CMEO Snack

Understanding the True Costs of ADHD: An Examination of the Whole-Life Impact

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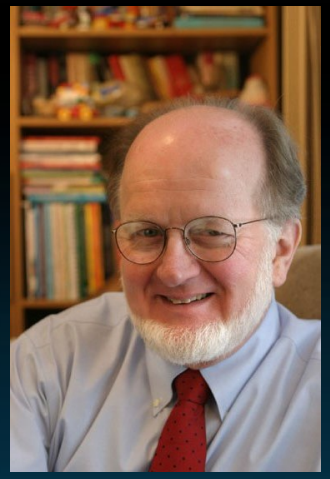

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Fellow of the American Psychological Association
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CME OUTFITTERS

Learning Objective

Identify the extensive burden imposed by ADHD, including brain morphology, cognitive and psychosocial functioning, and psychiatric and medical comorbidities.

What is the Essential Problem in ADHD?

Old understanding: behavior problems and not listening

New understanding: developmental impairment of the brain's management system

NEW

ADHD

1. Aspects of brain's EF don't come online in usual time frame
2. And they don't work consistently

ADHD = attention deficit hyperactivity disorder; EF = executive functions

Brown TE. *Attention Deficit Disorder: The Unfocused Mind in Children and Adults*. 2005.

ADHD: Comorbidities and Risks

Brown's Model of Executive Functions Impaired in ADHD

Executive Functions

- Wide range of central control processes of the brain
- Connect, prioritize, and integrate cognitive functions–moment by moment
  - Like conductor of a symphony orchestra

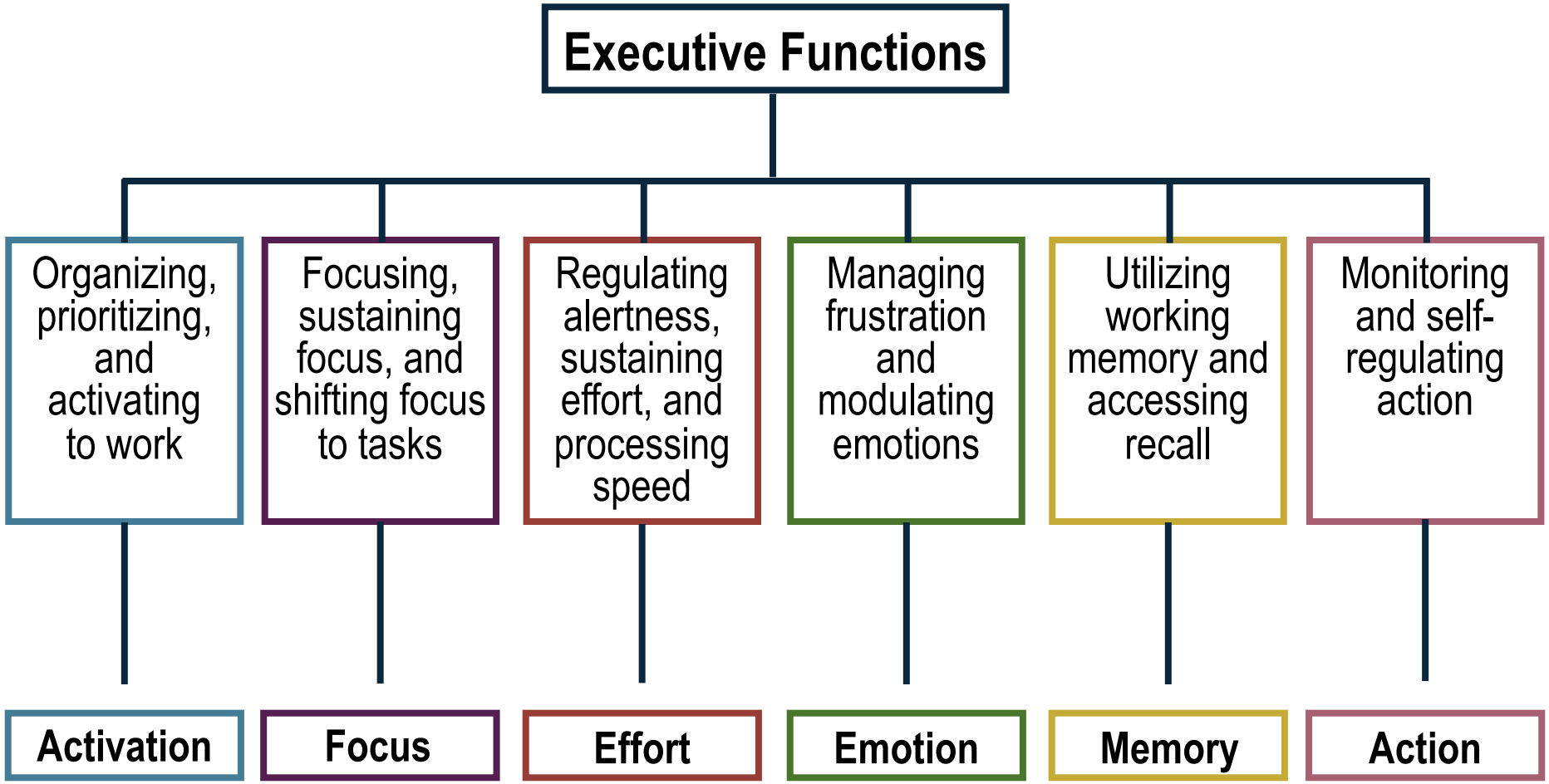
  - Dimensional, not "all-or-nothing"
  - Everyone sometimes has some impairments in these functions
  - In ADHD, it is a chronic, severe impairment

