

The Economic Costs of ADHD

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ADHD at a glance

- » Affects 3 - 7% of school-aged children,¹ with boys three times more likely to have it than girls²
- » Inheritable condition
 - ↳ 30 – 40% chance that a brother or sister will have ADHD³
 - ↳ More than half of all parents with ADHD will have a child with ADHD⁴
- » Experts estimate that up to 60% of children with the disorder carry their symptoms into adulthood⁵
- » Reported impacts suggest that children with ADHD often have problems in their everyday lives beyond the core symptoms of the disorder itself⁶
 - ↳ Low self-esteem⁷
 - ↳ Emotional and social problems⁸
 - ↳ Frequent underachievement at school⁹
 - ↳ Inability to participate in social exchanges (e.g., sharing, cooperation)¹⁰

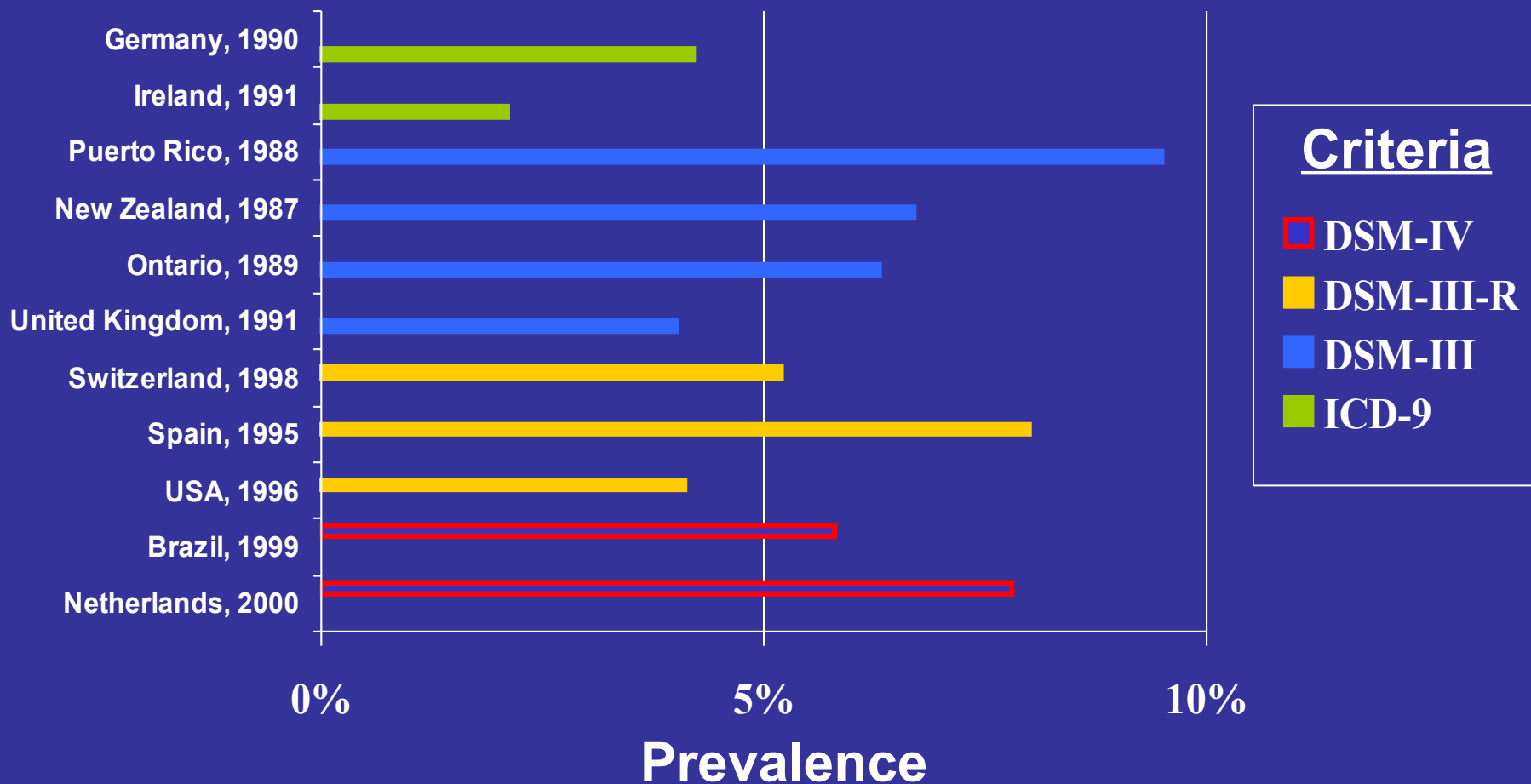
1 DSM IV; 2,3 Faraone SV 2008; 4 Biederman 2003; 5 Weiss G 1993; 6 Escobar 2005
7, 8, 9, NICE 2006; 10 Barkley RA 2002

ADHD: A Public Health Opportunity

- » Prevalence: 4 – 12% in 37 countries¹
- » Impairment²
 - ↳ Smoking, drug use, health costs, driving, accidents, school performance, behavior, academic achievement, peer relations, parental functioning, divorce, work, unemployment, dysemployment, psychopathology, quality of life, adaptive skills, divorce
- » Treatable³
 - ↳ 75% response rates of core symptoms
 - ↳ Symptom improvement correlates with improved function
 - ↳ Treatment may prevent comorbidity, smoking, drug abuse, accidents
 - ↳ Treatment in childhood in a Finish study markedly decreased burden of illness in adulthood and capacity to function
- Faraone SV, 2003. 2. Pelham WE, 2007 3. Barkley R, ADHD, *Guilford* 2006
Jensen P *ADHD State of Science, Best Practices*. Kingston, NJ. Civic Research Institute

Worldwide Prevalence in School Age Children

Site, Year



Criteria

- DSM-IV
- DSM-III-R
- DSM-III
- ICD-9

Prevalence of Adult ADHD

Childhood Epidemiology

- 3 - 7% of school-aged children
- 60% continue to have impairment into adulthood
- Therefore 2 - 4.2% prevalence in adults

Adult ADHD Epidemiology Studies

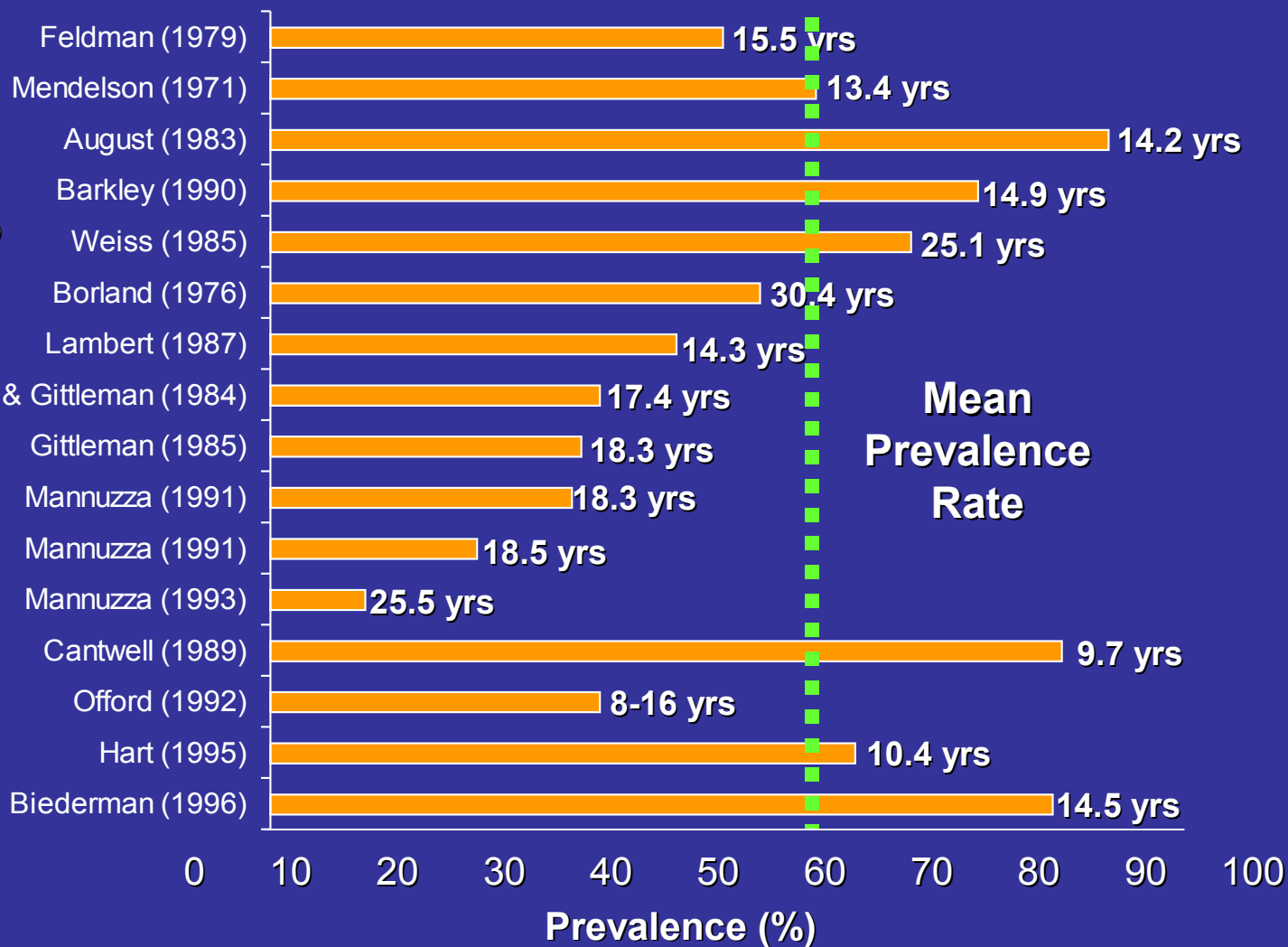
- Murphy and Barkley 1996a 4.7%
- Murphy and Barkley 1996b 4.7%
- DuPaul, Weyandt et. al. 1997 4.5%
- Heiligenstein et. al. 1997 4.0%

