorders and attention deficit hyperactivity disorders and the manifestations of those disorders, and the adaptations that can be implemented in regular education programs to address the instructional needs of pupils having these disorders.





# Legal Issues and AD/HD

- Internet resources regarding AD/HD and special education
  - [www.wrightslaw.com](http://www.wrightslaw.com)
    - [http://www.wrightslaw.com/advoc/ltrs/eligibility\\_add.htm](http://www.wrightslaw.com/advoc/ltrs/eligibility_add.htm)

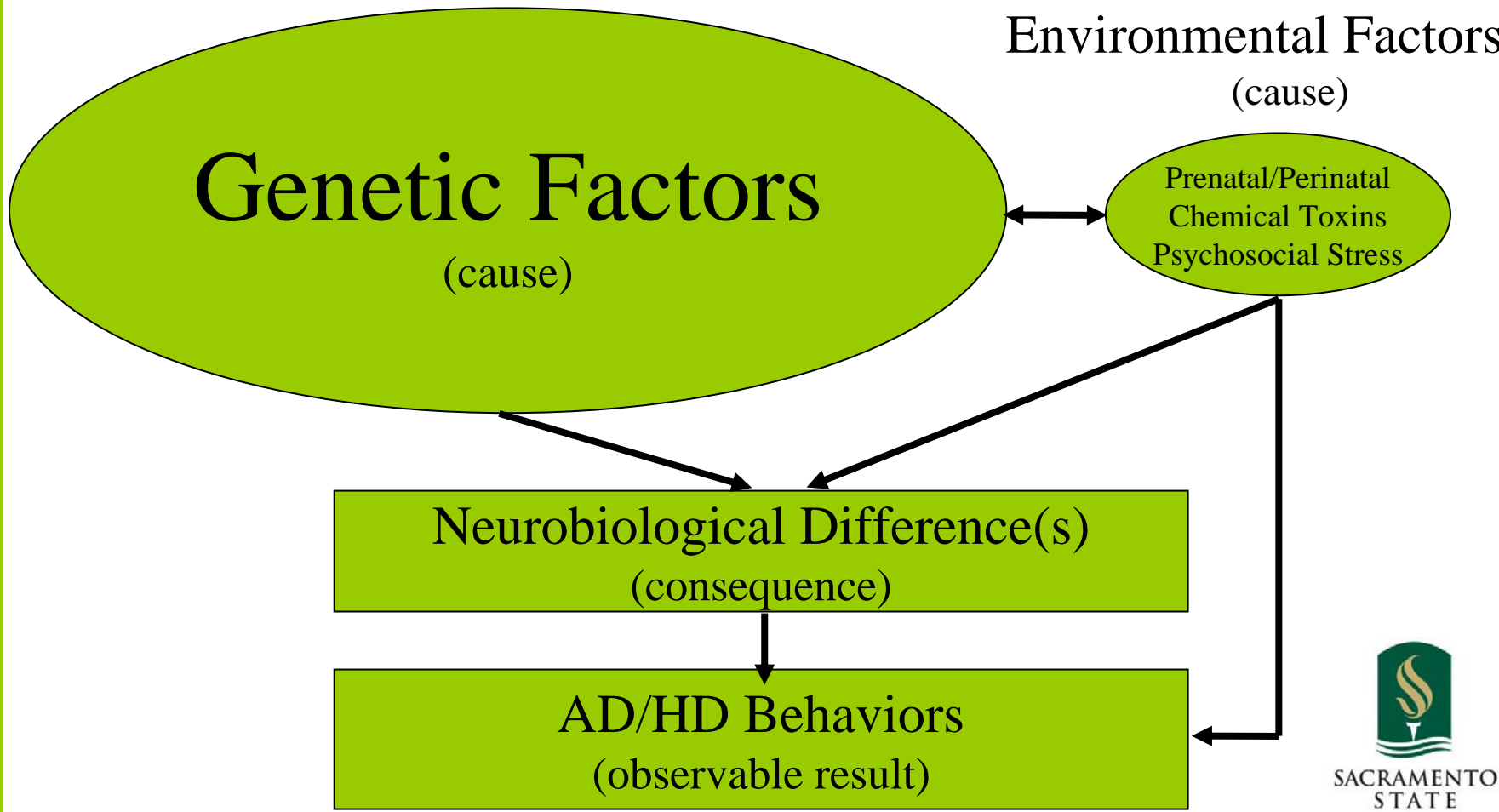


# Etiology of AD/HD

- Genetics (cause)
  - Plays a significant role, but does not account for all cases of AD/HD.
- Environment (cause)
  - Pre- and Postnatal factors
  - Chemical Toxins
  - Psychosocial stressors
- Neurobiological Differences (consequence)



# Etiology of AD/HD



# Etiology of AD/HD: Genetic Factors

- “Research shows that ADHD tends to run in families, so there are likely to be genetic influences. Children who have ADHD usually have at least one close relative who also has ADHD. And at least one-third of all fathers who had ADHD in their youth have children with ADHD. Even more convincing of a possible genetic link is that when one twin of an identical twin pair has the disorder, the other is likely to have it too” (NIMH, 2000).



# Etiology of AD/HD: Heritability

- Twin studies reveal that AD/HD is highly heritable.
- Spencer et al.'s (2002) review suggests a heritability of 0.75.
  - 0 means there is no genetic input.
  - 1 means the disorder is completely determined by genetics.
- In other words, approximately 75% of the etiologic contribution of AD/HD is genetic!



# Etiology of AD/HD: Heritability

- The incidence of AD/HD in the parents of children newly diagnosed with AD/HD is 25% indicating a strong genetic predisposition (Biederman et al., 1990).
- Thus, a family history of AD/HD is an important variable to consider when diagnosing this disorder.



# Etiology of AD/HD: Genetic Factors

- While genetic factors clearly help to explain a substantial amount of differences observed within the population of the behaviors that comprise AD/HD, they do not account for all symptom variance.
- Thus, other environmental factors, insults, and/or injuries have also been suggested to be possible etiological variables.



# Etiology of AD/HD: Environmental Factors

- Pregnancy and Birth Complications
  - “large scale epidemiological studies have generally not found a strong association between pre- or perinatal adversity and symptoms of AD/HD once other factors are taken into account, such as maternal smoking and alcohol use ...” (Barkley, 1998, p. 169).





# Etiology of AD/HD: Environmental Factors

- Environmental Toxins linked to AD/HD
  - Elevated body lead burden (usually from lead based wall paint)
  - Prenatal exposure to alcohol
  - Prenatal exposure to tobacco smoke
    - Goldstein & Goldstein (1998)
    - Mick et al. (2002)



# Etiology of AD/HD: Environmental Factors

- Psychosocial Stressors
  - “Some investigators have noted that the severity of ADHD has been associated with family stressors and psychosocial adversity. Although it is not clear that psychosocial adversity can cause ADHD per se, symptom severity does seem to be related to indices of stress and social adversity in the families of these children” (Jensen, 2000, p. 564).



# Etiology of AD/HD: Environmental Factors

- Psychosocial Stressors
  - Family Environment
    - Marital discord, family size, paternal criminality, maternal mental disorder, and foster care placement are risk factors (Biederman et al., 1995)
    - However, the link between adverse family and perinatal factors with hyperactivity is weak (Goodman & Stevenson, 1989)