- Situational variability: "If I'm interested"
  - Most persons with ADHD have a few activities where ADHD impairments are absent

While it may look like it, ADHD is *not* a willpower problem

Brown TE. *Attention Deficit Disorder: The Unfocused Mind in Children and Adults*. 2005.

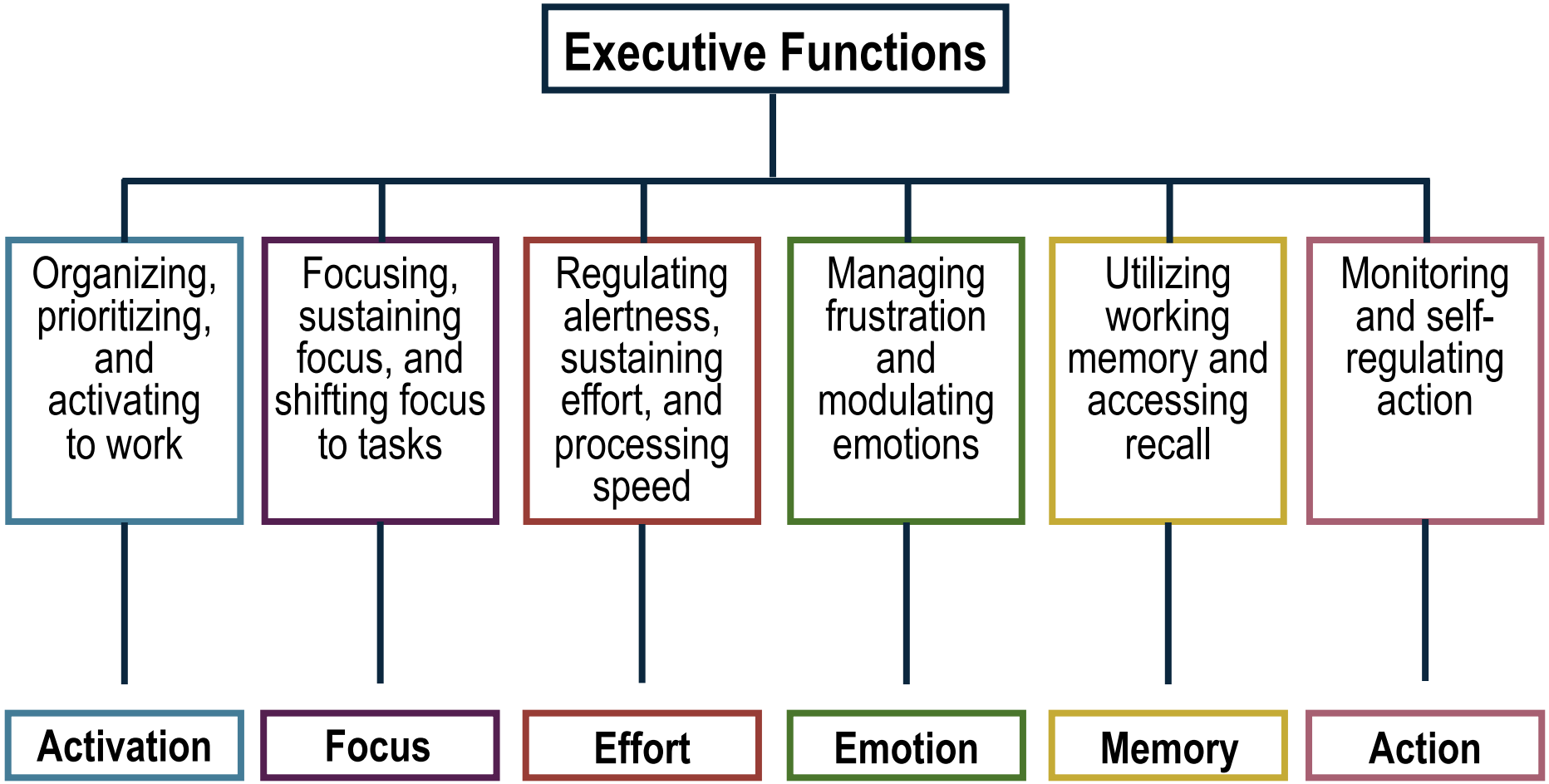
Brown's Model of Executive Functions Impaired in ADHD



Brown TE. *Attention Deficit Disorder: The Unfocused Mind in Children and Adults*. 2005.