**NATIONAL
COMORBIDITY
SURVEY REVISED**
Kessler, et al.

**Most quoted
adult
prevalence
rate is 4% (7
million adults)**

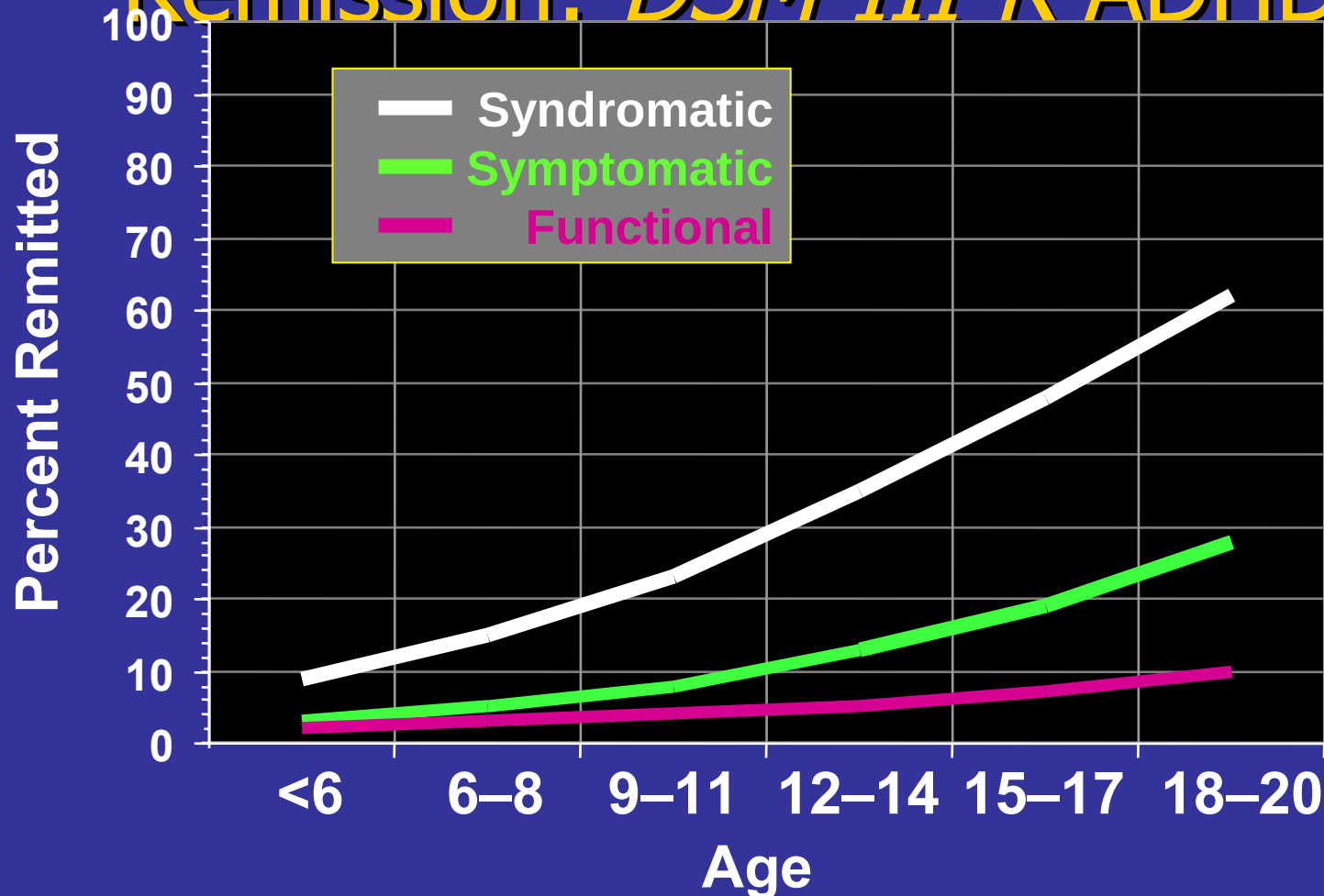
Persistence

ADHD Follow-up Studies

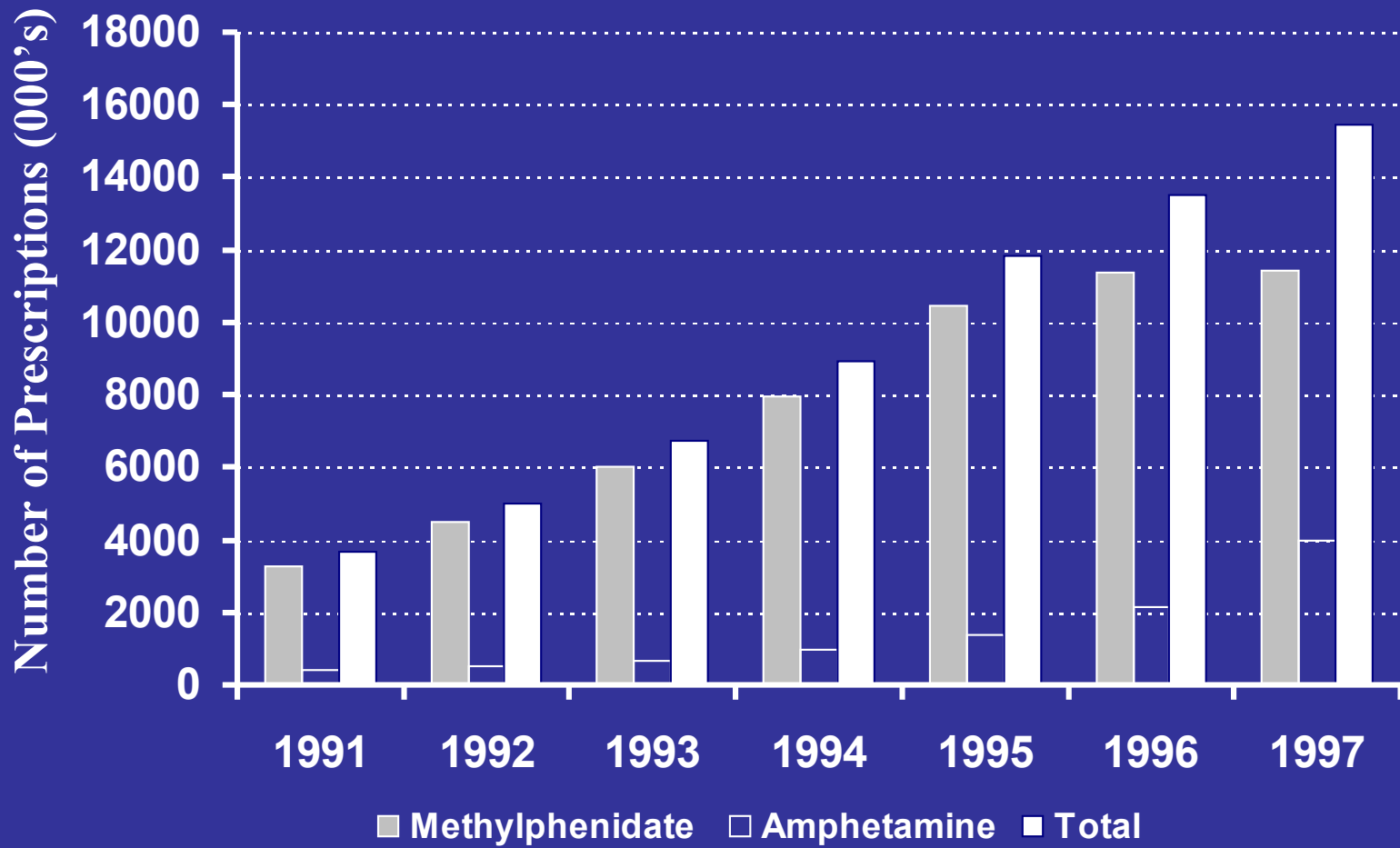


Age-specific Prevalence of ADHD

Remission: *DSM-III-R* ADHD



Methylphenidate and Amphetamine Prescriptions

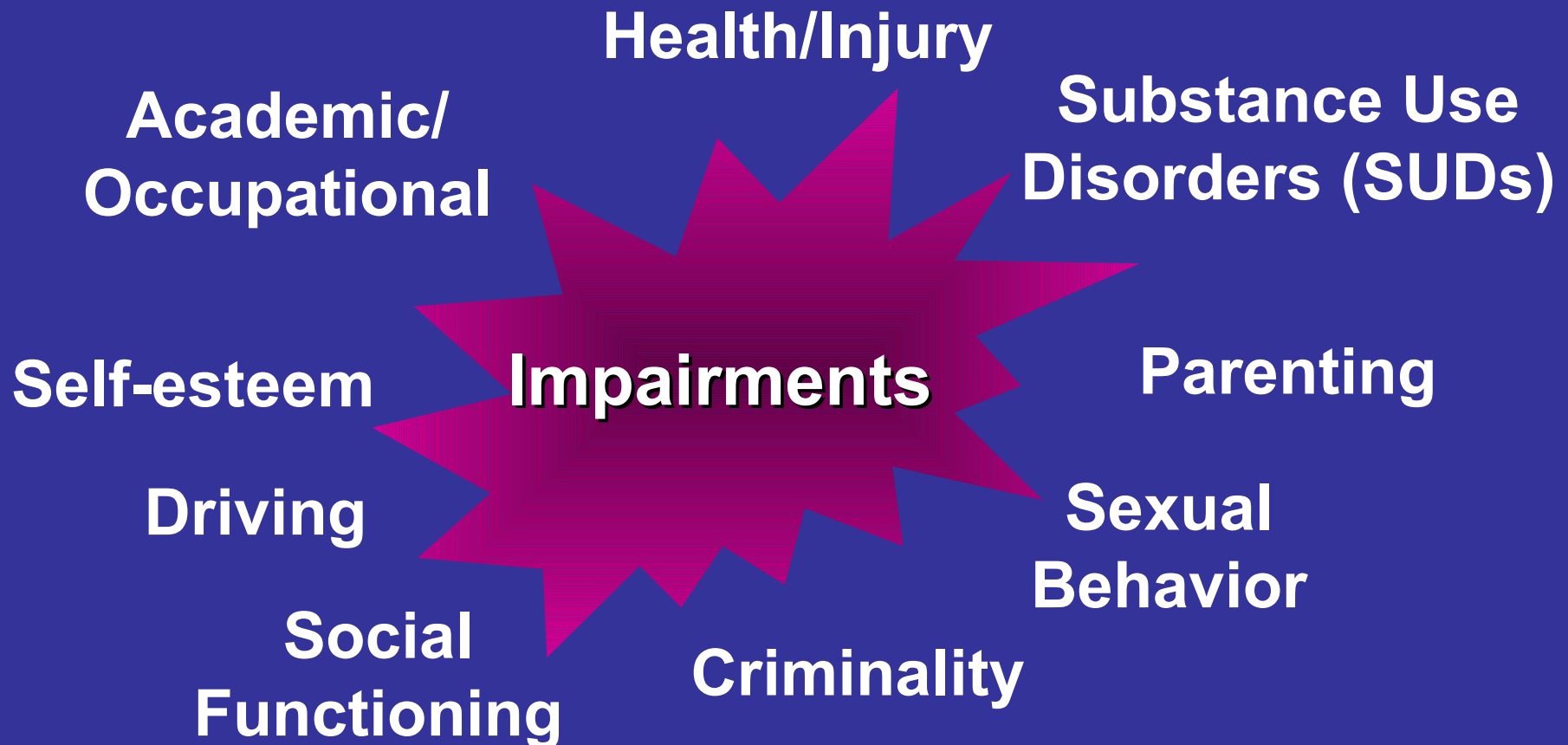


Source: IMS Health, National Prescription Audit Plus™

Average Prevalence of ADHD Comorbidity

<u>Comorbidity</u>	<u>Est. Prevalence</u>
•Mood Disorder	19% - 37%
•Anxiety Disorder	25% - 50%
•Alcohol Abuse	32% - 53%
•Other Substance Abuse	8% - 32%
•Personality Disorder	10% - 20%
•Antisocial Behavior	18% - 28%

Domains of Impairment



Impact of Untreated and Under-treated ADHD

Health Care System

50% ↑ in bike accidents¹
33% ↑ in ER visits²
2–4X more motor vehicle crashes³⁻⁵

Patient

Family

3–5X ↑ Parental Divorce or Separation^{11,12}
2–4X ↑ Sibling Fights¹³

School & Occupation

46% Expelled⁶
35% Drop Out⁶
Lower Occupational Status⁷

Society

Substance Use Disorders:
2X Risk⁸
Earlier Onset⁹
Less Likely to Quit in Adulthood¹⁰

Employer

↑ Parental
↑ Absenteeism¹⁴
and
↓ Productivity¹⁴

1. DiScala et al. 1998

2. Liebson et al. 2001

3. NHTSA, 1997.

4-5. Barkley et al. 1993; 1996.