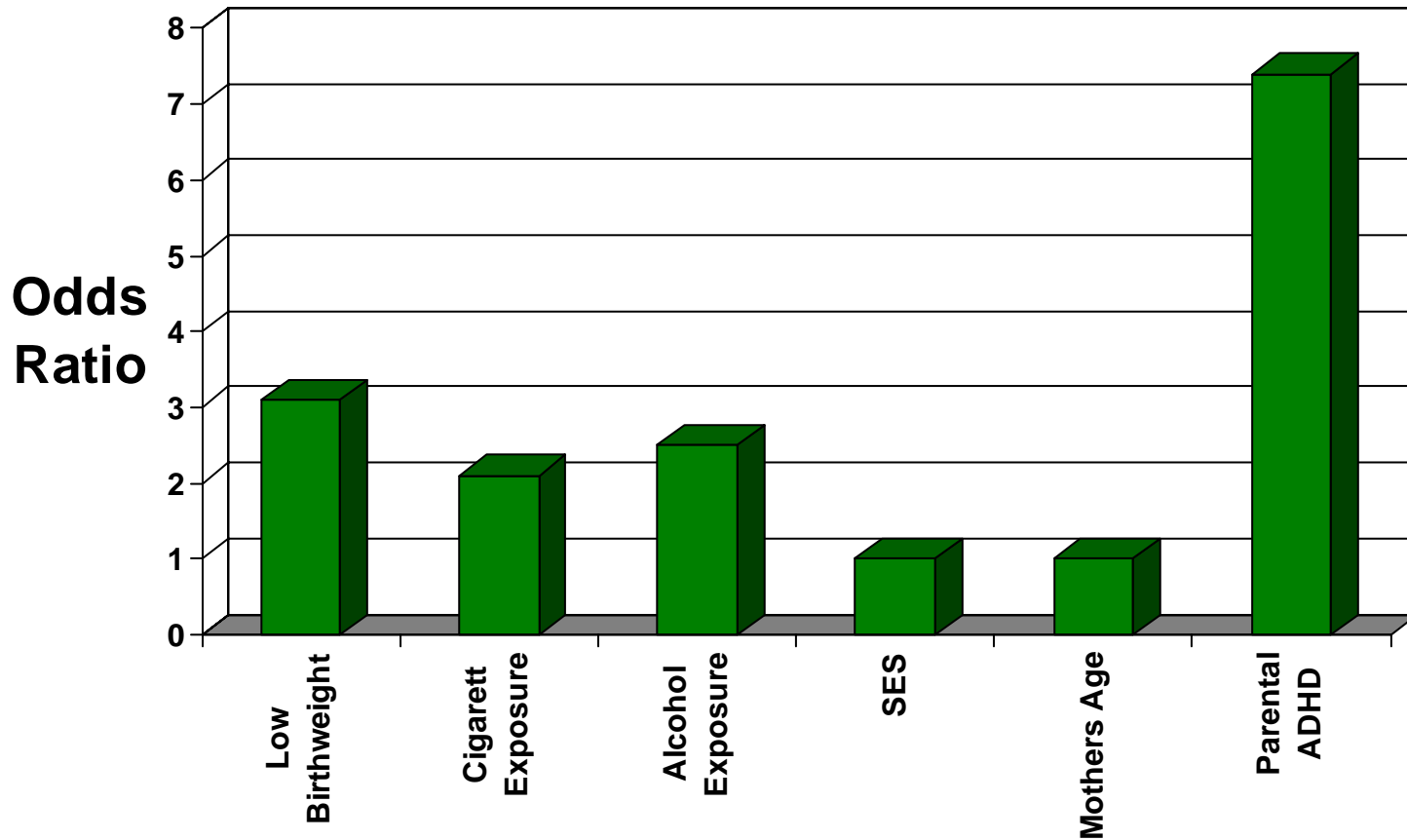


# Etiology of AD/HD: Environmental Factors

- Neurological Injury or Acquired (Traumatic) Forms of AD/HD
  - Approx. 20% of children with severe traumatic brain injury have been reported to have subsequent onset of substantial symptoms of impulsivity and inattention.
    - AD/HD itself may be a risk factor for traumatic brain injury, so genetic and brain injury causes may not be independent.



# Prenatal and Postnatal Risk Factors



Source: Mick et al., (2002).

# Prenatal and Postnatal Risk Factors

- Birth weight
  - Extremely Low Birth weight (<1000 grams/2.2 lbs)
    - Three fold increased risk of AD/HD (Teplin et al., 1991)
  - Very Low Birth weight (<1500 grams/3.3 lbs)
    - 47% have poor attention span (The Scottish Low Birth weight Study, 1992)
    - 23% have AD/HD (vs. 6% with normal birth weight, Botting et al., 1997)
  - Low Birth weight (<2500 grams/5.5 lbs)
    - AD/HD children 3.1 times more likely to be born weighing 5.5 lbs. or less.
    - By itself accounts for 13.8% of AD/HD cases (Mick et al., 2002)
  - However, Most children with AD/HD don't have a low birth weight (APA, 2000).



# Prenatal and Postnatal Risk Factors

- Prematurity
  - Even mild prematurity has negative consequences that include increased risk for AD/HD.
  - Cherkes-Julkowski (1998) report that among a group of children born on average 49 days early with a birth weight of 4.14 lbs., 75% had by grade 5 at least one learning problem including AD/HD.



# Prenatal and Postnatal Risk Factors

- Prenatal Maternal Smoking
  - Associated with higher teacher and maternal ratings of AD/HD behaviors (Fergusson et al., 1993)
  - Proposed mechanisms
    1. Maternal smoking leads to fetal hypoxia (Longo, 1989)
    2. Nicotine causes disturbances to the dopamine systems in the prefrontal cortex (Fung & Lau, 1989)





# Prenatal and Postnatal Risk Factors

- Prenatal Maternal Drinking
  - Among children who did not have FAS, children diagnosed with AD/HD were 2.5 times more likely than children without AD/HD to have been exposed to alcohol in utero (Mick et al., 2002)



# Etiology of AD/HD: Combined Factors

- A number of risk factors have now been associated with AD/HD, no factor or any combination is sufficiently explanatory to account for all AD/HD cases.
- In fact, many children suffer similar difficulties are exposed to comparable levels of such risk factors and do not develop AD/HD.
- It may require a combination of some trauma, toxic exposure, or subtle form of brain insult, coupled with a certain pattern of susceptibility genes, for the full syndrome to emerge.

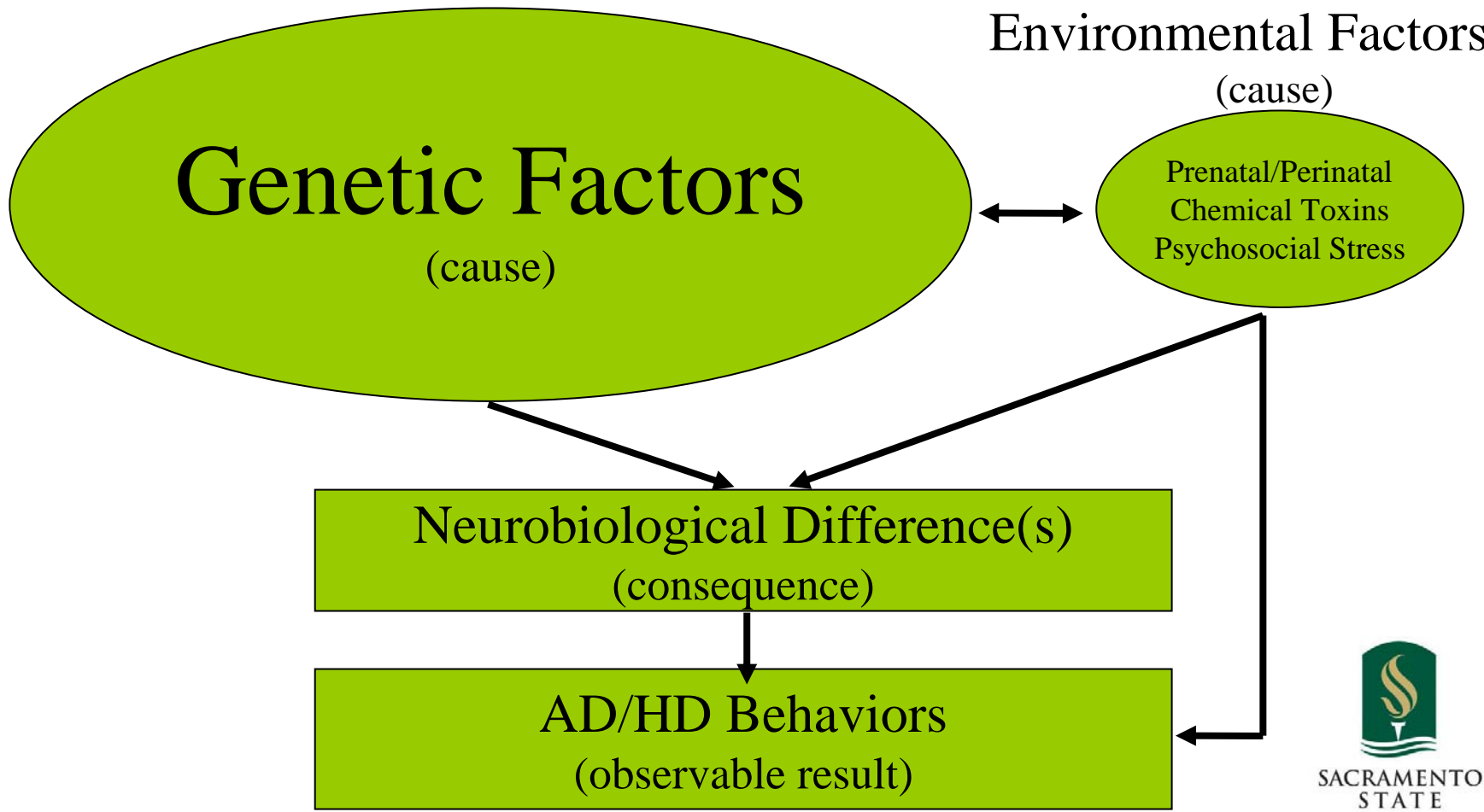


# Etiology of AD/HD: Neurobiology

- The effect of a certain combination of trauma, toxic exposure, or subtle form of brain insult, coupled with a certain pattern of susceptibility genes, is suggested to be neurobiological changes.
- According to the National Institute of Mental Health, AD/HD is a “chronic neurobiologic” disorder (NIMH, 2000).