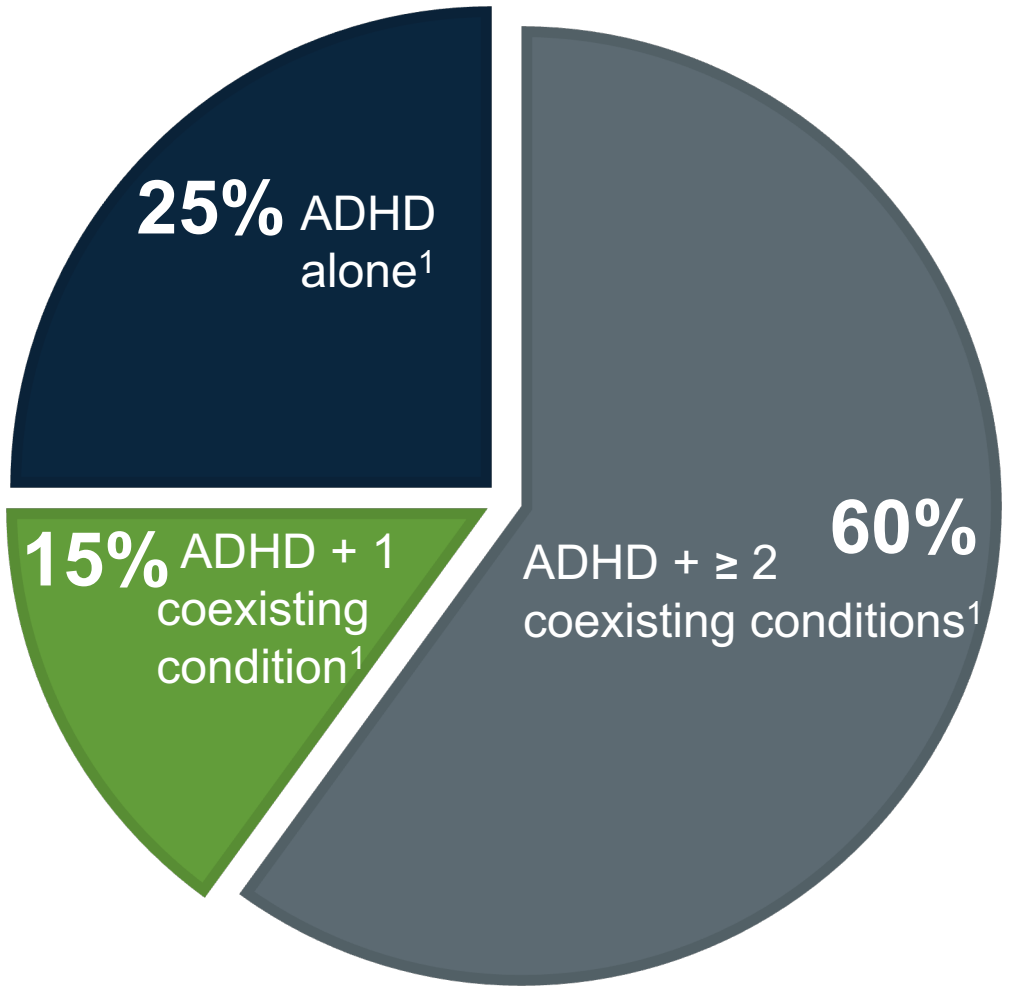
ADHD: Brain Mechanisms Involved

Brown's Model of Executive Functions Impaired in ADHD



Brown TE. *Attention Deficit Disorder: The Unfocused Mind in Children and Adults*. 2005.

Multiple Psychiatric Comorbidities is Common



Children[2]

- 70% learning disorders
- 59% autism spectrum disorder
- 55% tics
- 30%-50% ODD
- 15%-35% anxiety disorders
- 12%-50% depression