6. Barkley, et al. 1990.

7. Manuzza et al. 1997.

8. Biederman et al. 1997.

9. Pomerleau et al. 1995

10. Wilens et al. 1995.

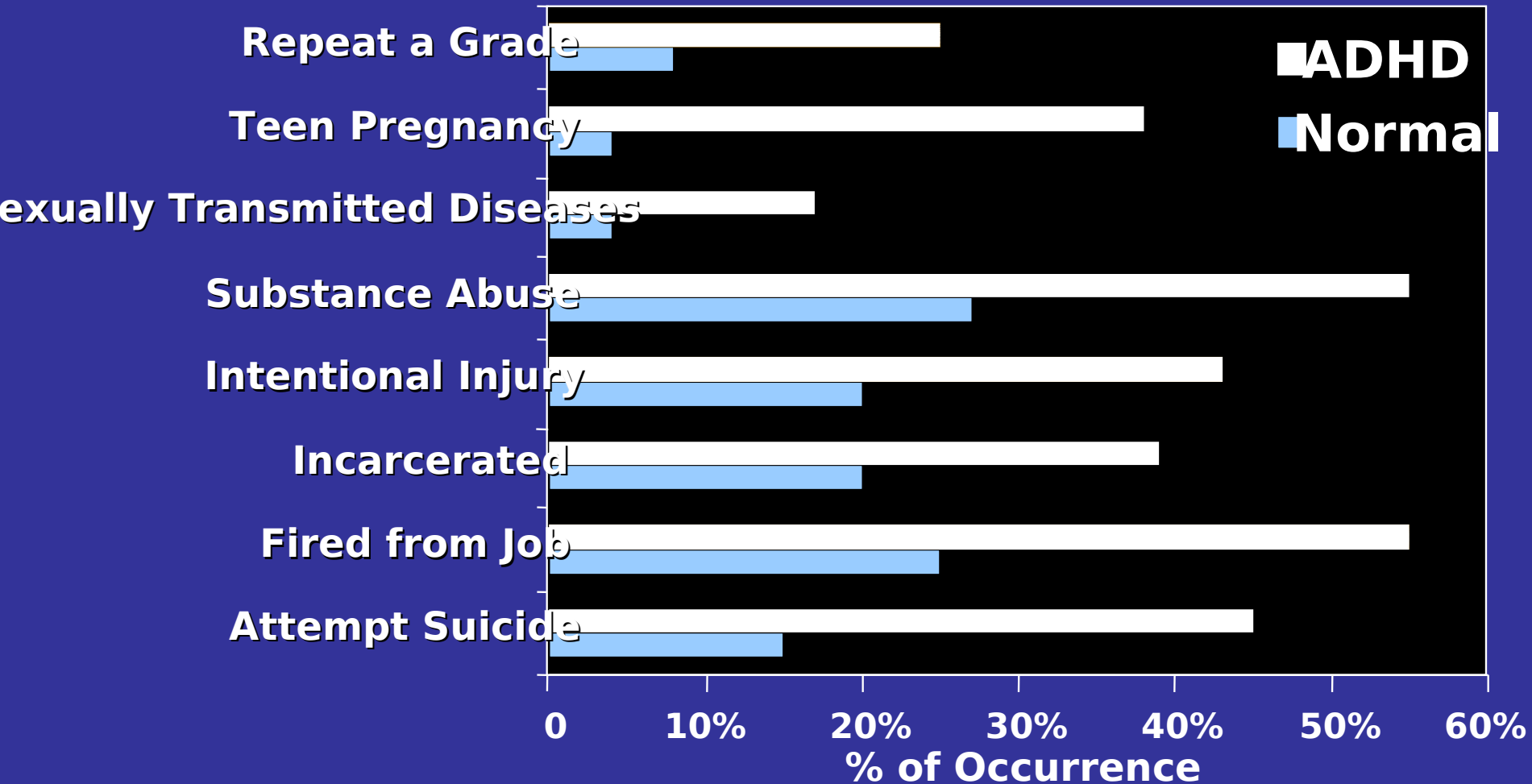
11. Barkley et al. 1991.

12. Brown & Pacini, 1989.

13. Mash & Johnston, 1983.

14. Noe et al, 1999

ADHD: Social, Emotional, and Cognitive Consequences



Barkley RA. *Attention-Deficit Hyperactivity Disorder: A Handbook for Diagnosis and Treatment*; 1998.

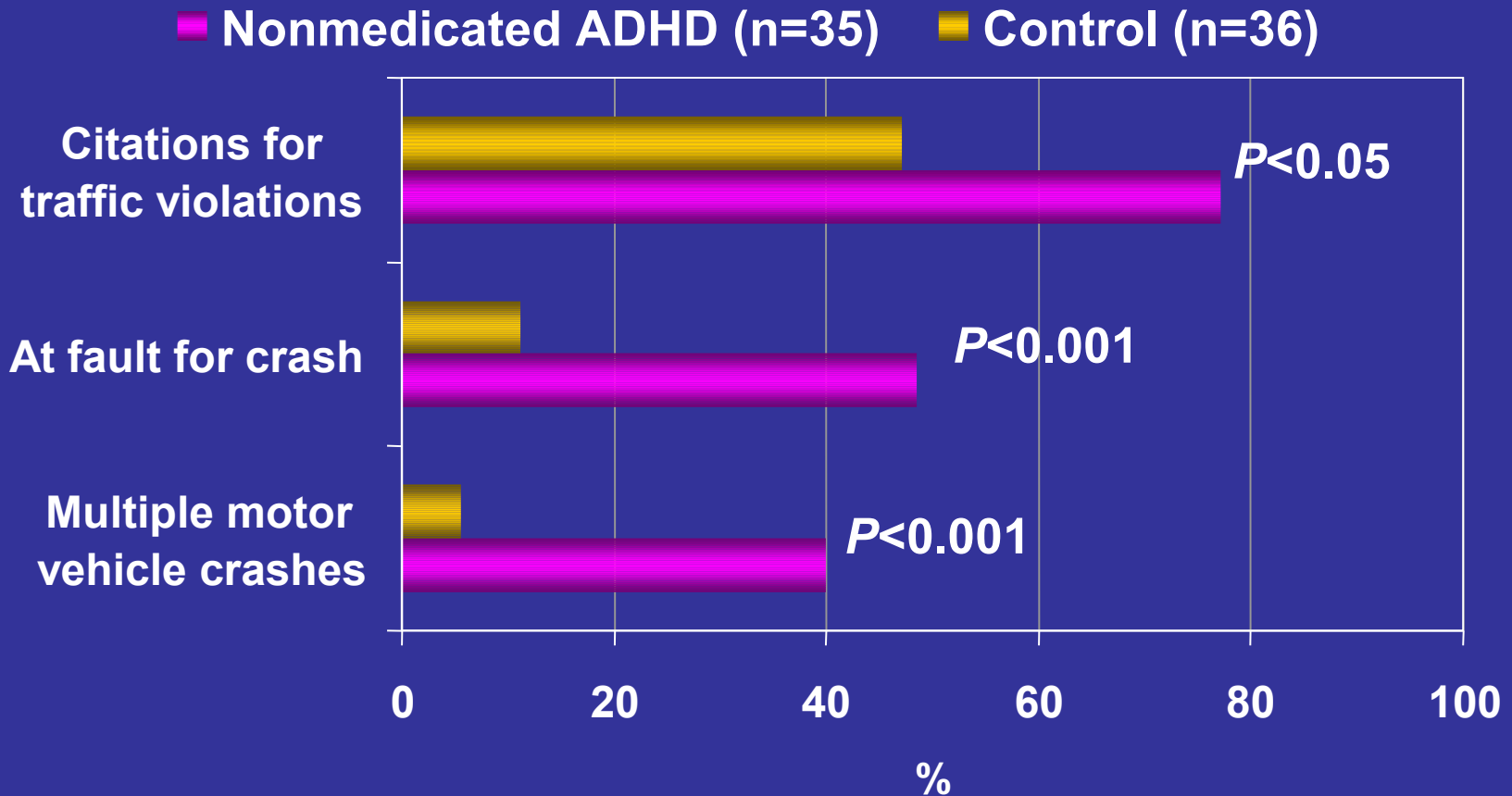
Swensen, AR. Manuscript in preparation, 2001.