# Etiology of AD/HD



# Etiology of AD/HD: Neurobiology

- The available research data has been fairly consistent in implicating neurological factors as playing an important causal role in the behavioral manifestations of AD/HD.



# Etiology of AD/HD: Neurobiology

- Neuropsychological Studies

- Disinhibition of behavioral responses (or impulse control) and difficulties with working memory, planning, verbal fluency, perseveration, motor sequencing, and other frontal lobe functions are common among children with AD/HD.
- The totality of findings in this area is impressive in “suggesting that dysfunction of the prefrontal lobes (inhibition and executive function deficits) is a likely basis for explaining ADHD” (Barkley, 1998, p. 165).



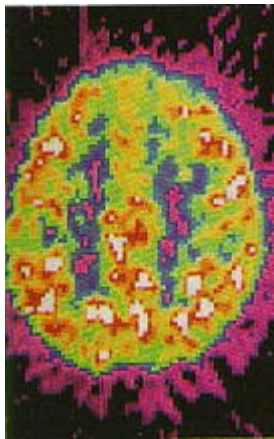
# Etiology of AD/HD: Neurobiology

- Neurological Studies

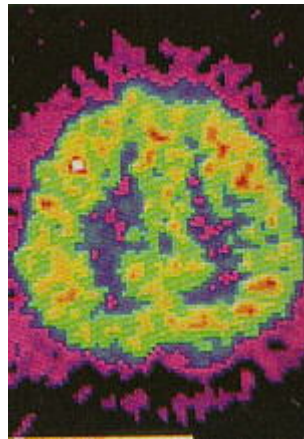
- New technology (e.g., fMRI) has allowed researchers to view the brain while it is working.
- Functional studies have exposed a decrease in the metabolic activity in the right frontal lobe, but also in an area known as the basal ganglia (this region is responsible for regulating movement and is connected with the frontal lobe region).



# Etiology of AD/HD: Neurobiology



No AD/HD



AD/HD

Source: Alan Zametkin, M.D.,  
Section on Clinical Brain Imaging,  
Laboratory of Cerebral  
Metabolism, Division of Intramural  
Research Programs, NIMH 1990

Brain scan images produced by positron emission tomography (PET) show differences between an adult with Attention-deficit Hyperactivity Disorder (AD/HD) (right) and an adult free of the disease (left).





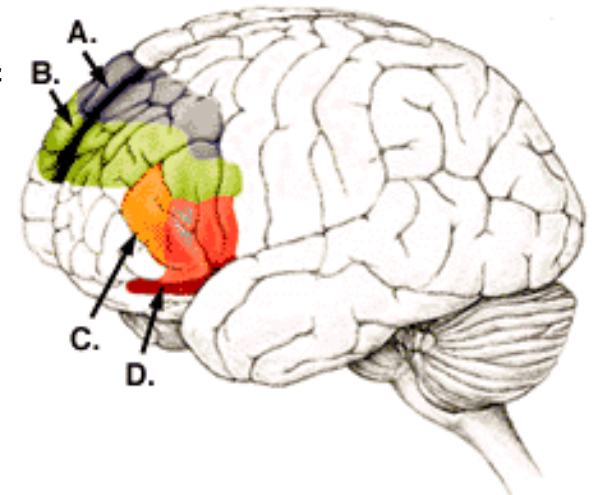
# Etiology of AD/HD: Neurobiology

- Neurological Studies
  - Functional imaging techniques have suggested 3 areas closely related to the basal ganglia, to be responsible for the symptoms of AD/HD:
    - the prefrontal cortex (part of the frontal lobe)
    - the caudate nucleus (part of the basal ganglia)
    - the globus pallidus (part of the basal ganglia)
  - Some researchers believe that problems in the circuit between these three regions are the underlying mechanisms that cause AD/HD symptoms.
  - The prefrontal cortex is thought to be the brain's "command center" while the other two parts translate the commands into action.

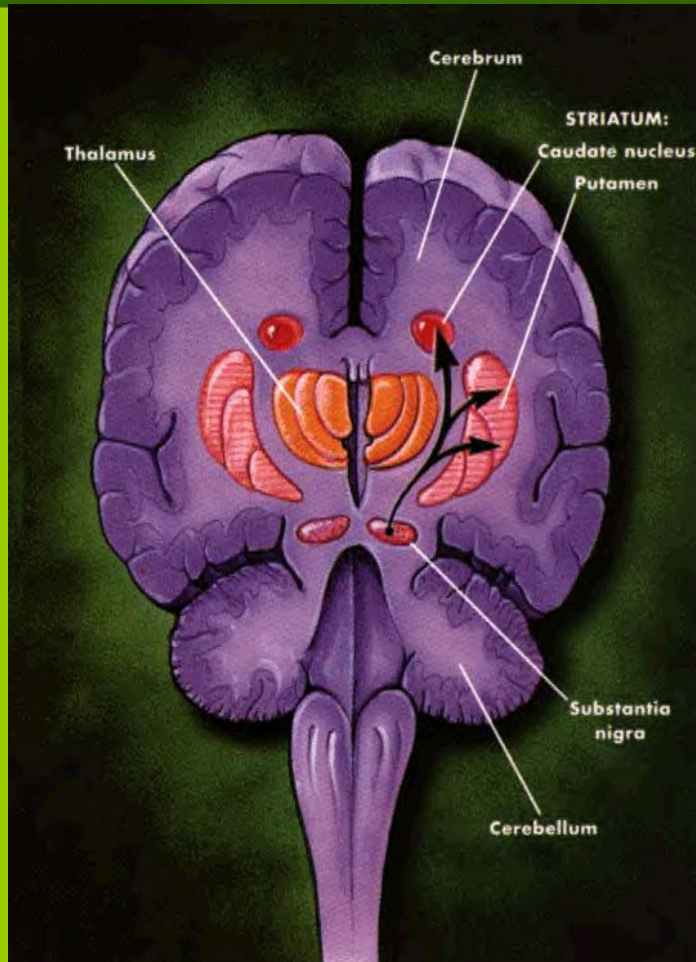


# Etiology of AD/HD: Neurobiology

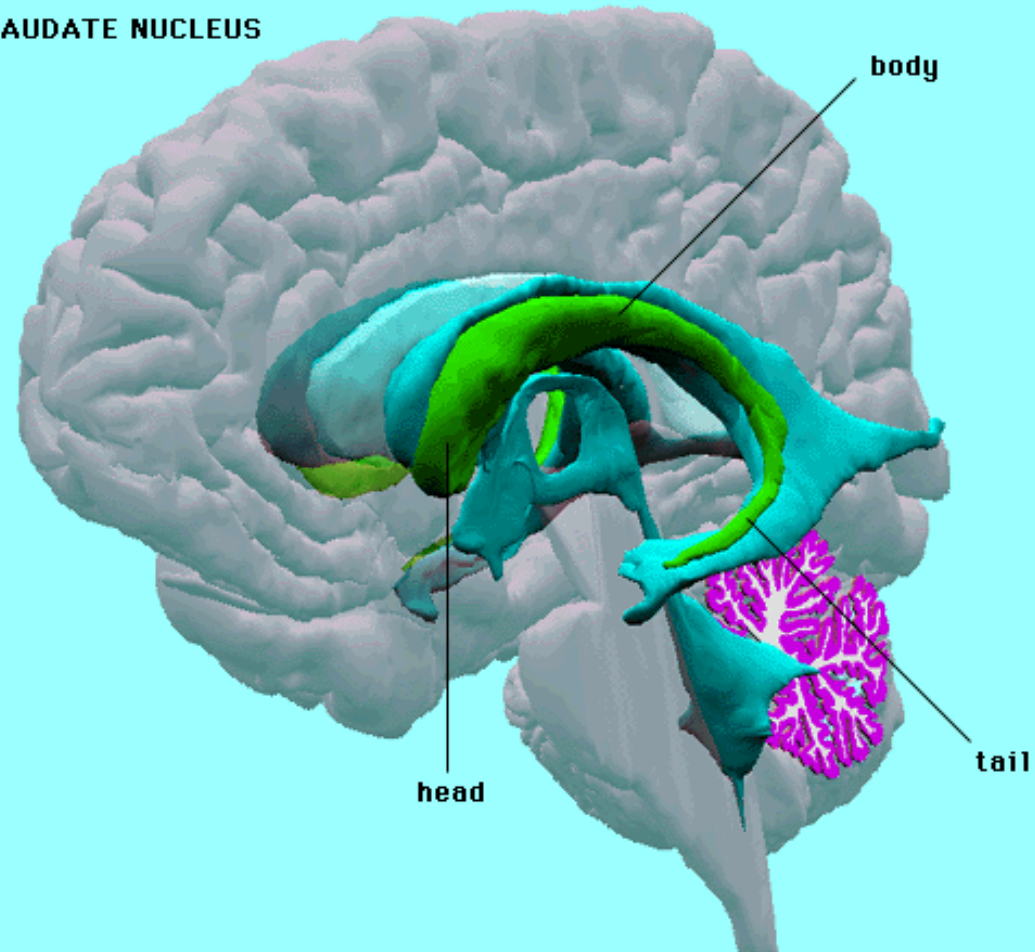
- Frontal-striatal areas of the brain:
  - A. Spatial working memory
  - B. Spatial working memory, performance of self-ordered tasks
  - C. Spatial, object and verbal working memory, self-ordered tasks, analytic reasoning
  - D. Object working memory, analytic reasoning