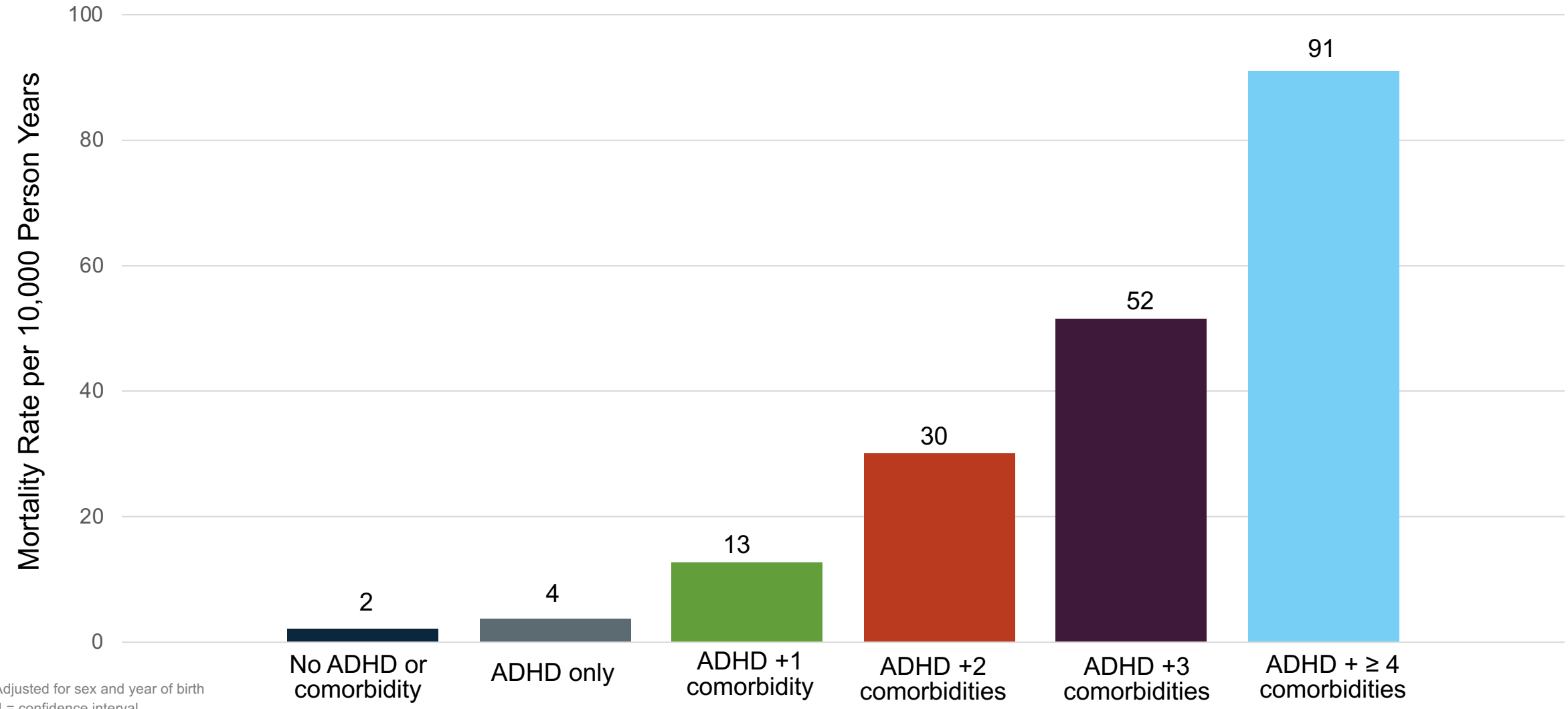
Adults[3]

- 19%-53% depression
- 50% anxiety
- 5%-47% bipolar disorder
- 2x greater risk of substance misuse disorders