Impact of Untreated ADHD on Academic Performance

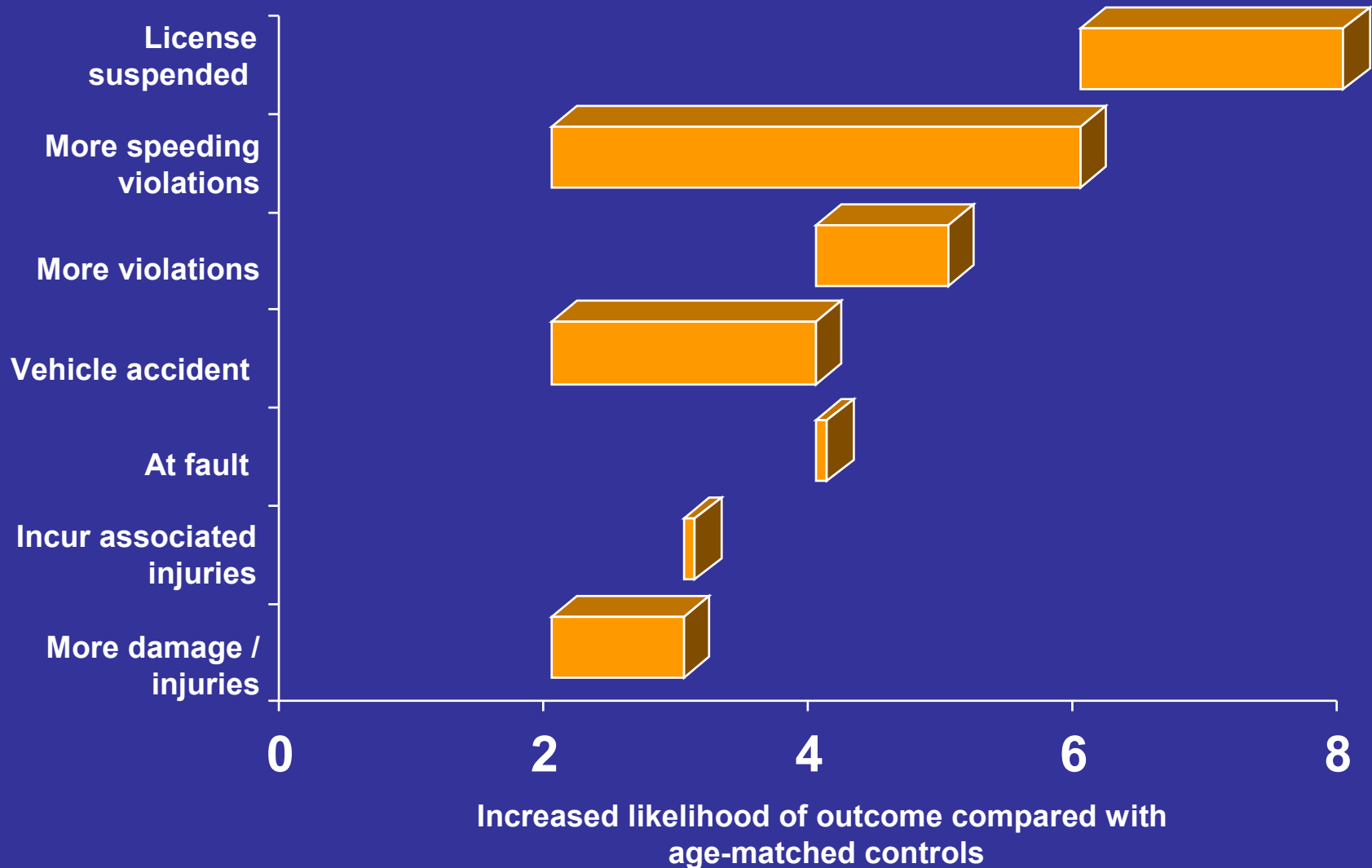
More than \$3 billion in annual public school expenditures



Driving-related Outcomes in Adolescent and Young Adults

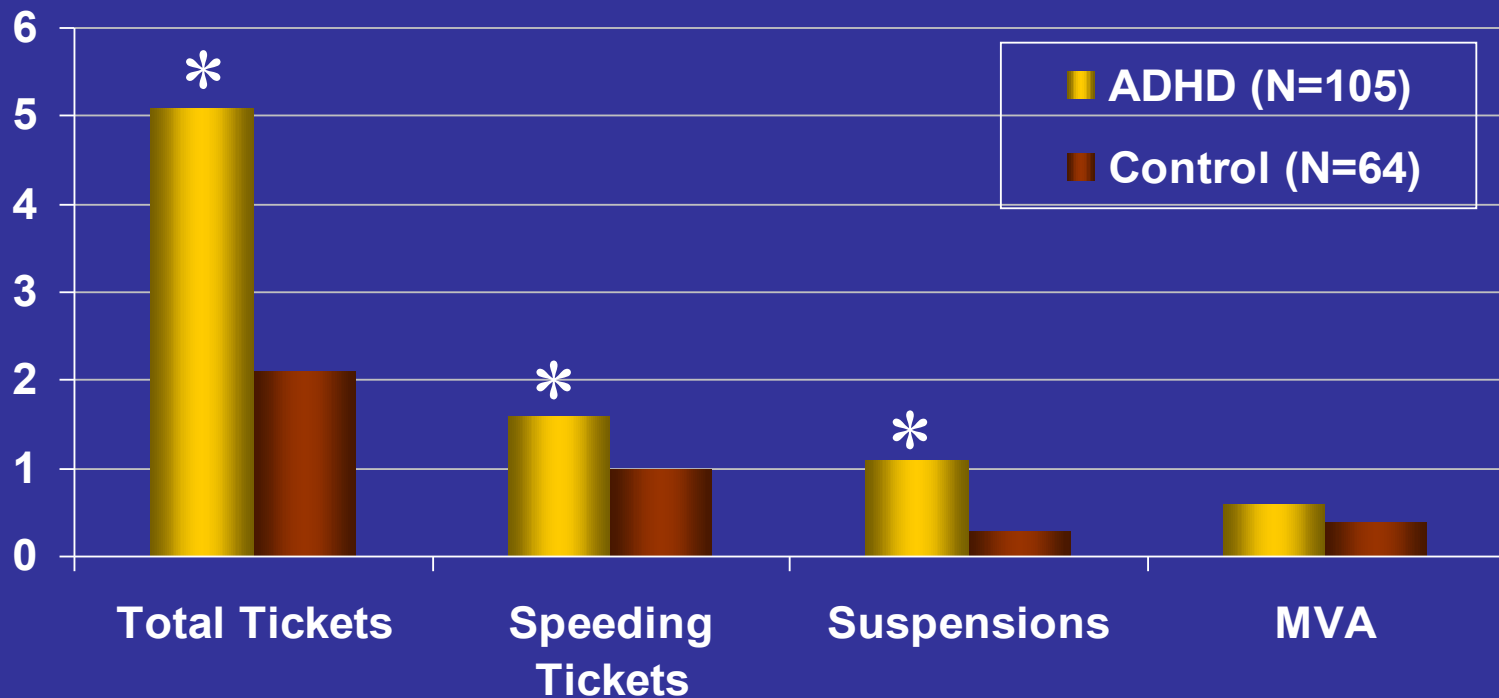


ADHD Adolescents and Driving



Driving Impairments in Adults with ADHD

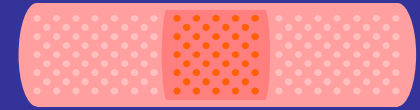
Department of Motor Vehicle Data



* $P < 0.01$.

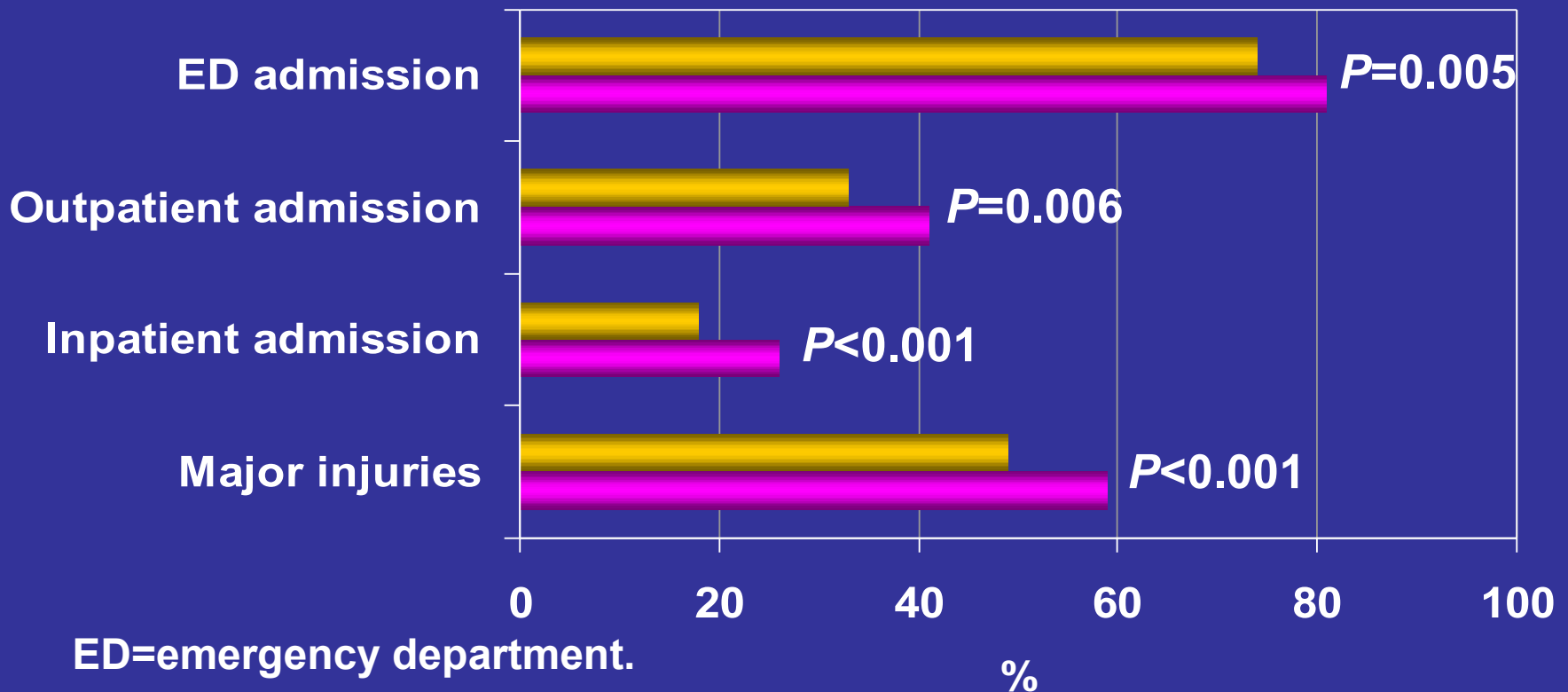
Driving Performance in Adolescents with ADHD

- » Randomized, crossover, single-blind study
- » 6 male drivers with ADHD aged 16–19 years
- » Comparison of equal doses of OROS[®] MPH (Concerta[®]) qd and MPH (Ritalin[®]) tid on driving performance
- » Patients treated for 7 days on each regimen, then drove a driving simulator at 2, 5, 8, and 11 PM
- » Primary outcome measure was Impaired Driving Score (IDS)