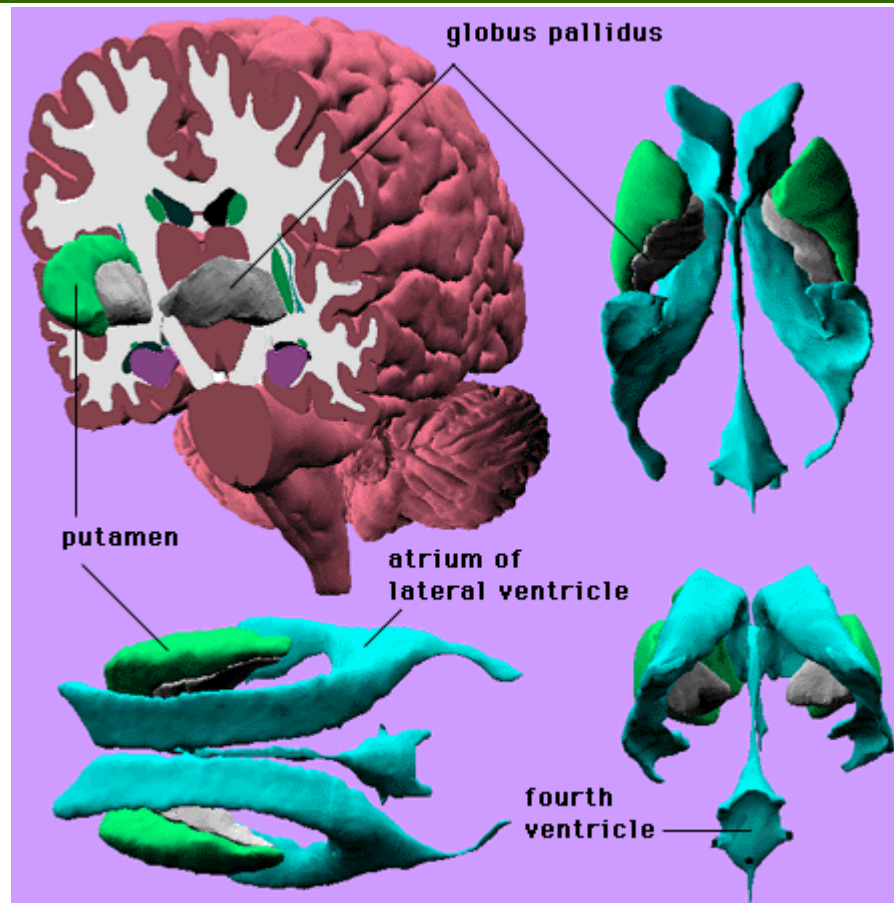
# Etiology of AD/HD: Neurobiology



CAUDATE NUCLEUS



# Etiology of AD/HD: Neurobiology



# Etiology of AD/HD: Neurobiology

- A Recent Study
  - Developmental Trajectories of Brain Volume Abnormalities in Children and Adolescents With AD/HD (Castellanos et al., *JAMA*, 2002).
    - 152 Compared children w/ AD/HD were compared to 139 age/sex matched peers.
    - MRI measured brain sizes/changes over time of both groups.
    - Children with AD/HD had smaller brain volumes in all regions.
    - w/ controls, previously unmedicated children with AD/HD also demonstrated significantly smaller brain volumes.



# Etiology of AD/HD: Neurobiology

- A Recent Study
  - Developmental Trajectories of Brain Volume Abnormalities in Children and Adolescents With AD/HD (Castellanos et al., *JAMA*, 2002).
    - Brain size differences remained stable over time (**with the exception of the *caudate nucleus* which normalized during adolescence**).
    - Conclusions: “Developmental trajectories for all structures, except caudate, remain roughly parallel for patients and controls during childhood and adolescence, suggesting that genetic and/or early environmental influences on brain development in AD/HD are fixed, nonprogressive, and unrelated to stimulant mediation” (p. 1740).



# Etiology of AD/HD: Neurobiology

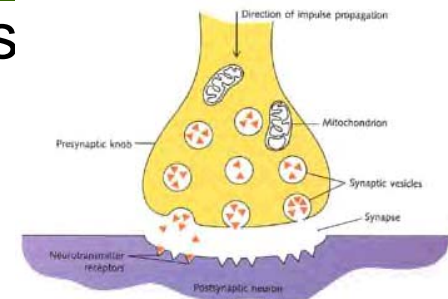
- Neurotransmitter Deficiencies
  - In 1937 Bradley identified a group of children whose impulsive aggressive behaviors were improved by treatment with amphetamines.
  - The paradox that CNS stimulants would decrease activity levels and increase attention span stimulated research that formed the foundation for our understanding of AD/HD as having a neurochemical basis.

Source: University of Virginia, Children's Hospital,  
<http://www.healthsystem.virginia.edu/internet/pediatrics/hcp/adhdetiology.cfm>



# Etiology of AD/HD: Neurobiology

- Neurotransmitter Deficiencies
  - The exact mechanism of action of AD/HD medications (e.g., Stimulants, clonidine, and tricyclic antidepressants) is unknown but presumably they exert their effects through modulation of neurotransmitters.
  - AD/HD medications affect Dopamine, noradrenaline and serotonin levels central nervous system.



Source: University of Virginia, Children's Hospital,

<http://www.healthsystem.virginia.edu/internet/pediatrics/hcp/adhdetiology.cfm>



SACRAMENTO  
STATE



# Etiology of AD/HD: Neurobiology

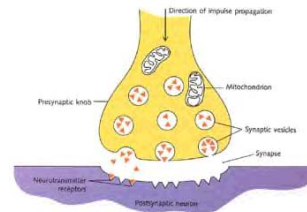
- Neurotransmitter Deficiencies
  - The available data suggests that no single neurotransmitter deficiency completely explains how the range of medications which improve AD/HD symptoms.
  - The single neurotransmitter concept is refuted by the inability of specific medications known to modulate individual neurotransmitters to improve symptoms. It is possible that AD/HD is due to imbalance of multiple inter-related neurotransmitters.

Source: University of Virginia, Children's Hospital,  
<http://www.healthsystem.virginia.edu/internet/pediatrics/hcp/adhdetiology.cfm>



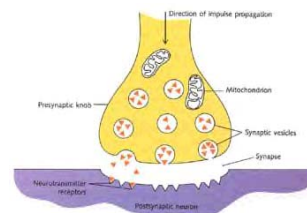
# Etiology of AD/HD: Neurobiology

- How Ritalin Works (Volkow, 2001)
  - Ritalin works by increasing levels of the neurotransmitter, dopamine, in the brain. In doing so it stimulates attention and motivation circuits (increasing the ability to focus and remain on-task).
  - Prior studies had suggested that Ritalin interfered with the reuptake (or recycling) of dopamine within the brain by blocking dopamine transporters (Solanto, 1998).
    - These prior studies, however, made use of much higher doses of Ritalin that would be used therapeutically.
  - Using a PET scan, researchers studied dopamine levels in 11 normal male subjects. Over two sessions, the volunteers were each given a dose of Ritalin (calculated using their body weight to correspond to the doses given to children with ADHD) or a placebo. Next, while their brains were scanned record dopamine levels.