ODD = oppositional defiant disorder

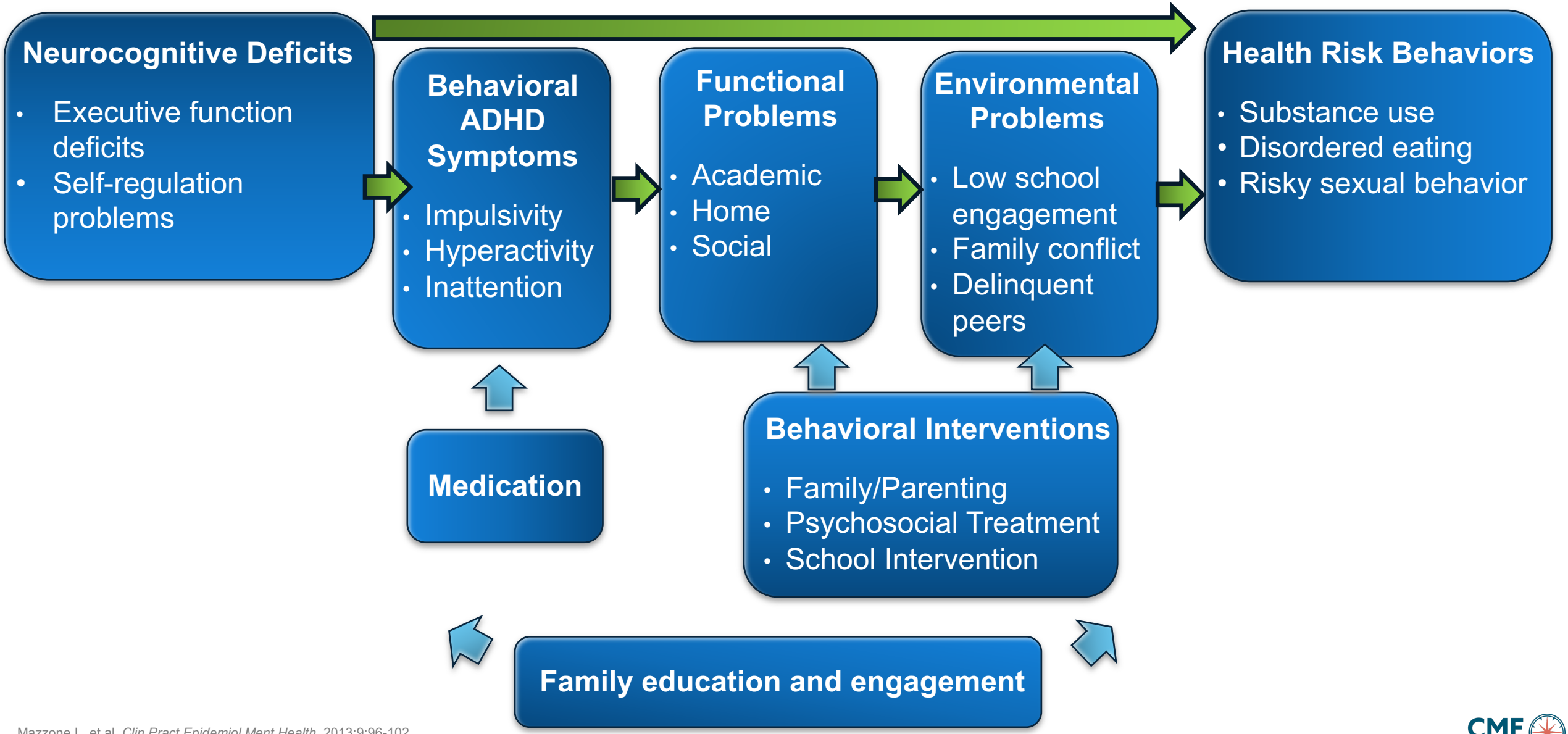
1. Banaschewski T, et al. *Dtsch Arztebl Int*. 2017;114(9):149-159. 2. Gnanavel S, et al. *World J Clin Cases*. 2019;7(17):2420-2426. 3. Katzman, et al. *BMC Psychiatry*. 2017;17(1):302.

Psychiatric Comorbidities Increase the Risk of Premature Mortality in Adults with ADHD



*Adjusted for sex and year of birth
CI = confidence interval
Sun S, et al. *JAMA Psychiatry*. 2019;76(11):1141-1149.

Health Risk Behaviors



Mazzone L, et al. *Clin Pract Epidemiol Ment Health*. 2013;9:96-102.

Lower Educational Attainment

- Children with treated ADHD are at higher risk of[1]:
  - Unemployment
  - Not continuing education or training 6 months after leaving school
  - Special educational needs

- In individuals with untreated ADHD[2]:
  - 79% have worse achievement test outcomes
  - 75% have worse academic performance

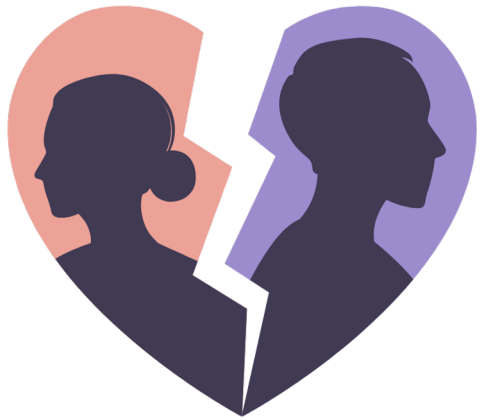
- Young adults with ADHD are[3]:
  - Significantly less likely to have graduated high school
  - 4x less likely to obtain a college degree

1. Fleming M, et al. *JAMA Pediatr*. 2017;171(7):e170691. 2. Arnold LE, et al. *J Atten Disord*. 2020;24(1):73-85. 3. Erskine HE, et al. *J Am Acad Child Adolesc Psychiatry*. 2016;55(10):841–850.

