# Special Presentation

CHADD

National Resource Center on ADHD
A Program of CHADD

## Health and Life Expectancy in ADHD: Treatment Matters More Than You Think

Russell A. Barkley, Ph.D.
Clinical Professor of Psychiatry
Virginia Treatment Center for Children
Virginia Commonwealth University Medical Center
Richmond, VA

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# CHADD is home to the

National Resource Center on ADHD
A Program of CHADD

A partnership between CHADD and the US Centers for Disease Control and Prevention (CDC)

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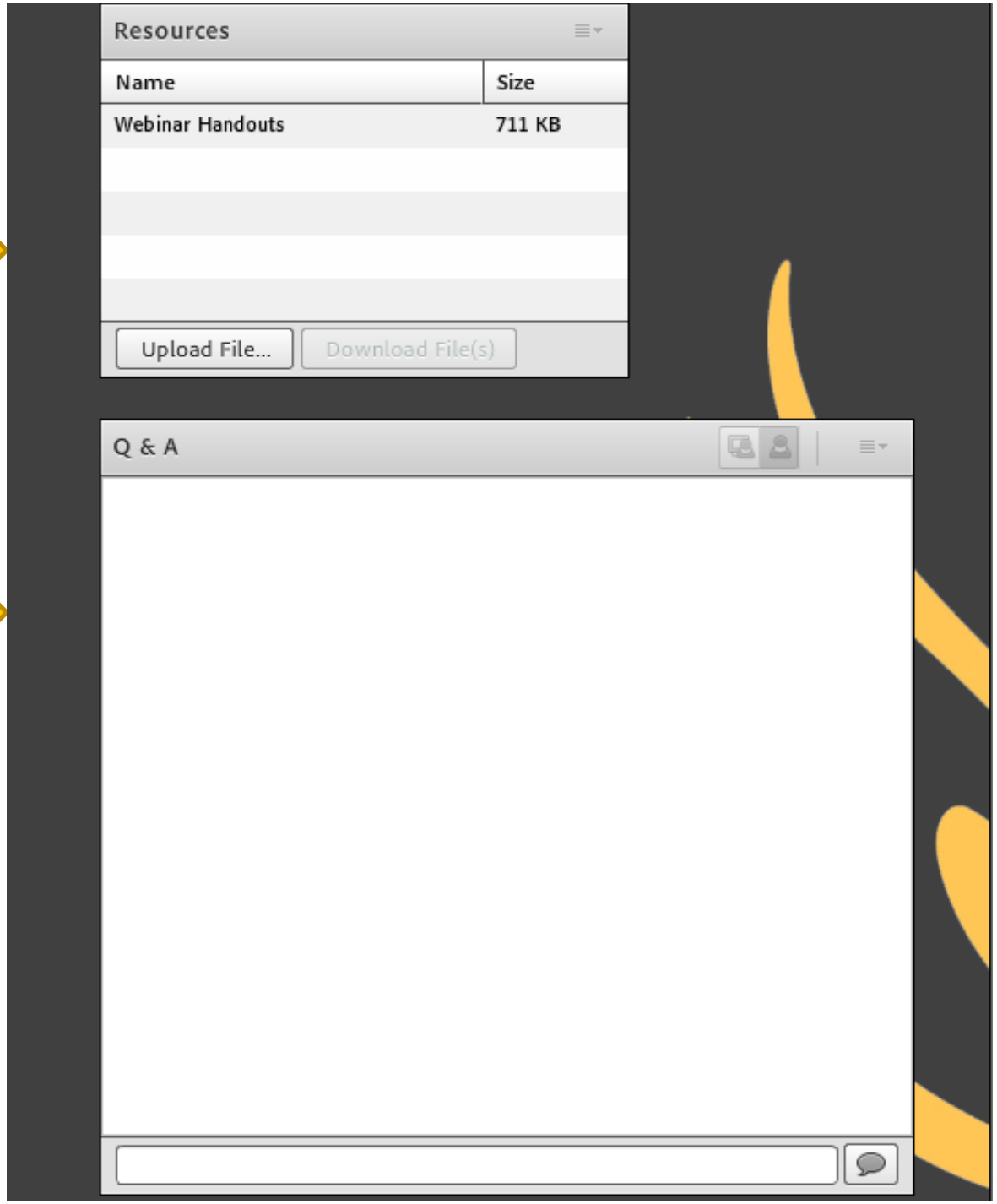
Slides

Ask a question



Do you know someone in need of ADHD Information and Resources?