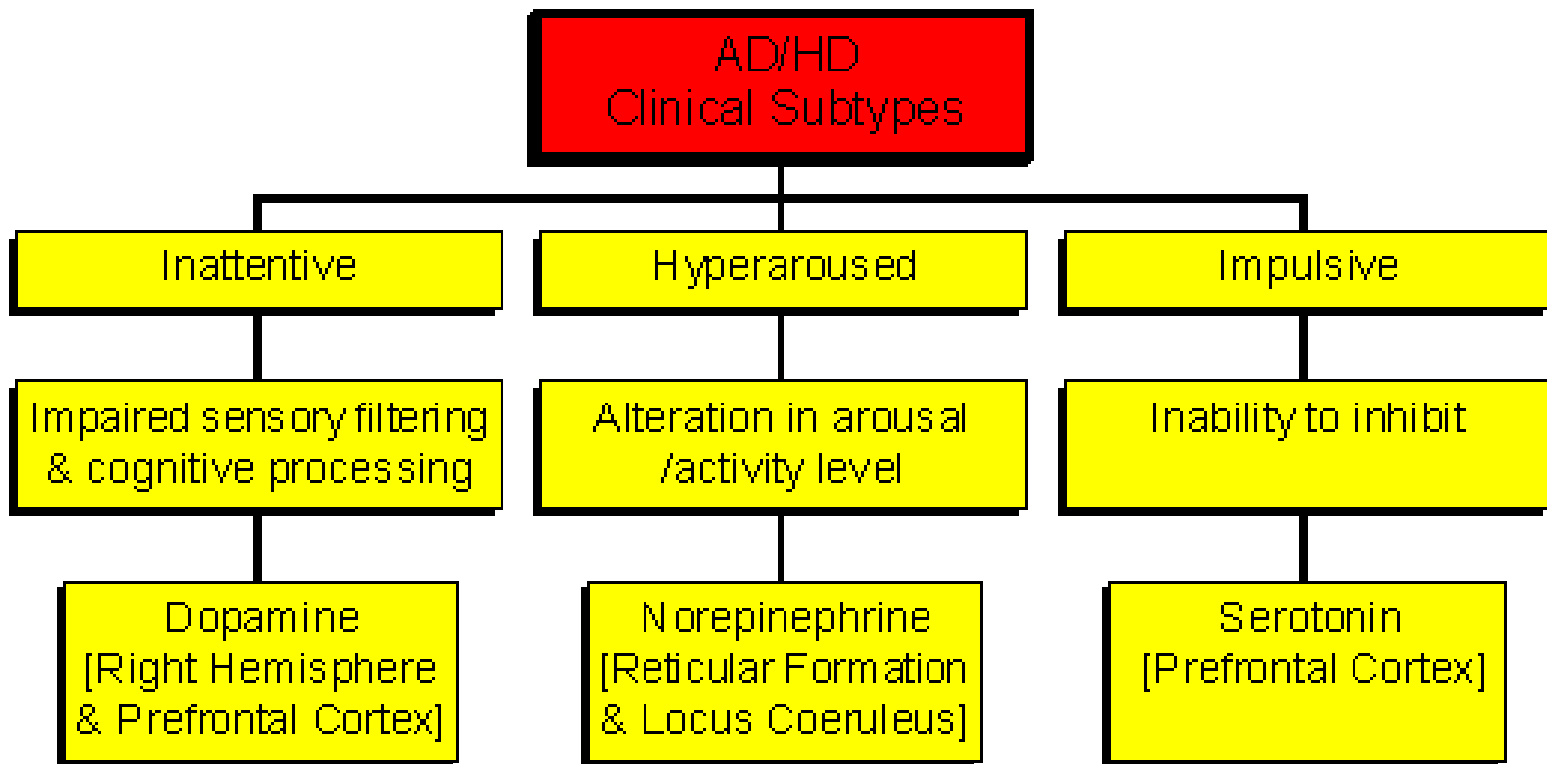


# Etiology of AD/HD: Neurobiology

- How Ritalin Works (Volkow, 2001)
  - The results showed that brain dopamine levels increased significantly approximately 60 minutes after ingestion of the drug as compared to the placebo.
  - Researchers suggested that Ritalin also suppresses "background" firing of neurons not associated with task performance, allowing the brain to transmit a clearer signal.
  - "We hypothesize that we will find that ADHD sufferers have decreased function of dopamine circuits and are therefore easily distracted," she said. "The effect of Ritalin should be to normalize these levels, allowing them to focus and pay attention."



# A Model of AD/HD

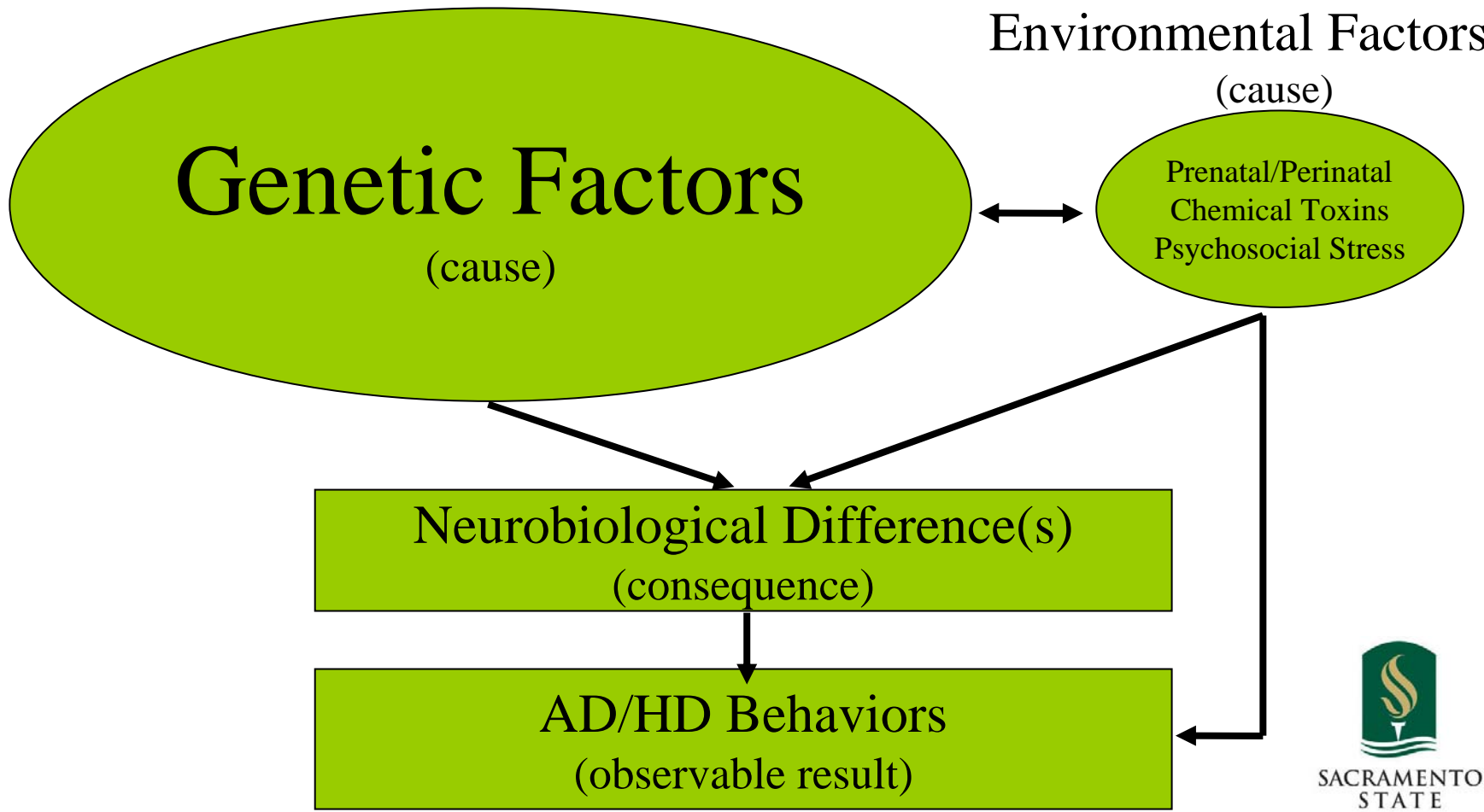


Source: University of Virginia, Children's Hospital

<http://www.healthsystem.virginia.edu/internet/pediatrics/hcp/ADHDMoell.cfm>



# Etiology of AD/HD



# Diagnostic Criteria

- Symptom Duration
  - 6 months.
- Developmental Level
  - Inconsistent with,
- Symptom Impairment Onset
  - Age 7 years per DSM IV-TR.
  - Age 9 for inattentive type?
- Symptom Display
  - Multiple settings.
- Clinical Significance
  - The effect of symptoms on functioning.
  - Child & Adolescent Functional Assessment Scale
  - <http://www.mhsip.org/library/pdfFiles/CHILDANDADOLESCENTFUNCTIONALASSESSMENTSCALE.pdf>
- Differential Diagnosis
  - Rule out other explanations for symptoms.