Reduced Social Functioning and QoL

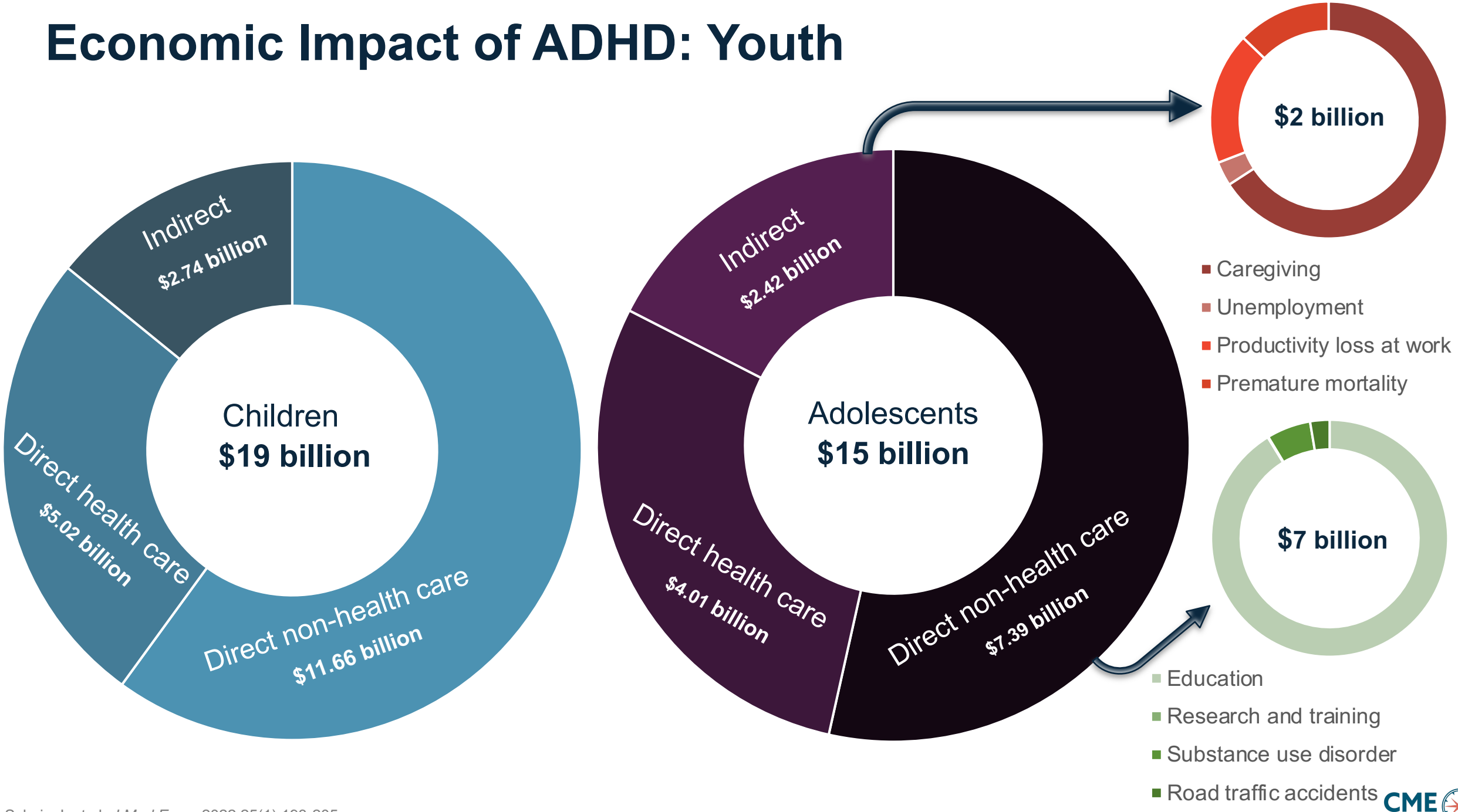
- ADHD prevalence in prison populations:
  - 30.1% among youth prisoners[1]
  - 26.2% among adult prisoners[1]
  - 2-3x risk of later arrest, conviction, and incarceration[2]

- Survey of 1,001 adults with ADHD found[3]:
  - 37% (vs. 18% controls) had been arrested
  - Divorce was more likely (28% vs. 15% controls)
  - Less satisfaction with their family, social, and professional lives