Refer them to our ADHD Helpline

1-800-233-4050,
Mon-Fri, 1-5pm ET

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# ADHD Lectures Online

View 10 hours of parent presentations and 25+ hours of professional presentations on ADHD by Dr. Barkley at this website:

ADHDLectures.com

For CE Credits, the same presentations can be found at:

PsychContinuingEd.com

For written CE courses by Dr. Barkley, visit:

ContinuingEdCourses.com

# Presenter Disclosure – Prior 12 Months

**Speaker (Honoraria):**

- Butler University Conference on Neuroscience and Education, Indianapolis, IN
- Seminarer Denmark, Copenhagen
- South Dakota Counselors Association, Sioux Falls, SD
- Nova University, Ft. Lauderdale, FL
- International Dyslexia Association annual conference, Atlanta, GA
- Yachad, Union of Orthodox Jewish Associations, Brooklyn, NY
- Archimeade – Parents Association for ADHD, Padua, Italy
- Chesapeake Academy, Virginia Beach, VA
- Delaware Valley Friends School Palais, PA
- Forman School, Litchfield, CT
- Florida Association of School Psychologists

**Royalties:**

- Guilford Publications (books, videos, newsletter);
- J & K Seminars (workshop DVDs);
- Premier Educational Seminars Inc. (PESI) (web courses and books);
- ContinuingEdCourses.net (web courses), Aptus Health (CE course for physicians)

**Industry Speaker/Consultant:**

- Shire (consultant)
- Ironshore Pharmaceutical & Development, Inc. – Consultant
- Takeda Pharmaceutical Company – Consultant

# Health Outcomes of ADHD: Impact on Life Expectancy?

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# Advances in Understanding the Symptoms of ADHD

The two dimensions of neuropsychological deficits are in:

1. **Hyperactivity-Impulsivity** (Executive Inhibition)

- Deficient motor inhibition (restless, hyperactive)
- Impaired verbal inhibition (excessing talking, interrupting)
- Impulsive cognition (difficulty suppressing task irrelevant thoughts, rapid decision making;
- Impulsive motivation (prefer immediate gratification, greater discounting of delayed consequences)
- Emotion dysregulation (impulsive affect; poor “top down” emotional self-regulation)
- Restlessness decreases with age, becoming more internal, subjective by adulthood