# AD/HD Diagnosis

- According to Pelham, Gabiano, and Massetti (2005):
  - “Because the definition of ADHD is currently a behavioral one based on the individual’s functioning in daily life (APA, 1994), assessment procedures must focus on the observable behavior as reported by adults or otherwise measured in natural (home and classroom) and laboratory (clinic, analogue classroom) settings” (p. 451).



# Differential Diagnosis

- Medical Conditions
  - Impairment of vision and/or hearing
  - Medication side effect(s)
  - Asthma (or reaction to asthma medications)
    - <http://www.lungusa.org/site/pp.aspx?c=dvLUK9O0E&b=263990&printmode=1>
  - Allergic rhinitis (or reaction to antihistamine)
  - Incontinence of urine or feces
  - Malnutrition (vitamin or metabolic deficiency)
  - Thyroid disorder
  - Lead toxicity





# Differential Diagnosis

- Neurologic and Psychiatric Conditions
  - Learning disabilities
  - Tic disorder
  - Seizure disorder (or effect of antiepileptic)
    - <http://www.epilepsy.ca/eng/content/antiepi.html>
  - Mental retardation or intellectual precocity
  - Low developmental level.
  - Brain damage or injury
  - Sleep disorders (including sleep apnea and insomnia)
  - Oppositional Defiance and Conduct Disorders
  - Substance abuse
  - Anxiety
  - Depression (or Bipolar Disorder)
  - Obsessive-compulsive Disorder
  - Posttraumatic Stress Disorder

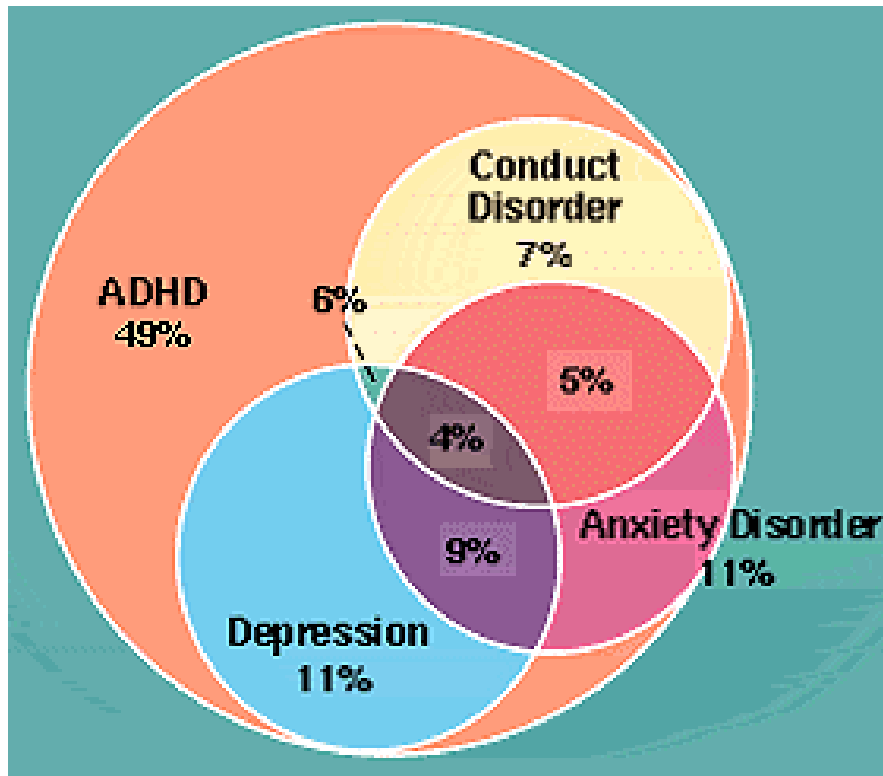


# Differential Diagnosis

- Environmental Conditions
  - Improper or poor learning environment
  - Mismatched curriculum and child
  - Dysfunctional or stressful home
  - Poor parenting (inconsistent, punitive)
  - Neglect or abuse
  - Parental psychopathology
  - Low motivation.



# Differential Diagnosis: Made Difficult by Comorbidity



“The highest comorbidity is between ADHD and disorders related to aggression (i.e., children with oppositional defiant disorder and conduct disorder) and learning problems, with much lower rates of comorbid internalizing problems” (Pelham et al., 2005, p. 452)

Chart shows percentages of attention deficit hyperactivity disorder cases in which other disorders were also present (co-morbidity). (By Leigh Coriale Design & Illustration from a chart by Drs. Biederman and Faraone.)

[http://www.med.harvard.edu/publications/On\\_The\\_Brain/Volume5/Number1/ADD.html](http://www.med.harvard.edu/publications/On_The_Brain/Volume5/Number1/ADD.html)



# Diagnostic Procedures: Survey of the Literature

- A variety of different procedures were identified.
- Most could be classified into one of six categories.
- Behavior rating scales, diagnostic interviews, behavioral observations, and laboratory/psychoeducational testing are the most frequently recommended.
- Medical evaluations and school record review were also recommended.



# Diagnostic Procedures: Survey of the Literature

## Sources:

Brock, S. E. (1999). The diagnosis of attention-deficit/hyperactivity disorder (AD/HD) in childhood. *The California School Psychologists, 4*, 18-29. Available <http://kady.education.ucsb.edu/schpsych/CSP-Journal/index.html>

Clinton, A., & Brock, S. E. (in preparation). *Diagnosis of attention-deficit/hyperactivity (AD/HD) in childhood: A review of the literature.* California State University, Sacramento, CA.



# Diagnostic Procedures: Rating Scales

- Cited in 100% of the papers reviewed.
- Strengths:
  - Quick and cost effective way to document the presence of AD/HD symptoms.
  - Provide a normative frame of reference.
  - Useful in assessing treatment effectiveness.
  - Allow for assessment of behavior in specific settings.
- Weaknesses:
  - Many false positives.
  - Rater bias.
  - Unrepresentative samples.
- Recommendations:
  - Raters must have observed the child for at least six weeks.
  - Symptom specific and broad band rating scales are recommended.



# Diagnostic Procedures: ADHD Symptom Specific Rating Scales

## ADHD Rating Scale – IV

Checklists, Norms, and  
Clinical Interpretation

George J. DuPaul  
Thomas J. Power  
Arthur D. Anastopoulos  
Robert Reid

### ADHD RATING SCALE-IV: HOME VERSION

Child's name \_\_\_\_\_ Sex: M F Age \_\_\_\_\_ Grade \_\_\_\_\_  
Completed by: Mother \_\_\_\_\_ Father \_\_\_\_\_ Guardian \_\_\_\_\_ Grandparent \_\_\_\_\_

Circle the number that *best describes* your child's home behavior over the past 6 months.

	Never or rarely	Sometimes	Often	Very often
1. Fails to give close attention to details or makes careless mistakes in schoolwork.	0	1	2	3
2. Fidgets with hands or feet or squirms in seat.	0	1	2	3
3. Has difficulty sustaining attention in tasks or play activities.	0	1	2	3
4. Leaves seat in classroom or in other situations in which remaining seated is expected.	0	1	2	3
5. Does not seem to listen when spoken to directly.	0	1	2	3
6. Runs about or climbs excessively in situations in which it is inappropriate.	0	1	2	3
7. Does not follow through on instructions and fails to finish work.	0	1	2	3
8. Has difficulty playing or engaging in leisure activities quietly.	0	1	2	3
9. Has difficulty organizing tasks and activities.	0	1	2	3
10. Is "on the go" or acts as if "driven by a motor."	0	1	2	3
11. Avoids tasks (e.g., schoolwork, homework) that require sustained mental effort.	0	1	2	3
12. Talks excessively.	0	1	2	3
13. Loses things necessary for tasks or activities.	0	1	2	3
14. Blurts out answers before questions have been completed.	0	1	2	3
15. Is easily distracted.	0	1	2	3
16. Has difficulty awaiting turn.	0	1	2	3
17. Is forgetful in daily activities.	0	1	2	3
18. Interrupts or intrudes on others.	0	1	2	3

From *ADHD Rating Scale-IV: Checklists, Norms, and Clinical Interpretation* by George J. DuPaul, Thomas J. Power, Arthur D. Anastopoulos, and Robert Reid. Copyright 1998 by the authors. Permission to photocopy this scale is granted to purchasers of *ADHD Rating Scale-IV* for personal use only (see copyright page for details). ADHD criteria are adapted by permission from DSM-IV. Copyright 1994 by the American Psychiatric Association.