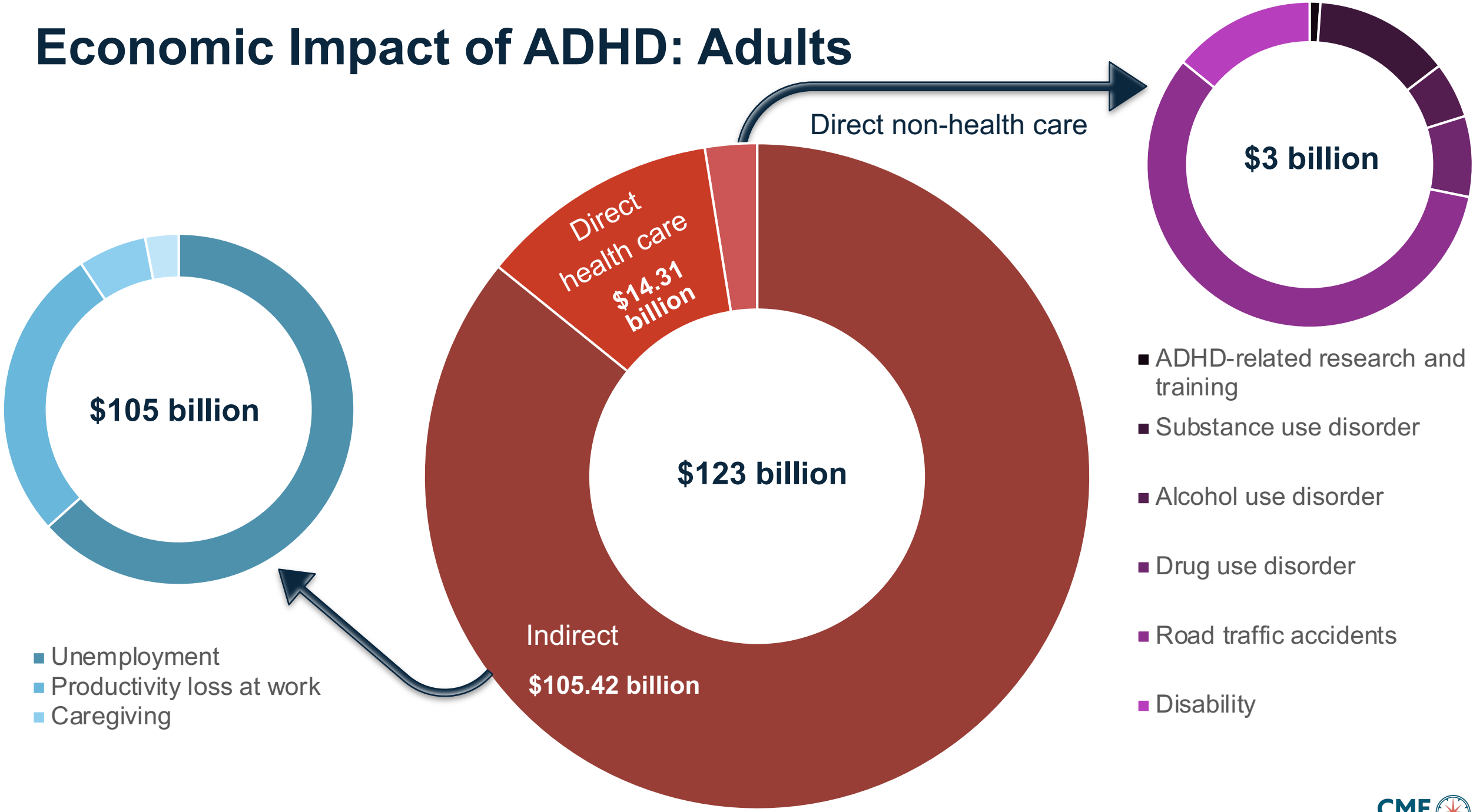
1. Young S, et al. *Psychol Med*. 2015;45(2):247-258. 2. Young S, et al. *BMC Psychiatry*. 2018;18:281. 3. Biederman J, et al. *J Clin Psychiatry*. 2006;67(4):524-540.

Economic Impact of ADHD: Youth



Schein J, et al. *J Med Econ*. 2022;25(1):193-205.

Economic Impact of ADHD: Adults



Schein J, et al. *J Manag Care Spec Pharm*. 2022;28(2):168-179.

Modes of Treatment

CBT

- Cognitive
- Behavioral

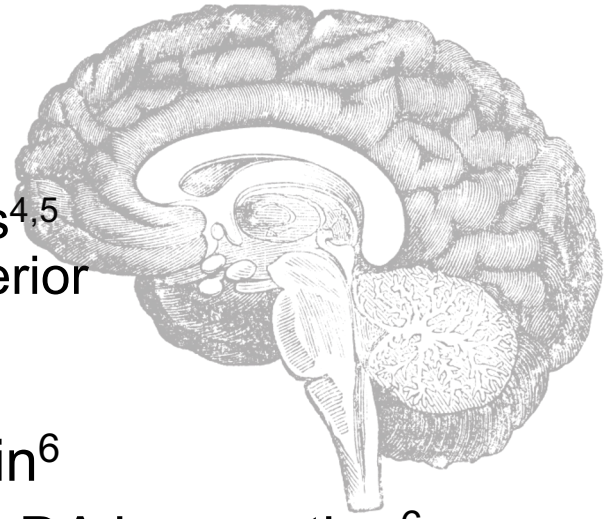
Metacognitive therapy

Pharmacological treatments

- Stimulants
- Nonstimulants

American Academy of Family Physicians. 2022. https://www.aafp.org/family-physician/patient-care/prevention-wellness/emotional-wellbeing/adhd-toolkit/treatment-and-management.html