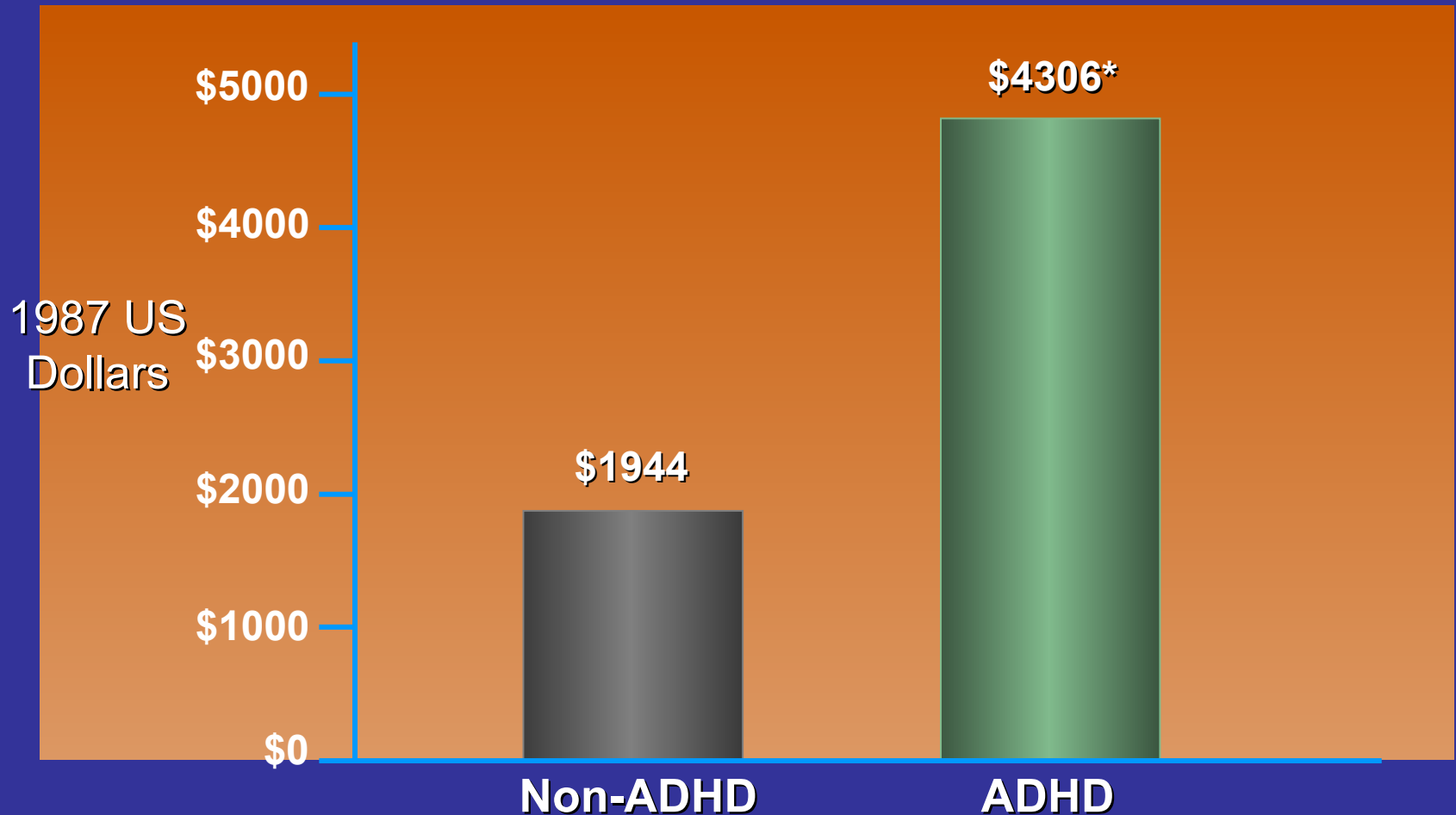
Medical Costs in Children and Adolescents with ADHD

■ ADHD (N=309) ■ Control (N=3810)



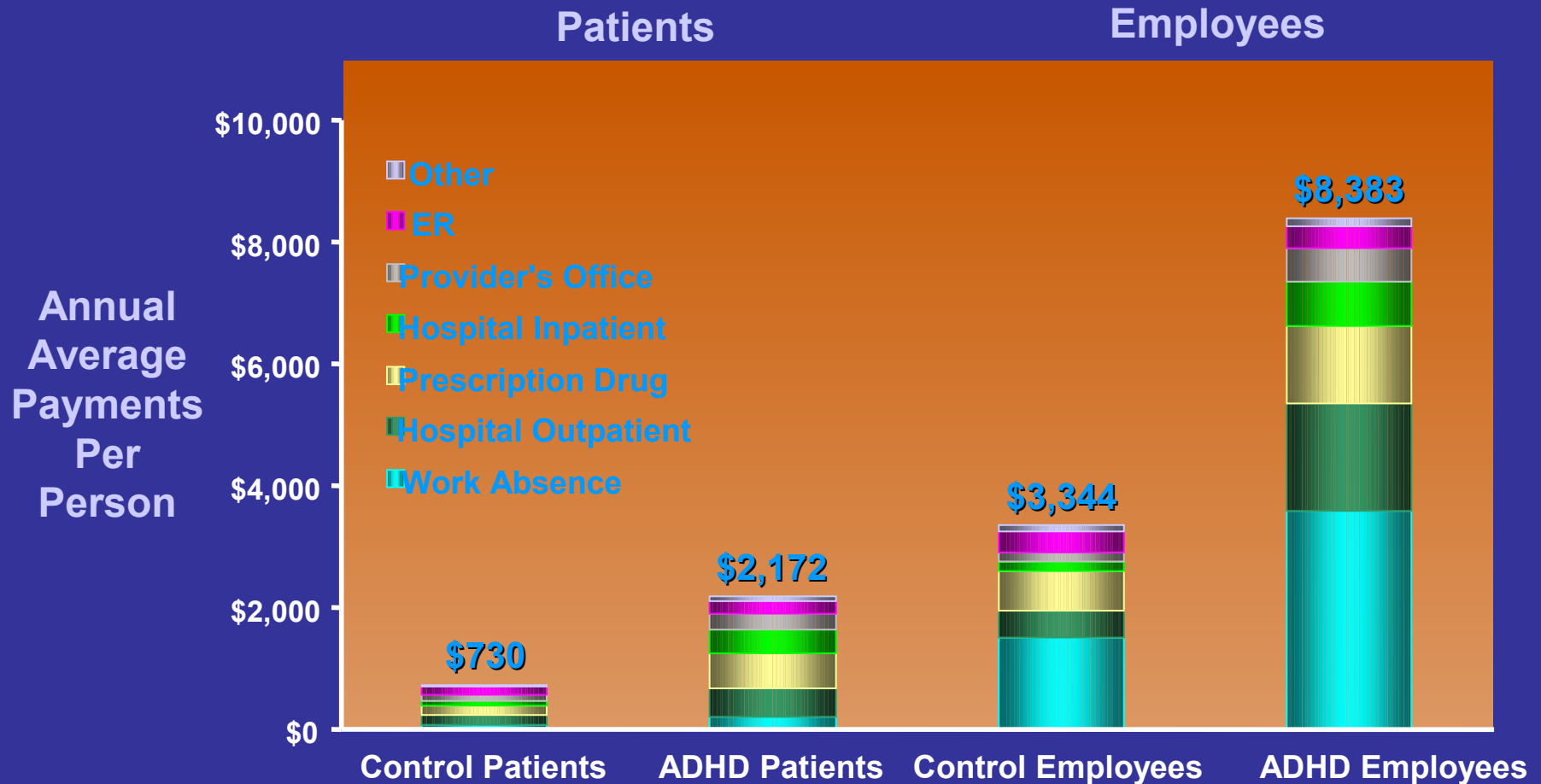
ADHD: Cost of Medical Care

9-year median cost per person

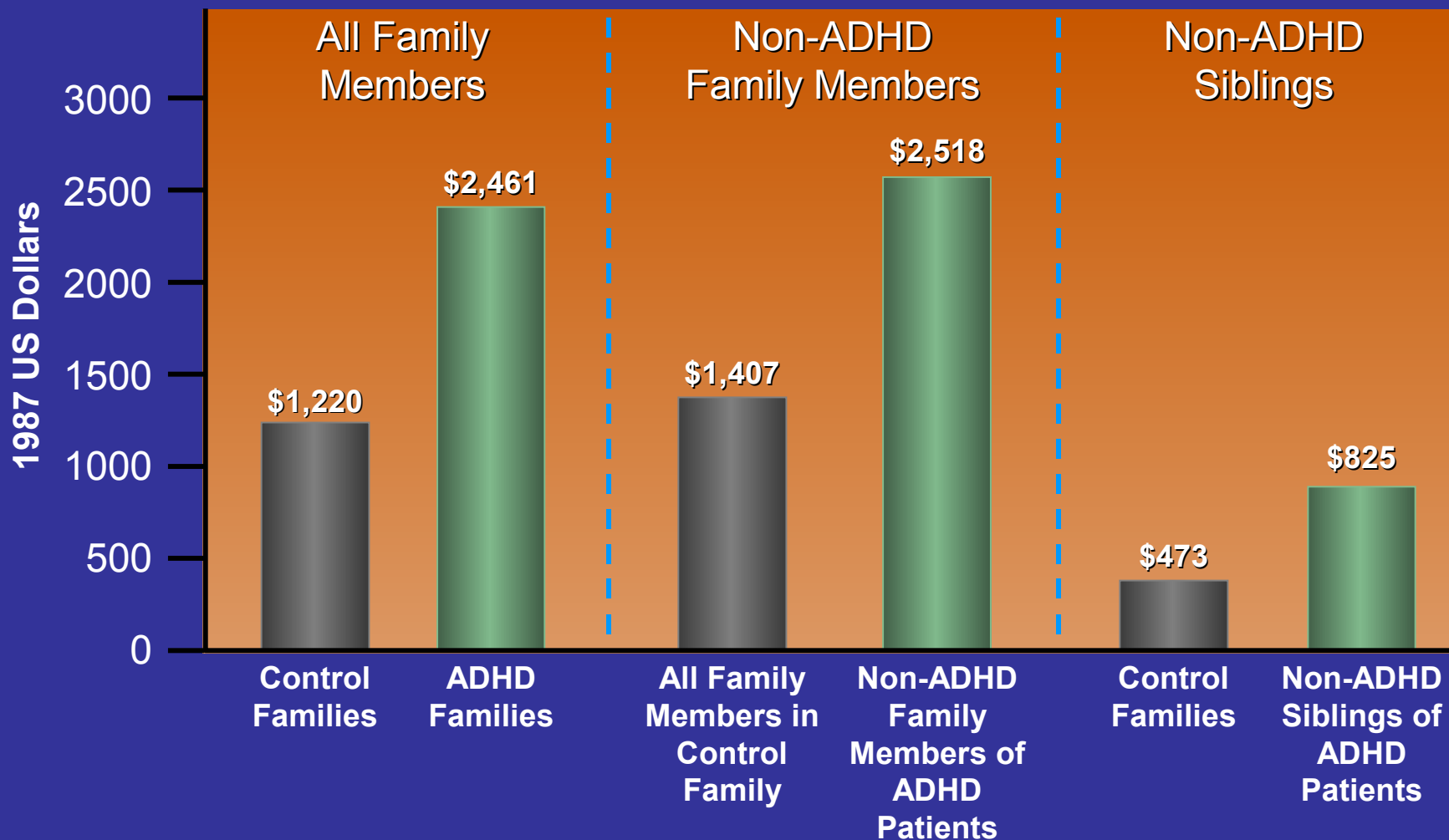


* $P < .01$ vs non-ADHD Leibson CL et al. *JAMA*. 2001;285:60-66.