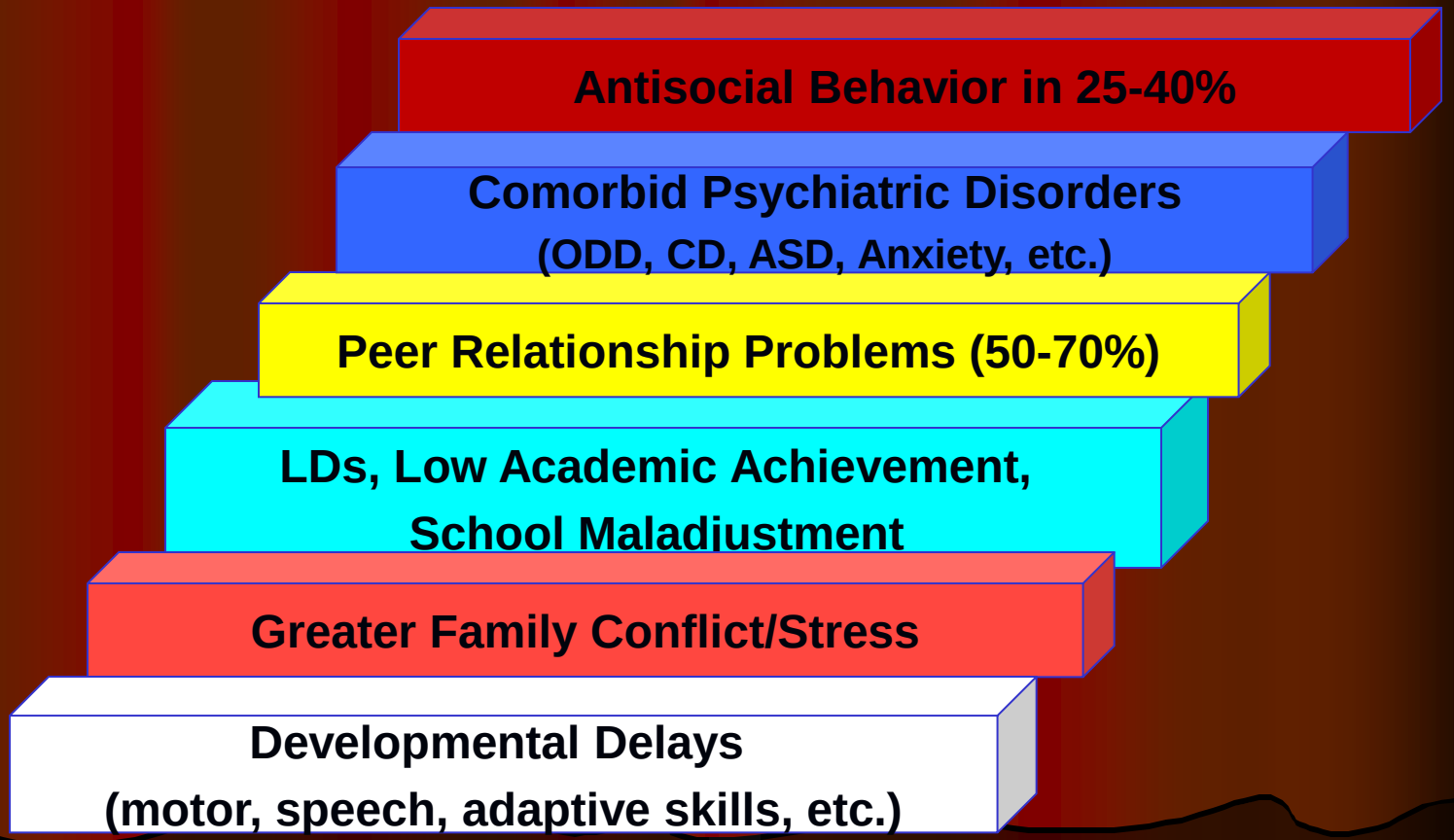
# More on ADHD

**Inattention:** But 6 types of attention exist – not all are impaired in ADHD. What is?

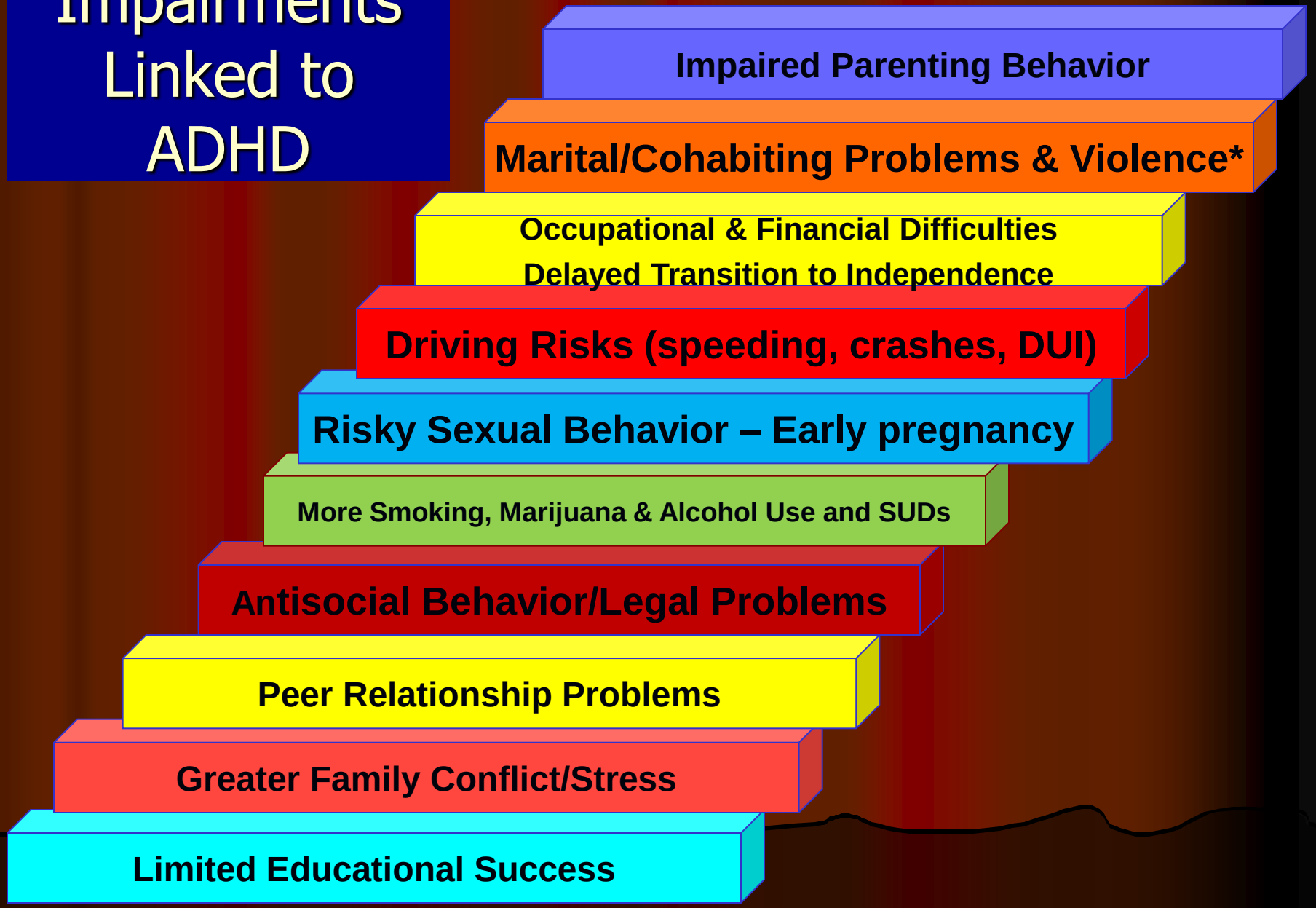
Executive Attention (& Functioning)