Effects on Brain Physiology in ADHD



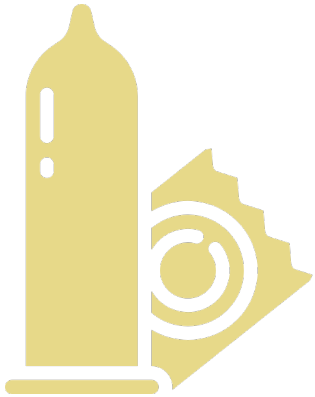
- Stimulants can exert regulating effects on brain structure[1-5]
  - Volume reductions present in children and adolescents, but not in adults[4,5]
  - Long-term treatment may normalize changes found in white matter, anterior cingulate cortex, thalamus, and cerebellum[4,6]
- AMP increases the release of DA across multiple regions of the brain[6]
- Dose-dependent AMP alters regional CBF to areas of the brain with DA innervation[6]
- MPH may normalize cortical development trajectory, brain activation patterns, and functional connectivity in children with ADHD[4]
- MPH reduces regional CBF in the prefrontal cortex and increases regional CBF in the thalamus and precentral gyrus[7]
- Nonstimulants increase neuronal activity in the frontal cortex[8]
  - In animal studies, nonstimulants prevent dendritic spine loss in the PFC and protects working memory performance[8]
  - Increase lateral prefrontal cortex activity, correlating with improvement in ADHD symptoms[9]

AMP = amphetamine; CBF = cerebral blood flow; DA = dopamine; MPH = methylphenidate

1. Frodl T, et al. *Acta Psychiatr Scand*. 2012;125:114-126. 2. Nakao T, et al. *Am J Psychiatry*. 2011;168:1154–1163. 3. Onnink AMH, et al. *Eur Neuropsychopharmacol*. 2014;24:397–409. 4. Schweren LJ, et al. *Eur Neuropsychopharmacol*. 2013;23(10):1151-1164. 5. Tebartz van Elst L, et al. *J Psychiatry Neurosci*. 2016;41(6):422-430. 6. Faraone SV. *Neurosci Biobehav Rev*. 2018;87:255-270. 7. Schweitzer JB, et al. *Biol Psychiatry*. 2004;56(8):597–606. 8. Bilder RM, et al. *J Am Acad Child Psychiatry*. 2016;55(8):667-673. 9. Sugimoto A, et al. *Front Hum Neurosci*. 2021;15:755025.

Impact of Treatment on Youth Psychosocial Outcomes

- ADHD pharmacological treatment reduced the probability of teens[1]:
  - Contracting an STD by 3.6%
  - Having a substance use disorder by 7.3%



- In adolescent patients receiving consistent stimulant treatment, smoking rates were noted to be significantly lower[2,3]

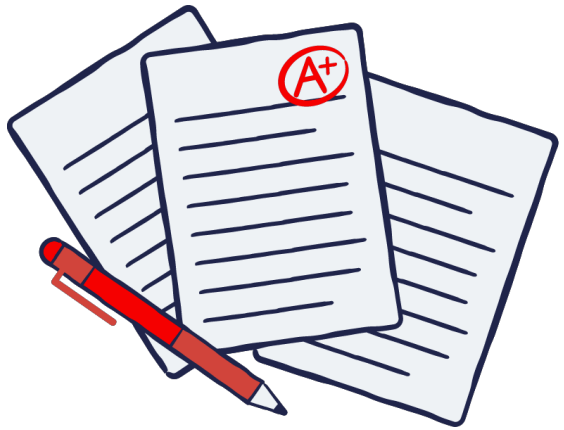
STD = sexually transmitted disease

1. Chorniy A, et al. *Lab Econ*. 2016;43:87-105. 2. Schoenfelder EN, et al. *Pediatrics*. 2014;133(6):1070-1080. 3. Schoenfelder EN et al. *J Pediatr Psychol*. 2016;41(7):735-740.

Impact of Treatment on Educational Outcomes

- A meta-analysis of 176 studies (1980-2012) of long-term (≥ 2 years) academic outcomes found[1]:
  - Achievement test outcomes (79%) and academic performance outcomes (75%) were **worse** in untreated ADHD compared with non-ADHD controls
  - Improvement in both outcome groups was associated with treatment, more often for achievement test scores (79%) than academic performance (42%)

- A Swedish study of 657,720 students (n = 29,128 w/ ADHD) after 3 months of ADHD treatment found[2]:
  - Decreased risk of failing to advance to next school level
  - Higher GPA
  - Positive teacher assessments



GPA = grade point average

1. Arnold LE, et al. *J Atten Disord*. 2020;24(1):73-85. 2. Jangmo A, et al. *J Am Acad Child Adolesc Psychiatry*. 2019;58(4):423-432.

SMART Goals

Specific, Measurable, Attainable, Relevant, Timely

- Understand the whole-life impact of ADHD and appreciate the benefits of different treatment modalities in alleviating multiple categories of disease burden
- Appreciate the impact that medication adherence has on ADHD symptoms and comorbidities
- Recognize that the comorbidity profiles of ADHD differ in children and adults

CMEO Snack

Snack 2

Can You ID ADHD? Tips and Tools to Improve Your Rate of Detection in Adults

Snack 3

Moving Beyond Limitations in ADHD Management: Best Practices for Personalized Therapy for Children and Adults

Snack 4

Empowering Patients to Make Informed Treatment Decisions in ADHD: What They Need to Know

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