1998 Average Costs per Patient and per Employee by Medical and Prescription Drug Claims and Work Loss



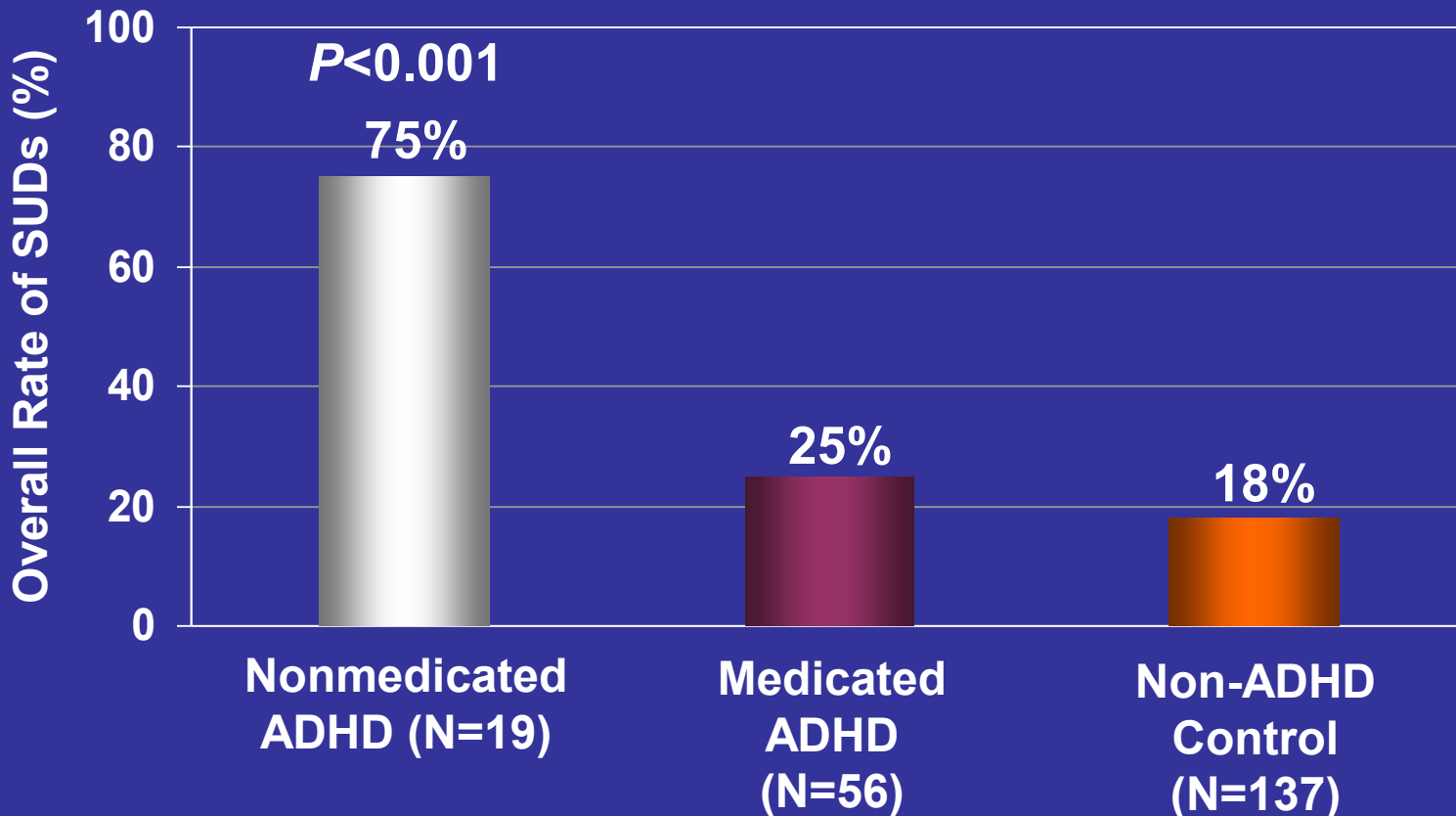
ADHD and Economic Burden



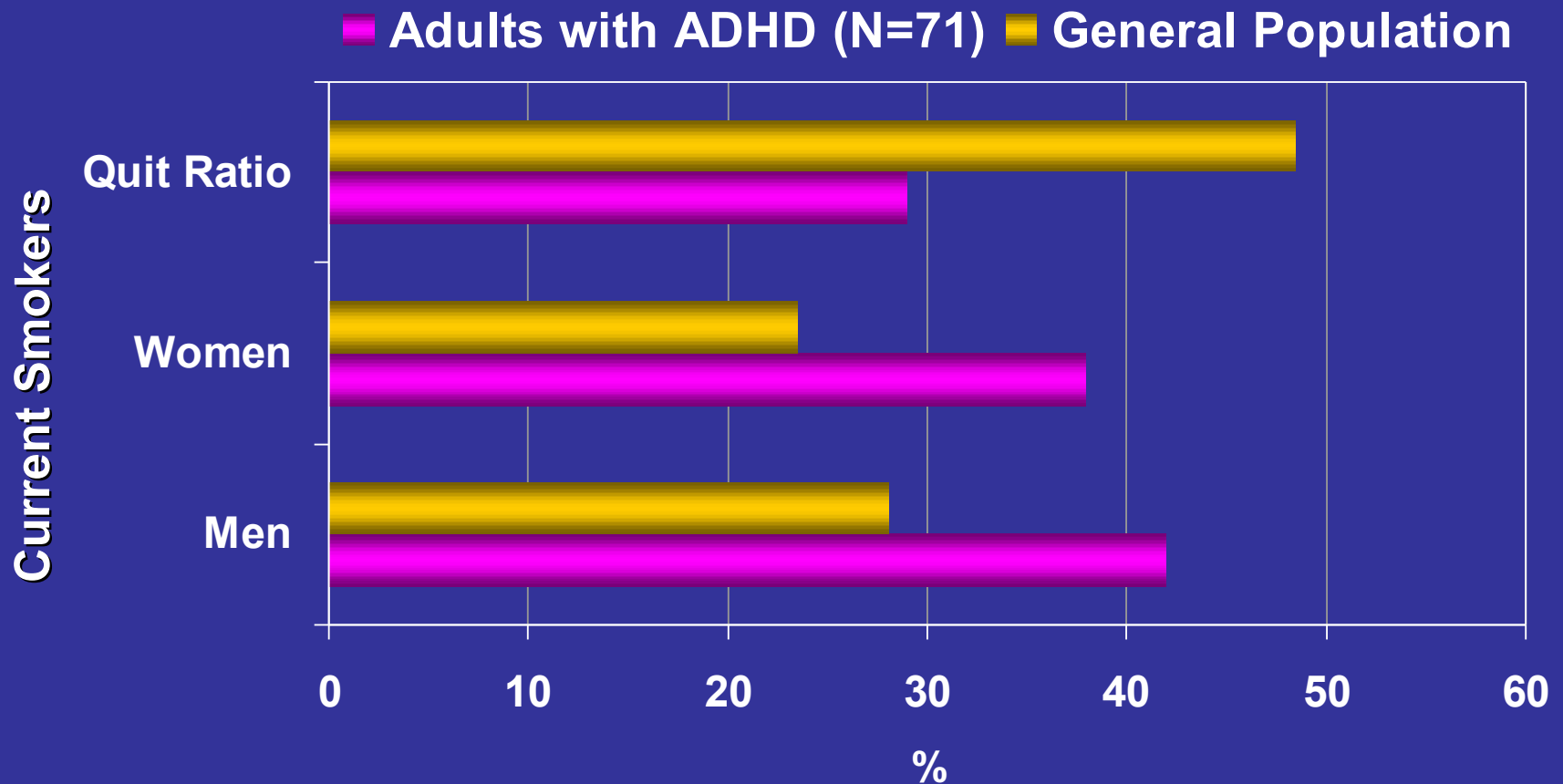
Sexual Behavior

- » Longitudinal follow-up at young adulthood of a cohort of children (ongoing Milwaukee follow-up study) with ADHD compared with controls
 - ↳ Sexual intercourse at earlier age (15 vs 16 years)
 - ↳ More sexual partners (19 vs 7)
 - ↳ More pregnancies (38% vs 4%)
 - ↳ More sexually transmitted diseases (17% vs 4%)
 - ↳ Tested for HIV (54% vs 21%)

SUDs in Adolescents with ADHD



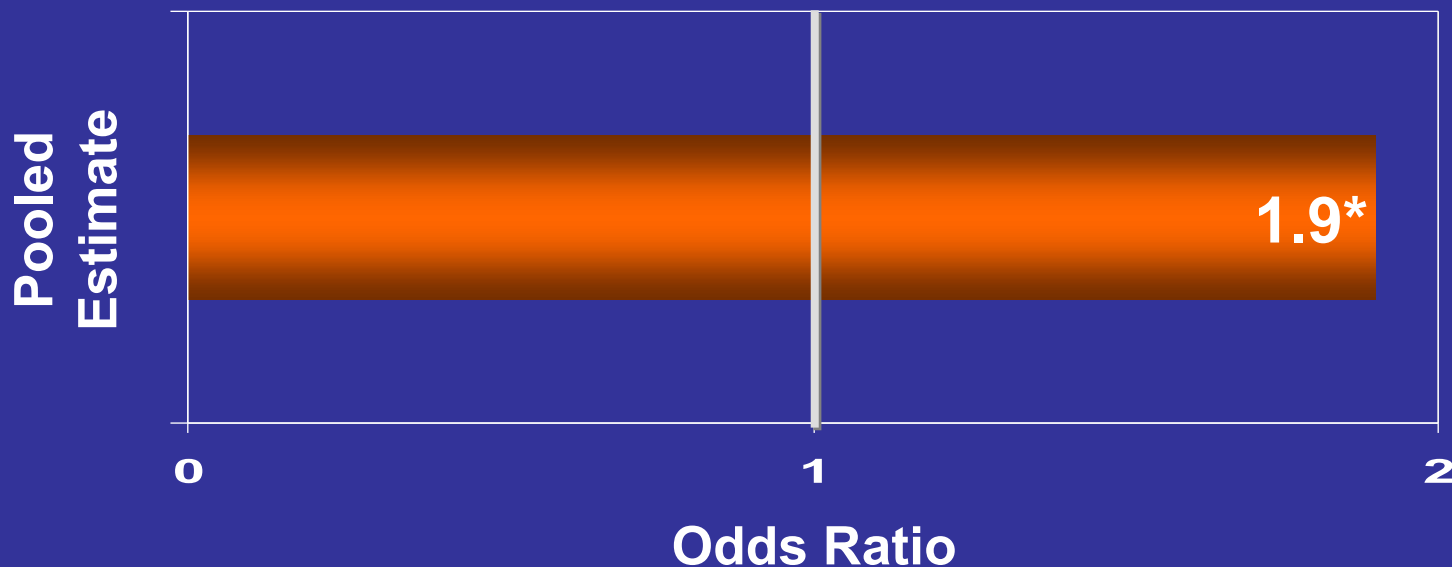
ADHD and Smoking in Adults



SUD Meta-analysis

Pooled Estimate of Odds Ratio

* $P < 0.05$; 95% CI for OR = 1.1–3.6.