- Poor persistence toward goals, tasks, and the future (can't sustain attention/action over time)
- Distractible (impaired resistance to responding to goal-irrelevant external and internal events)
- Deficient task re-engagement following disruptions (skips across uncompleted tasks)
- Impaired working memory (forgetful in daily activities, cannot remember what is to be done)
- Diminished self-monitoring

# Impairments Associated with Child ADHD



# Life Course Impairments Linked to ADHD



# Reasons to Expect ADHD to be Linked to Shortened Life Expectancy

# ADHD Related Health Concerns

- Greater risk for traumatic brain injuries
  - Greater driving, motorsports, sports injuries
- Greater risk for accidental injuries of all types
  - Risk extends across childhood into adulthood
- Increased likelihood of violence as both perpetrator and victim due to more reactive aggression, bullying, assaults, and victimization by others
- Higher risk for earlier childbearing and for contracting sexually transmitted diseases by late adolescence and adulthood
  - Puts them at risk for higher HPV infection and subsequent cancer risk by mid-life
- Poorer self-reported physical health by young adulthood
  - This is found even in remitted cases; but worse in persistent cases
  - More complaints of vague medical concerns, especially if comorbid anxiety/depression
- Increased risk for fibromyalgia syndrome
  - This is more so in female than male cases with ADHD
  - Also, 30% of females with fibromyalgia have ADHD – linked to impulsivity
- Greater occurrence of migraine headaches

# More Health Concerns

- Less healthy “Western style” high carb diet
- More dental placque, caries, and trauma; poorer oral hygiene practices
- 3x risk of obesity by adolescence and eat impulsively
  - shared heritability between ADHD and obesity risk
  - 2-3x more likely to be obese by adulthood; risk increases with age
  - Conversely, ADHD is over-represented in patients treated for obesity at eating disorders clinics (32% vs. 4% population prevalence)**
- Higher risk for Type 2 diabetes: teens (2.83x); adults (3.28x)
- 3.5 x risk in females for eating disorders & increased eating pathology***
  - 10-20% of ADHD females vs. 0-5% of controls
  - Bulimia is most likely subtype, being 5.6x more likely by age 16
  - ED linked to earlier impulsivity, peer rejection & harsh parenting,** and concurrent MDD, anxiety disorders, & ODD/CD*
- Greater use of tobacco, marijuana, and alcohol; more difficulty quitting.
- As a consequence, a possibly greater risk for mid- and late-life cancer ?

# More Health Concerns

Greater risk of cardiovascular disease (CHD) and events*

- Greater risk for hypertension
- Lower HDL cholesterol and higher Total/HDL ratio
- Higher atherosclerotic risk to coronary arteries
- Higher Framingham CHD risk percent over next 5 and 10 years
- For every 1 SD decrease in self-regulation there is 20% increase in coronary heart disease or events. ADHD is the bottom 1.5-2 SDs or 2-7% of self-regulation***

- Greater risk for developing dementia (5.5%) which is 3.4 times higher when controlling for other factors
- 2.4 x Greater risk of diseases of the basal ganglia (e.g. Parkinsons, 8 vs. 1%) and cerebellum (this rises to 8.6x risk if treated with stimulants – probably because treated cases are worse in ADHD)
- Recent genome wide association study found genetic correlations between ADHD and an increasing risk for most of these adverse health and lifestyle factors

# Extant Evidence for Earlier Mortality

# Suggestive Evidence

- Multiple studies have noted an increased risk for suicidal ideation, attempts and completions (SMR = 4.83
  - Peak risk is during high school years but remains elevated thereafter
  - Ideation is related to depression generally; in females to low self-concept and in males to high impulsivity. Attempts are related to impulsivity in both.
  - Beginning in 2000 with the Freidman et al. follow-up study of the "Termites," studies and reviews continue to show that decreased child conscientiousness is associated with earlier death by all causes (<25$^{th}$ percentile = -7 yrs) . Also noted in multiple reviews.
  - ADHD is linked to very low conscientiousness (includes behavioral disinhibition), and shares genetic heritability with it. Given that ADHD is the bottom 5-7% of the population in disinhibition and hence conscientiousness, it should be linked to an even greater reduction in life expectancy.
  - Greater child externalizing behavior has been linked to 1.5-2x greater risk of mortality by age 46