# Diagnostic Procedures: ADHD Symptom Specific Rating Scales (FREE)

- SNAP
  - [http://www.adhd.net/SNAP\\_SWAN.pdf](http://www.adhd.net/SNAP_SWAN.pdf)
  - <http://www.adhd.net/snap-iv-instructions.pdf>
- DBD
  - [http://ctadd.net/ctadd/PDFs\\_CTADD/DBD.pdf](http://ctadd.net/ctadd/PDFs_CTADD/DBD.pdf)
- Vanderbilt ADHD Diagnostic Parent Rating Scale
  - [http://www.vanderbiltchildrens.com/uploads/documents/ccdr\\_adhd\\_scale.pdf](http://www.vanderbiltchildrens.com/uploads/documents/ccdr_adhd_scale.pdf)
- Vanderbilt ADHD Diagnostic Teacher Rating Scale
  - <http://www.brightfutures.org/mentalhealth/pdf/professionals/bridges/adhd.pdf>





# Diagnostic Procedures: ADHD Symptom Specific Rating Scales

- These measures are ...
  - Reliable, however, cross-informant reliabilities are low ranging from .14 to .59
  - Effective at discriminating between clinical and nonclinical groups and among ADHD subgroups.
  - Have a long history of use as treatment outcome measures
  - Are sensitive to both behavioral and pharmacological treatment effects

# Diagnostic Procedures: Broad Band Rating Scales

- Include items that span the range of child psychopathologies.
- By themselves are not currently recommended for the diagnosis of ADHD in clinical practice (Pelham et al., 2005).
- Useful as a tool for considering comorbid or competing diagnoses.
- Examples:
  - Behavior Assessment System for Children (Reynolds & Kamphaus, 2002)
    - Order at: <http://www.agsnet.com/group.asp?nGroupInfoID=a30000>
  - Child Behavior Checklist (Achenbach & Rescorla, 2001)
    - Sample: <http://www.aseba.org/support/SAMPLES/CBCLSample.pdf>
  - Teacher Report form (Achenbach & Rescorla, 2001)
    - Sample: <http://www.aseba.org/support/SAMPLES/TRFsample.pdf>



**ASEBA**

Achenbach System of Empirically Based Assessment



# Diagnostic Procedures: Diagnostic Interviews

- Cited in 95% of the papers reviewed.
- Help to answer the following questions:
  - Are AD/HD symptoms present?
  - When did symptoms begin to present problems?
  - How long have symptoms been problematic?
  - Is there a family history of AD/HD?
  - Is the developmental history suggestive of AD/HD?
  - Are there learning disabilities?
  - Are there interpersonal difficulties?
- Interview Types:
  - Structured, semistructured, and unstructured interview
  - Parent, teacher, and student interviews



# Diagnostic Procedures: Diagnostic Interviews

- Structured interviews
  - *Strengths:* allow for normative comparison.
  - *Weaknesses:* cumbersome, don't facilitate school interventions, false positives.
- Unstructured interview
  - *Strengths:* flexible, interviewee focused, facilitate collection of psychosocial data.
  - *Weaknesses:* Lack reliability.



# Diagnostic Procedures: Diagnostic Interviews

- Parent interviews
  - *Strengths:* Identifies historical data (e.g., family, developmental, and school histories).
  - *Weaknesses:* Lacks reliability.
- Teacher interviews
  - *Strengths:* Informant has knowledge of developmental expectations. Has frequent observations. Helps to identify behavioral contingencies. Provides academic data.
  - *Weaknesses:* May lack objectivity. Under utilized. If parent report is positive for AD/HD, there is a 90% probability that the teacher report will be positive.
- Student interviews
  - *Strengths:* May facilitate behavioral observations and helps in the identification of psychopathology.
  - *Weaknesses:* AD/HD symptoms may not be displayed during the interview. AD/HD symptoms may not be recognized by the student.



# Diagnostic Procedures: Diagnostic Interviews

- Structured
  - Diagnostic Interview for Children and Adolescents – Revised
  - Diagnostic Interview Schedule for Children
- Semistructured
  - Kiddie Schedule for Affective Disorders and Schizophrenia
    - Available: <http://www.wpic.pitt.edu/ksads/ksads-pl.pdf>
  - Child and Adolescent Psychiatric Assessment
- These measures are reported to have validity with respect to diagnostic classification, demonstrate both sensitivity and specificity (indicating strong concurrent and discriminant validity).



# Diagnostic Procedures: Behavioral Observations

- Cited in 76% of the papers reviewed.
- Strengths:
  - Confirm rating scale and interview data.
  - May be more valid than test data.
- Weaknesses:
  - Cost.
  - Requires extensive training.
  - Lack of normative data.
  - Low frequency behaviors may not be seen.



# Diagnostic Procedures: Behavioral Observations

- Recommendations:
  - Should conduct several observations in different settings given that symptoms may vary across situations and times.
  - Should include the setting(s) where in the student is reported to have his/her greatest difficulty.
  - Classroom observations are particularly important.
  - Both anecdotal and systematic observations should be used.





# Diagnostic Procedures: Behavioral Observations

## Behavioral Contingency Assessment (Time)

Student Name: \_\_\_\_\_ Date: \_\_\_\_\_

Observers(s): \_\_\_\_\_

Behavior being observed: \_\_\_\_\_

\_\_\_\_\_

- Behavior not observed
- 1 behavior observed
- 2 behaviors observed
- 3 behaviors observed
- 4 behaviors observed
- 5 or more behaviors observed

Time	Date									
7:30										
7:45										
8:00										
8:15										
8:30										
8:45										
9:00										
9:15										
9:30										
9:45										
10:00										



# Diagnostic Procedures: Behavioral Observations

## Behavioral Contingency Assessment (Activity)

Student Name: \_\_\_\_\_ Date: \_\_\_\_\_

Observers(s): \_\_\_\_\_

Behaviors being observed: \_\_\_\_\_

- Behavior not observed    
  1 behavior observed    
  2 behaviors observed    
  3 behaviors observed    
  4 behaviors observed    
  5 or more behaviors observed

<i>Behaviors</i>	Transition	Large Group Lecture	Small Group	Independent work	Paper-pencil task	Worksheet/Workbook	Read aloud	Read silently	Instructional game	Media	Other



# Diagnostic Procedures: Behavioral Observations

## Interval Time Sample of On-task Behaviors

Student Name: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Teacher Name: \_\_\_\_\_ Observer Name: \_\_\_\_\_

Code	T = On-task	P = Passive off-task	V = Verbal off-task	M = Motor off-task
------	-------------	----------------------	---------------------	--------------------

Time	Target	Comparison	Class Scan	Setting, Task, and Anecdotal Notes



# Diagnostic Procedures: Behavioral Observations

- ADHD School Observation Code (ADHD SOC)
  - <http://www.checkmateplus.com/product/adhd-soc.htm>
- BASC Student Observation System (SOS)
  - <http://www.agsnet.com/Group.asp?nGroupInfoID=a11300>
- Behavioral Observation of Students in Schools (BOSS)
  - [http://harcourtassessment.com/haiweb/Cultures/en-US/Products/Product+Detail.htm?CS\\_ProductID=015-8048-601&CS\\_Category=AchievementBasicSkills&CS\\_Catalog=TPC-USCatalog](http://harcourtassessment.com/haiweb/Cultures/en-US/Products/Product+Detail.htm?CS_ProductID=015-8048-601&CS_Category=AchievementBasicSkills&CS_Catalog=TPC-USCatalog)



# Diagnostic Procedures: Testing

- Cited in 76% of the papers reviewed.
- Strength:
  - Assists in differential diagnosis.
- Weakness:
  - May not directly assess AD/HD.
- Recommendations:
  - Psychoeducational tests are best used to rule in or out competing explanations for AD/HD symptoms (e.g., learning disabilities).
  - Continuous performance tests appear to be the most useful for AD/HD diagnosis.