Stimulant treatment of ADHD in youth was associated with a 2-fold reduction in risk for SUD

Public Health Implications



High prevalence of ADHD in youths

**High risk of youths with ADHD
developing SUD**

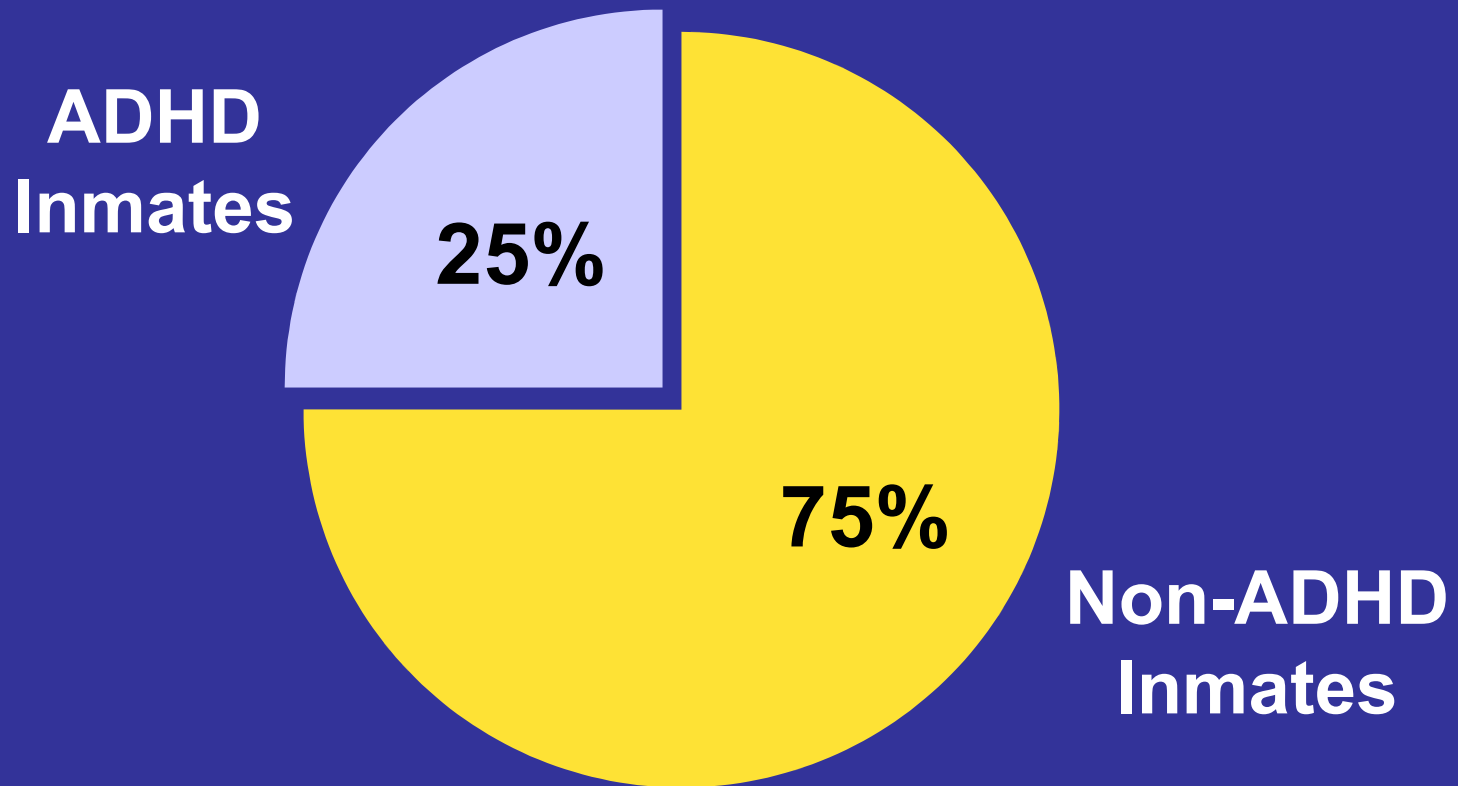


**Identification and treatment of youths with
ADHD may affect a large segment of the
adolescent and young adult populations at
risk for SUD.**

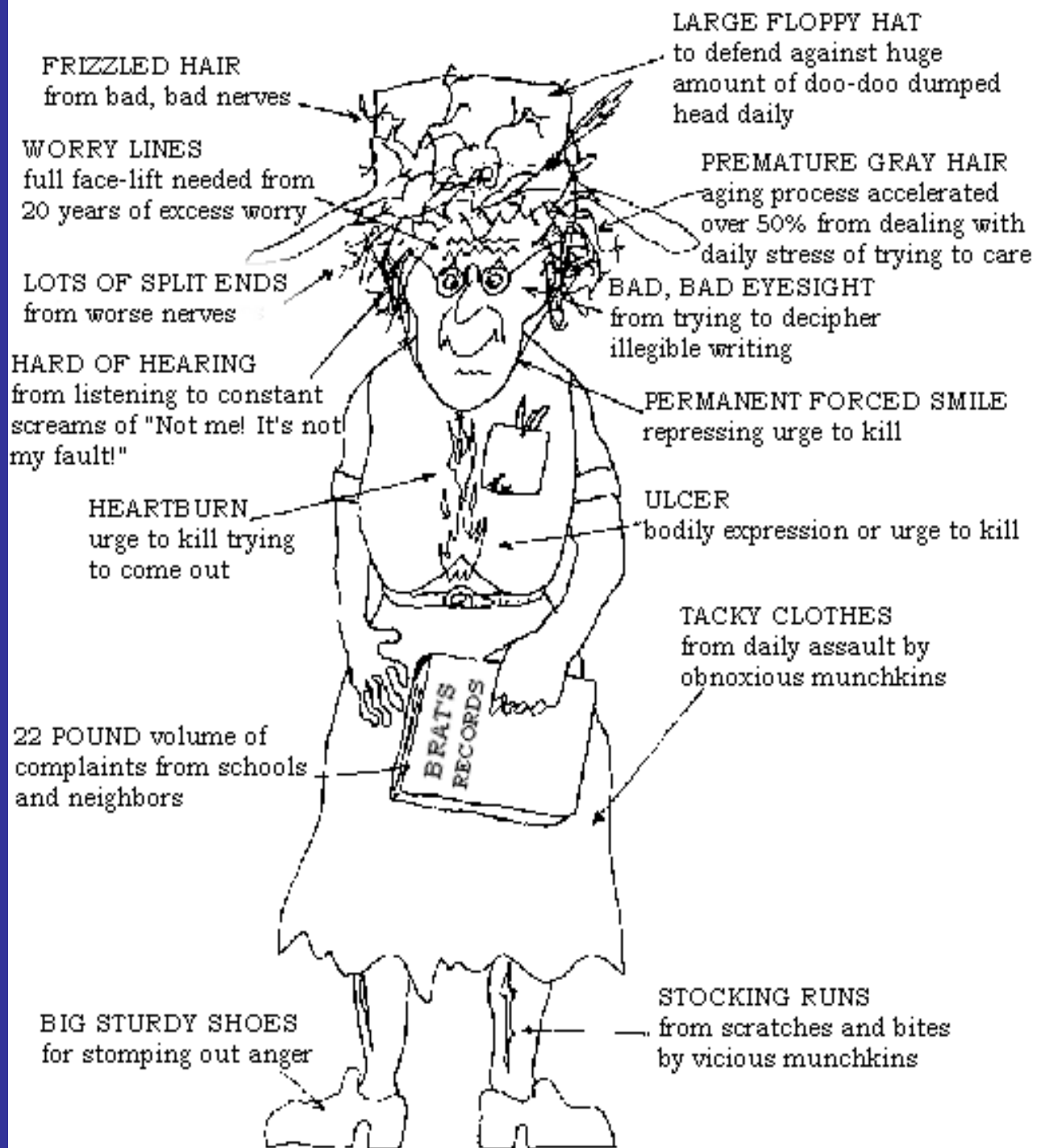
Criminality and ADHD

- » Conduct disorder and resulting antisocial disorders occur more frequently in patients with ADHD than controls
 - ↳ Coupled with an impulsive, high-risk lifestyle increases risk for legal problems
- » Patients with ADHD are more likely to be
 - ↳ Arrested (39% vs 20%)
 - ↳ Convicted (28% vs 11%)
 - ↳ Jailed (9% vs 1%)

ADHD in Adult Prison Inmates



Portrait of the care giver for an ADHD child



ADHD: Impairments in Socialization

- » Children are stigmatized by their behavior
 - Troublemakers (bad sports)
 - Excessive talking
 - Cannot sit still
 - Unfocused, not responsive
 - Impulsive aggression

- » Adolescents continue to demonstrate social problems
 - ↳ Poor participation in group activities
 - ↳ Few friends, limited opportunities
 - ↳ Vulnerable to antisocial groups, drug abuse, peer pressure

AACAP. *J Am Acad Child Adolesc Psychiatry*. 1997;36:85S-121S.
Barkley RA. *J Am Acad Child Adolesc Psychiatry*.
1991;30:752-762.

Is ADHD a Serious Public Health Concern?

Prevalence

Impairment

Chronicity



**Public Health
Significance**

Treatment
Effectiveness

Cost of Illness: COI

- » Cost to government
- » Cost to the family
- » Cost to the patient
- » Opportunity cost
- » Public health costs
- » ADHD is expensive, creates suffering, impairs social productivity, and creates a public health risk to the public at large

Cost Adult ADHD¹

- » Survey of 500 subjects with ADHD compared with 501 matched controls
- » Annual US household income losses due to ADHD 77 billion/year
- » \$8,900 to \$15,400 per year per household

Costs of Adult ADHD

- » Less than 25% receive treatment¹
- » Adults with ADHD incur high health care costs²
- » Adults with ADHD are at increased risk of asthma, depression, anxiety, bipolar, personality disorder, drug abuse, smoking
- » Even after controlling for these conditions, despite the rates of inpatient, outpatient, prescription costs
- » Health care cost of adult ADHD \$5600 vs \$2700 for controls²
- » Loss of work productivity³

Cost Adult ADHD¹

- » Excess per capita health care and work loss age 7 to 44 and family members
- » Administrative claims data from a large company
- » Total excess cost ADHD in 2000 in the US \$31.6 billion
 - ↳ 5% treatment of the condition
 - ↳ 38% other health care costs
 - ↳ 45% increased health care costs of family members
 - ↳ 12% productivity losses of adult family members

Comparator Costs¹

- » ADHD in children: 42.5 billion
- » Depression: 44 billion
- » Substance abuse: 180 billion
- » BUT
- » ADHD increases risk for these other diseases
- » Prevalence > 5%
- » Adult impact based on prevalence of 4.4% even greater

Cost ADHD in Children¹

- » Annual cost ADHD in children \$14,600 per individual in 2005 US \$
 - ↳ 18% health care
 - ↳ 34% education
 - ↳ 48% crime and delinquency
- » 42.5 billion/year
- » Comparable to asthma²
- » Increased risk ER visits, comorbidity, accidents

¹ Pelham W 2007; Chan 2002; Leibson 2001, Swensen 2003

Cost of Childhood ADHD³

- » 13 studies, none Canadian
- » Per unit cost medication has increased
- » Prescribing has increased to include preschoolers, women, attention problems and adults
- » No info on costs of new vs. old medications or their cost effectiveness
- » Mental health treatment \$2636
- » Annual per child cost \$5518
- » Education \$4900
- » Crime \$7040
- » Total \$14576

Costs not accounted for

- » Smoking²
- » Drug abuse³
- » Foster care
- » Fetal alcohol and narcotic syndrome
- » Victims of crime
- » Victims of drug accidents
- » Insurance rates
- » Increased prevalence and adult prevalence 4.4% with 90% comorbidity⁴
- » Suffering to the individual, siblings, families, other children and teachers
- » Decreased life expectancy¹

Summary of US Cost Data

- » Diagnosis increased from 1.4% (1979) to 9.2% (1996)¹
- » Total costs of adult ADHD 31.6 billion year 2000 US\$²
- » Total costs child ADHD 42.5 billion
- » Loss of work productivity in adults \$77 billion
- » Total 74.1 billion
- » Annual costs of ADHD children \$14,600
- » Total cost treatment 1.6 billion or 5%²

We do not know?