# Direct Evidence

- ✓ Klein et al (2012) found that by age 41 years, there was an increased mortality rate (7.2% vs. 2.8% in controls)
- ✓ London & Landes (2016) found that adults with ADHD have mortality risk 1.8x more within any 4 year.
- ✓ Dalsgaard et al. (2015) using Danish population found the risk for mortality is nearly double in childhood (1.86) and more than doubles again (4.25) in adulthood. And those with ADHD are 3x more prone (13% vs. 4%) to death by accident.
- ✓ Virtanen et al. (2018) used the Swedish population database for 2001-2010 ages 10-35 yrs and found a 2.54 increased risk for early mortality in ADHD cases (3.93 risk for suicide) [risks for ASD were 2.06 and 3.02, respectively]. In ADHD cases, comorbid disorders further increased risks by 2.4 and 2.8.
- ✓ Genome wide association study by Demontis et al. (2018) showed genetic correlation between ADHD and earlier parental mortality in both mothers and fathers of probands.

# Computing the Life Expectancy of Children with ADHD Followed to Young Adulthood

# Milwaukee Study Collaborators

- Mariellen Fischer, Ph.D., Co-PI
  - Department of Neurology, Medical College of Wisconsin (MCOW), Milwaukee, WI
- Karen M. Smith, Ph.D. (Genotyping)
  - Dept. of Biology, University of Louisiana - Lafayette
- Research Assistants:
  - Lori Smallish, Lori Bauer (MCOW)
- Health Screeners – Physician Assistants:
  - Hope Schrader, Kent Shiffert (MCOW)
- Data Entry Software Program
  - Kenneth Fletcher, Ph.D., University of Massachusetts Medical School
- Data Entry
  - Peter Leo

# Milwaukee Study Methods

- 158 children ages 4-11 years diagnosed as hyperactive child syndrome in 1978-1980
  - Had significant symptoms of inattention, impulsiveness, and hyperactivity as reported by parents
  - Were +2SDs on Conners Hyperactivity Index & Werry-Weiss-Peters Activity Rating Scale, and +1SD (6 or more settings) on Home Situations Questionnaire
  - Onset of symptoms by 6 years of age
  - Excluded children with autism, psychosis, deafness, blindness, epilepsy, significant brain damage, etc.
- 81 control children from same schools and neighborhoods matched on age and obtained via a "snowball" sampling procedure
- Most children re-evaluated at mean ages of 15 (C=78% & H=81%), 21 (C=93 & H=90%), and now 27 years (C=93% & H=85%).
- To be currently ADHD (H+ADHD), participants in thius aspect of the study had to have 4+ symptoms on either DSM-IV symptom list and 1+ domains of impairment (out of 8) by self report (N=54). Remainder (N=77) were grouped as H-ADHD. Community Controls = 71
- Groups were 83-94% males

Source: Barkley, R. A., Murphy, K. R., & Fischer, M. (2008). *ADHD in Adults: What the Science Says*. New York: Guilford Press.