# Diagnostic Procedures: Continuous Performance Tests



- The most frequently studied laboratory test for AD/HD.
- Examples include the Gordon Diagnostic System and the Conners Continuous Performance Test.
- Require the student to listen to or look at a series of numbers or letters, and to respond in some way.
- Scores are typically based upon number of correct responses, errors of omissions, and errors of commission.
- Should not be used as the only data source when making an AD/HD diagnosis.
- For more information go to:
  - <http://www.division42.org/MembersArea/IPfiles/IPFall00/CE/ADHD.html>



# Diagnostic Procedures: Continuous Performance Tests

Name: \_\_\_\_\_ Age: \_\_\_\_\_ Date: \_\_\_\_\_

**Instructions:** *Cross this out (point to target stimuli) every time you see one, as fast as you can (do not name stimuli).*

592

569	562	598	561	591	564	563	591	569	561
564	561	592	599	562	594	591	562	598	592
599	593	563	564	591	598	562	564	569	599
563	599	594	569	561	591	592	599	592	564
561	564	591	562	599	599	561	569	598	594
594	592	563	569	594	564	594	599	561	563
569	562	569	599	598	563	591	564	599	592
563	592	561	563	591	561	569	598	562	569
562	591	594	564	592	563	599	592	599	591
598	561	592	599	562	594	564	562	563	598
564	563	599	598	594	569	596	561	599	562
598	592	569	591	564	562	594	598	594	591
561	563	564	562	592	598	563	592	564	562
569	591	598	594	561	569	591	594	561	563

Errors: \_\_\_\_\_  
Time: \_\_\_\_\_

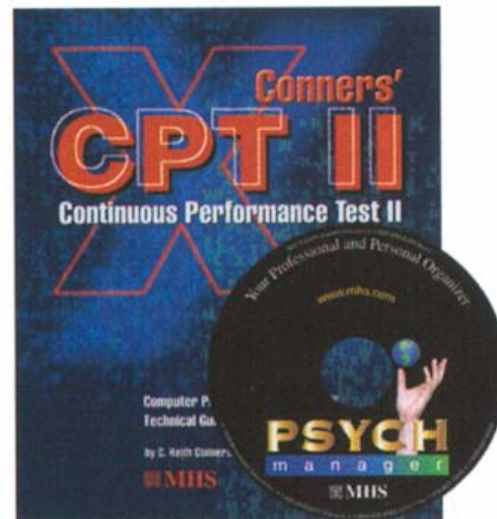
592

Age	Total Error		Time (Seconds)	
	Mean	S.D.	Mean	S. D.
4 to 5	13	4	-	-
6 to 7	6	3	200.76	81.51
8 to 9	2	2	116.00	33.71
10 to 11	2	2	90.70	24.66
12 to 13	2	2	67.13	15.76

# Diagnostic Procedures: Continuous Performance Tests

## Conners' Continuous Performance Test II (CPT II) for Windows®

*C. Keith Conners, Ph.D. & MHS Staff*



**Description:** Assessment software that helps identify attention problems and measures treatment effectiveness

**Age:** 6 and older

**Administration:** Self-completed performance measure

**Administration Time:** 14 minutes

**Qualification Level:** b (see page 130)





# Diagnostic Procedures: Intelligence Tests

- Digit Span, Coding, and Arithmetic data have been reported by Barkley to not be able to distinguish AD/HD students from either LD or normal students.
- May assist in the determination of a learning disability.
- Will help to rule in or out intellectual delay or giftedness as a cause of AD/HD symptoms.



# Diagnostic Procedures: Test Taking Behavior

- Observations of children taking CPTs may be as sensitive to discriminating AD/HD children from other diagnostic groups as CPT scores themselves.
- During testing students with AD/HD typically make more careless and impulsive errors. In addition, they may find it difficult to sit still, may display sustained concentration difficulties, and be distracted by events outside of the testing room.
- Test performance often characterized by omissions or insertions, or misinterpretation of easy items when motivated to do well (not just when completing task that are not intrinsically valued).



# Diagnostic Procedures: Medical Examination

- Cited in 28% of the papers reviewed.
- Includes the medical interview and the physical examination.
- From this examination the need for diagnostic medical testing can be determined.
- By itself is inadequate to diagnosis AD/HD.



# Diagnostic Procedures: Medical Examination

- Critical for children with a seizure disorder and/or asthma.
- Purposes of . . .
  - Identify conditions that may have caused symptoms.
  - Identify medical conditions associated with the symptoms that may require treatment.
  - Identify medical conditions that would contraindicate treatment with stimulant medications.



# Diagnostic Procedures: Review of School Records

- Cited in 17% of the papers reviewed.
- Cumulative folders (report cards).
- Document symptom onset and duration.
- Document symptom changes over time.



# Diagnosis vs. Psycho-educational Assessment

- While diagnosis will focus on the presence or absence of relevant symptoms, the psycho-educational assessment should operationalize specific problem behaviors, evaluate establishing operations and immediate antecedents, and consider the environmental consequences that may exacerbate, precipitate, and maintain the behavior (Pelham, 2005).



# Connecting Diagnosis to Treatment

Student: \_\_\_\_\_ BD: \_\_\_\_\_ School: \_\_\_\_\_  
 Psychologist: \_\_\_\_\_ Teacher: \_\_\_\_\_

	Initial Evaluation	Follow-up 1	Follow-up 2	Follow-up 3	Follow-up 4
Date					
Rx/Dosage					
Other intervention					
CTRS (HI) <sup>1</sup>					
CBCL (AP) <sup>2</sup>					
ADHD (I) <sup>3</sup>					
ADHD (H/I) <sup>4</sup>					
Other rating Scale					
Observations <sup>5</sup>					
Interview code <sup>6</sup>					

**Additional Comments and Interview Notes:**

Date: \_\_\_\_\_

Psychologist: \_\_\_\_\_

Date: \_\_\_\_\_

Psychologist: \_\_\_\_\_

Date: \_\_\_\_\_

Psychologist: \_\_\_\_\_

Date: \_\_\_\_\_

Psychologist: \_\_\_\_\_

<sup>1</sup> Conners Teacher Rating Scale Hyperactivity Index.

<sup>2</sup> Child Behavior Checklist Attention Problems Scale.

<sup>3</sup> ADHD Rating Scale: School Version Inattention Scale.

<sup>4</sup> ADHD Rating Scale: School Version Hyperactive/Impulsive Scale.

<sup>5</sup> Momentary interval time sample of on-task behavior (% of intervals on-task).

<sup>6</sup> Imp = teacher/parent reports that problematic symptoms have improved, Unc = teacher/parent reports that problematic symptoms are unchanged, Wor = teacher/parent reports that problematic symptoms have worsened.



# Diagnosis of AD/HD

- American Academy of Pediatrics (2000)
  - Clinical Practice Guideline: Diagnosis and Evaluation of the Child With Attention-Deficit/Hyperactivity Disorder
    - <http://aappolicy.aappublications.org/cgi/reprint/pediatrics;105/5/1158.pdf>
- American Academy of Child and Adolescent Psychiatry (1997)
  - Practice Parameters for the Assessment and Treatment of Children, Adolescents, and Adults with Attention-Deficit/Hyperactivity Disorder
    - <http://www.aacap.org/clinical/parameters/fulltext/Adhd.doc>





# The Diagnosis of AD/HD: Conclusion

- Diagnosis is as much an art as it is a science.
- There is no single psychological or medical test.
- There are a number of conditions that generate AD/HD-like symptoms.
- Requires a multidisciplinary team, accessing multiple data sources, and using multiple assessment procedures.



# Internet Resources

- **About: ADD**  
<http://add.miningco.com/health/add/>
- **ADD Warehouse**  
<http://addwarehouse.com/>
- **Children and Adults with Attention Deficit Disorder (CHADD)**  
<http://www.chadd.org>
- **Frontline: Medicating Kids Program**  
<http://www.pbs.org/wgbh/pages/frontline/shows/medicating/>
- **LD Online**  
<http://www.ldonline.org/>
- **National Attention Deficit Disorder Association (ADDA)**  
<http://www.add.org>
- **National Institutes of Mental Health**  
<http://www.nimh.nih.gov/publicat/adhd.cfm>
- **One ADD Place**  
<http://www.oneaddplace.com/>
- **University of Virginia, Curry School of Education—ADD**  
<http://teis.virginia.edu/go/cise/ose/categories/add.html>
- **Attention deficit hyperactivity disorder in adults: conceptual and clinical issues**  
[http://www.mja.com.au/public/issues/171\\_8\\_181099/trollor/trollor.html](http://www.mja.com.au/public/issues/171_8_181099/trollor/trollor.html)



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