# 14 Life Expectancy Calculator Variables Goldenson Center for Actuarial Research[1]

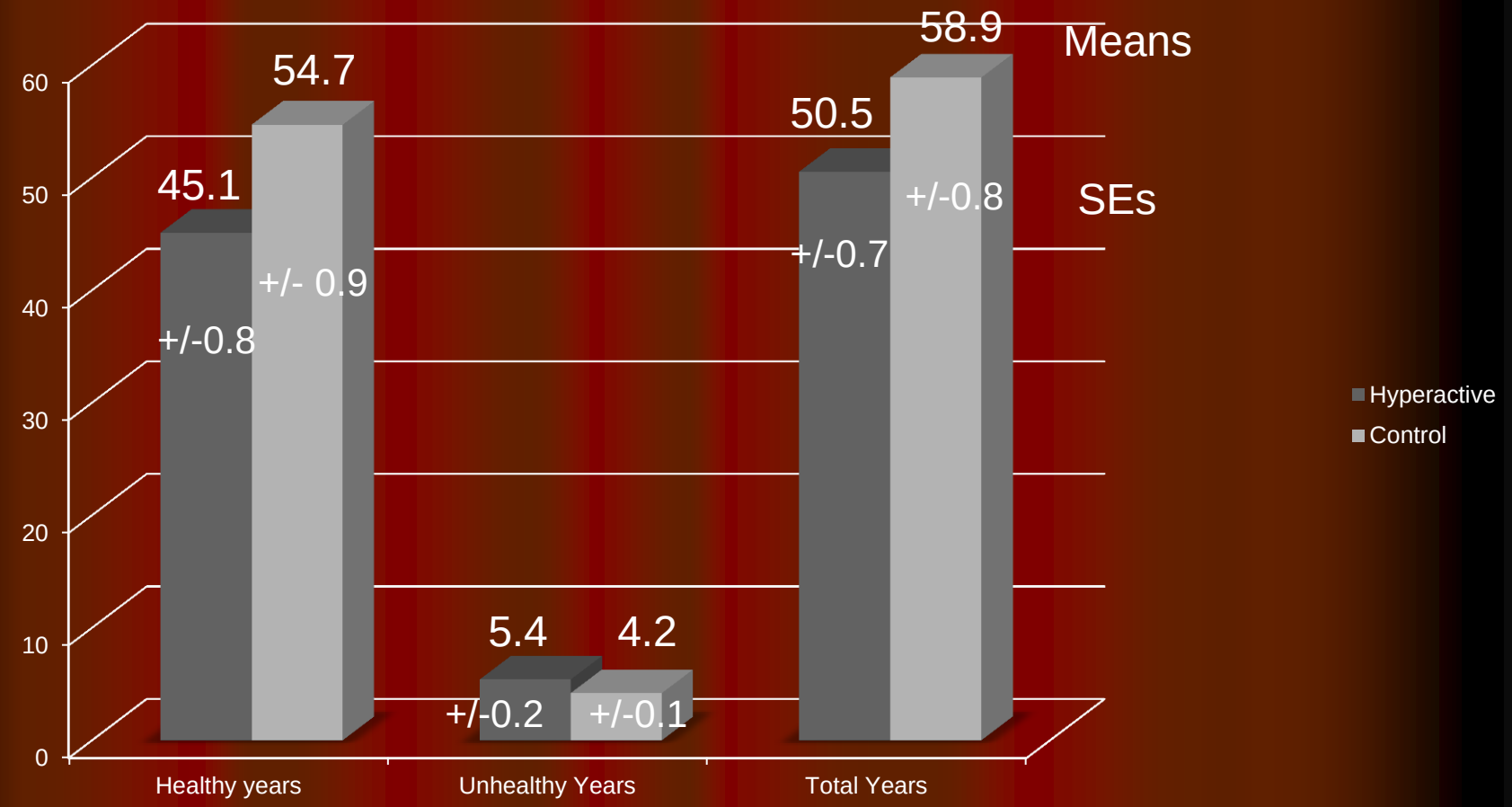
- Sex - 83-94% of all groups were male
- Age - 27 years (mean)
- Height – in cm
- Weight – in kg
- Mean income (always $25-50K categorization)
- Type 2 diabetes (just 3 cases)
- Current Health (options Poor, Fair, Very Good, Excellent)
- Nutrition (options Poor, Fair, Good, Excellent)
- Exercise (times per week – usually 1-3x)

[1]https://apps.goldensoncenter.uconn.edu/HLEC/

# More Calculator Entries

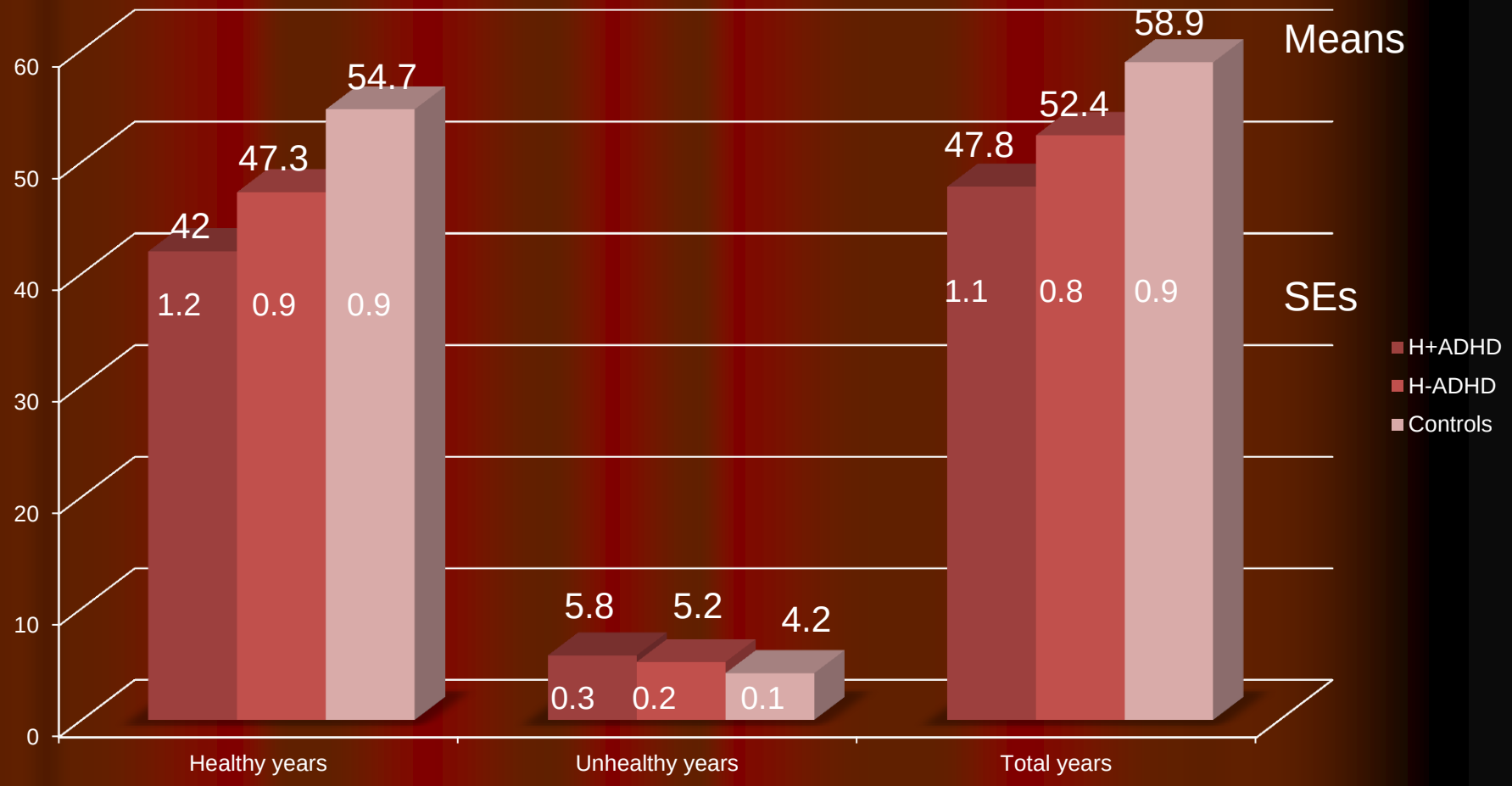
- Sleep (8+ hrs/night, <5 hrs, 5-8 hrs)
- Education (non-HS, HS, college, or graduate school)
  - We adjusted above high school - 11 months added to ELEs per extra year of education
- Driving – 0, 1, 2+ license revocations
  - A proxy for risky driving
- Current Smoker – No or Yes
  - Project added amount smoked per day and adjusted ELE outputs: if 20+/day, then reduced ELEs by 2.4 yrs
- Alcohol Use - (No, 1-2 per day, 3-7 per day, 8+)

# Estimated Life Expectancy (yrs. Left) Hyperactive (ADHD-C) Children vs. Controls




From Barkley, R. A. & Fischer, M. (in press). *Hyperactive child syndrome and estimated life expectancy at young adult follow-up: The role of adult ADHD and other potential predictors. Journal of Attention Disorders, in press.*

# Estimated Life Expectancy Persistent vs. Non-persistent ADHD

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# First Order Calculator Variables Contributing to Group Differences in Life Expectancy

- Less education in both ADHD groups (32-37%+ did not graduate high school)
- Less annual income ($24-25K vs. $37K per year)
- Greater frequency of alcohol use per week (H+ADHD)
- More likely to smoke (both ADHD groups)(57-65% vs. 35%)
- More likely to smoke more than 20+ cigarettes per day (H+ADHD)(43% vs. 11%)
- Less likely to be in excellent health (18-36% vs. 69%)
- Less likely to get 8+ hrs. sleep/night (both ADHD groups)(48-67% vs. 86%)
- More license suspensions/revocations ($p$ = .06)

From Barkley, R. A. & Fischer, M. (2018). *Hyperactive child syndrome and estimated life expectancy at young adult follow-up: The role of persistent ADHD and other potential predictors. Journal of Attention Disorders, in press.*

# Second Order – Background Predictors of Life Expectancy

- Four second order background factors explained 40% of the variance in estimated life expectancy (ELE)
  - Behavioral disinhibition (from EF Rating Scale) – 31% of variance in ELE
  - Verbal IQ – 6%
  - Interpersonal Hostility – 2%
  - Nonverbal fluency (working memory) – 1%

From Barkley, R. A. & Fischer, M. (2018). *Hyperactive child syndrome and estimated life expectancy at young adult follow-up: The role of persistent ADHD and other potential predictors. Journal of Attention Disorders, in press.*

# ADHD Risk Gene Predictors

- Three risk genes had been genotyped earlier in the project – DRD4 (7+ repeat), DAT1, and DBH Taq1
- Two of the three genes predicted additional reductions in ELE apart from the second order psychological predictors
  - DBH TaqI A1/A2 allele polymorphism in heterozygous pairing (-2 yrs.) compared to the homozygous pairings (A1/A1 or A2/A2)
  - DAT1 9/9 allele pair vs. 10/10 pair (-5 years)
  - DAT1 9/9 vs. 9/10 pair (-2 yrs.)
  - DAT1 9/10 vs. 10/10 (-3 yrs.)
- Genes were likely operating via impact on alcohol use (DBH) and education, smoking risk, smoking amount, and exercise (DAT1)

From Barkley, R. A., Smith, K. M., & Fischer, M. (2018). *ADHD Risk Genes Involved in Dopamine Signaling and Metabolism are Associated with Reduced Estimated Life Expectancy at Young Adult Follow-up in Hyperactive and Control Children.* Submitted for publication.

# Limitations

- Predictive accuracy of online ELE calculators has yet to be established, although internal validity is sound given large actuarial databases followed over time to create regression weights and entry variable adjustments to ELE
- Relatively small sample sizes for inferring risk
- Clinical samples of ADHD cases are more severe than community samples and so may exaggerate differences in life expectancy
- Severely limited number of females restricts results to male cases

# More Limitations

- Lack of ethnic and regional diversity restricts results to mainly white populations and Midwest of US
- Under-reporting of symptoms and impairments in young adults with ADHD could yield conservative estimates of ELE
- Some health variables known to impact ELE adversely were not used in the calculator, such as lipid profiles, accidents, etc. making estimates conservative. But low behavioral inhibition may have explained their link to ELE
- ELE risk is not immutable going forward; it may change as risk factors increase or are reduced (by time or intervention)

# 9 Malleable Factors in the Calculator Can Change ELE

- Years of Education (and hence income also)
- Weight
- Nutrition
- Exercise
- Sleep Duration
- Risky Driving
- Smoking
- Alcohol Use
- Current Health

**Behavioral Inhibition (Conscientiousness)**

So clinicians cannot just focus on the specific health concerns but must also address the underlying ADHD symptoms and particularly deficient behavioral inhibition and self-regulation

# Conclusions

- ADHD is a disorder of self-regulation
- The disorder is associated with numerous and serious impairments in major life activities
- But ADHD is also linked to adverse health and lifestyle risks generally known to negatively impact life expectancy
- More recent research demonstrates an increased risk for earlier mortality in children and especially adults with ADHD, particularly related to accidents and suicide
- Evidence shown here indicates that besides the risk for death by injury or suicide, childhood ADHD may typically shorten healthy life expectancy by nearly 10 years and by nearly 13 years if it is persistent into young adulthood compared to concurrently followed control children

# Implications

- ADHD is a serious public health problem; it accounts for greater reductions in ELE than any single risk factor of concern to public health and medical professionals, such as smoking, excess alcohol use, obesity, coronary heart disease, nutrition, sleep, exercise, or risky driving among other widely accepted health risks.
- It is 2.5x worse than even the top 4 above combined.
- Primary Care Providers need to:
  - recognize the role of ADHD in diminished health, wellness, and life expectancy in their practice
  - recognize that their patients who are failing in typical health improvement programs may have adult ADHD that is undermining their success
  - assess for adult ADHD, and
  - treat it or refer to others more expert in doing so to improve chances of responding to health and lifestyle self-improvement interventions
- Mental health professionals need to:
  - broaden their evaluations to include health, lifestyle, and other factors related to life expectancy
  - Include recommendations for reducing those first order risk factors as part of their treatment package

# More Implications

- Treating ADHD and especially its behavioral inhibition deficits, such as with medications, may facilitate reduction in the associated health risks that may thereby improve estimated life expectancy
- ADHD is among the most treatable psychiatric disorders yet it is not recognized as such in primary care or by public health officials in their policies and programs
- The greatest problems currently are under-recognition and treatment of teen and adult ADHD and its health risks, access to evidence-based treatments, cost, and getting patients to remain in treatment through the critical adolescent and adult years.

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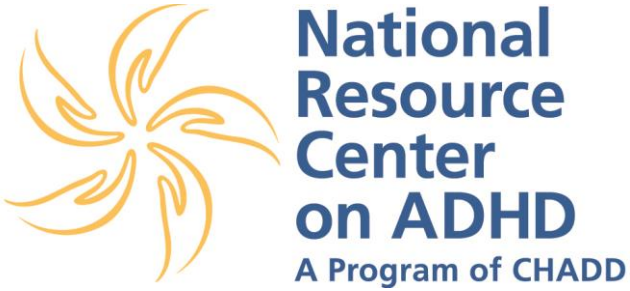


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