- » Current medication costs in Canada
- » Patterns of insurance
- » Cost effectiveness of new medications
- » Cost of not insuring new medications – 4/6 provinces cover new medications
- » Mean cost of non medication treatment in practice – MTA behavior therapy, parent training, summer camp and school consultation \$6988/year

Excluded Indirect Costs

- » Fetal alcohol/narcotic syndrome
- » Life expectancy
- » Damaged self concept
- » Burden to siblings
- » Foster care and adoption
- » Welfare
- » Child and spousal abuse
- » Alcohol and drug abuse in parents
- » Parental morbidity

Summary

- » Cost of ADHD to health care, education, work, justice, social welfare system and driving insurance are exorbitant
- » Cost of medication treatment approximates \$1200, but with high rates of non-adherence
- » Cost of psychological treatment approximates \$400 - \$1200 in practice
- » The opportunity cost of non treatment greatly exceeds the cost of treatment

The economic problem

- » Resources are scarce, wants or demands are infinite
- » Individuals have to make choices or trade-offs
- » Consumers have a budget constraint
 - ↳ budget=disposable income
 - ↳ balanced against prices and amount of goods/services consumed
- » Consumers have preferences – they know what they like
 - ↳ Preferences reflect well-being obtained through consumption
 - ↳ Preferences are endowed & well behaved - axioms of choice
 - ↳ All choices are risky – expected utility theory

Economics is the science of choice

“Allocation of funds and facilities are nearly always based on the opinion of consultants but, more and more, requests for additional facilities will have to be based on detailed arguments with ‘hard evidence’ as to the gain to be expected from the patient’s angle and the cost. Few could possibly object to this.”

Cochrane AL. Effectiveness and Efficiency: random reflections on health services. Nuffield Provincial Hospitals Trust, London, 1972.

Generic steps economic evaluation

(1) Define study question and perspective

↳ Describe alternatives, determine study perspective

(2) Identify, measure and value costs and benefits

↳ Measure costs and benefits in physical units relevant for study perspective, value costs and benefits

(3) Analysis of costs and benefits

↳ Discounting, incremental (additional) costs and benefits of alternatives, sensitivity analysis on key parameters

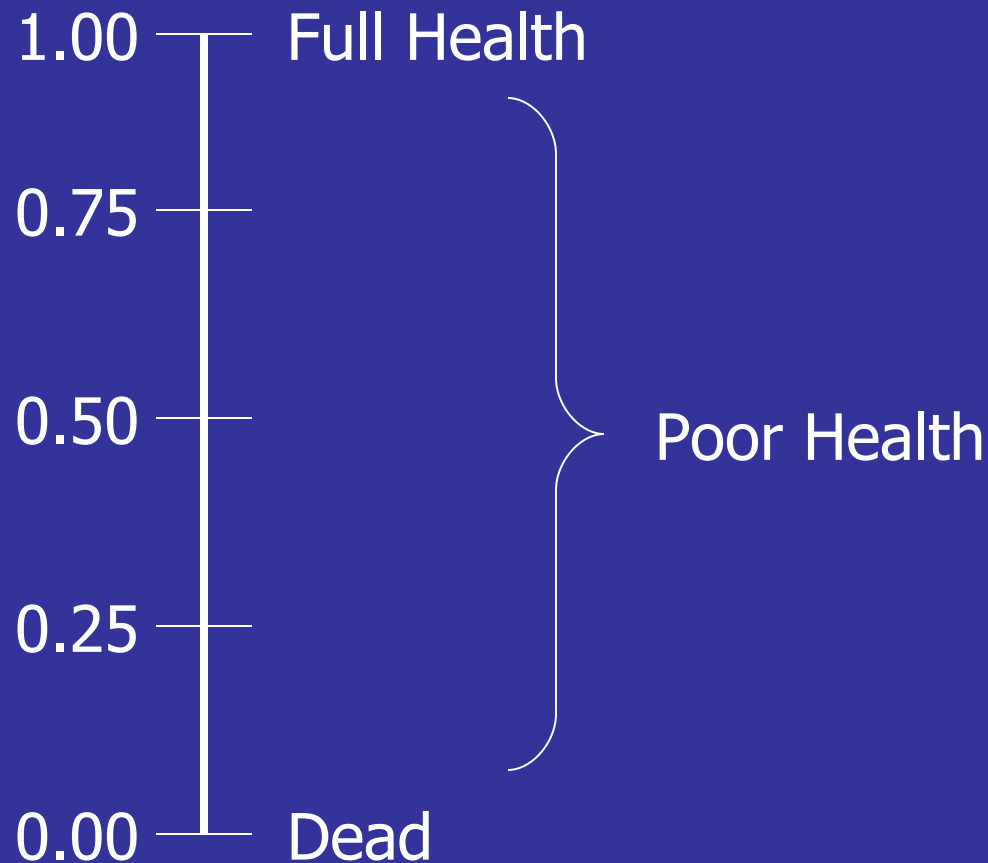
(4) Decision rule

↳ Incremental Cost-Effectiveness Ratios (ICERs) e.g. cost per LYG or QALY thresholds, other decision-making criteria

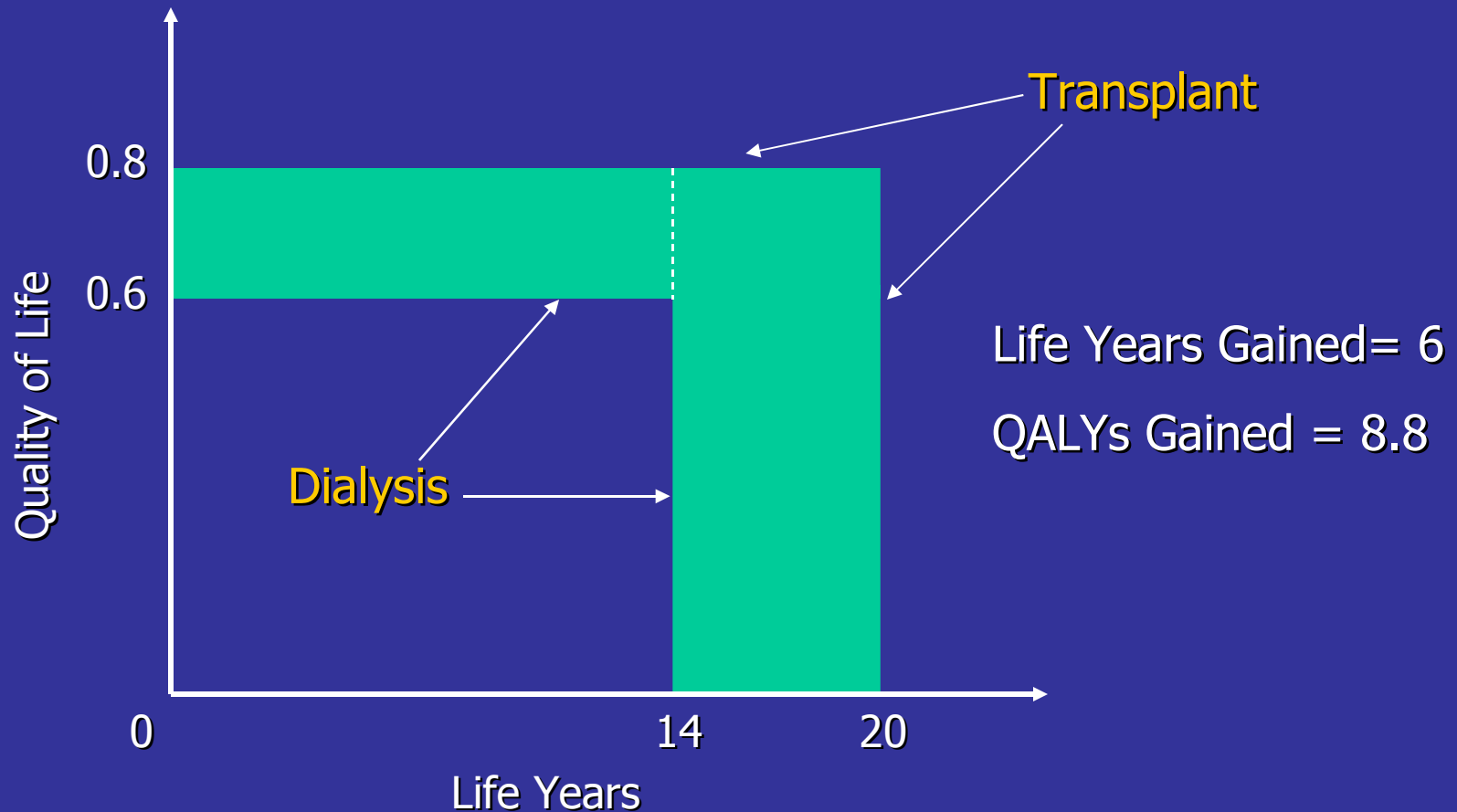
Types of economic evaluation

- » Cost-Effectiveness Analysis (CEA)
 - ↳ Benefits not explicitly valued - natural units used e.g. Life Years Gained (LYG) or cases detected
- » Cost-Utility Analysis (CUA)
 - ↳ Benefits valued – typically based on LYG weighted by an index of Quality of Life – Quality Adjusted Life Years (QALYs)
- » Cost-Benefit Analysis (CBA)
 - ↳ Benefits valued - based on monetary valuations of health improvements and expressed in dollars

Quality Adjusted Life Years (QALYs)



Quality Adjusted Life Years (QALYs)



Health Economics of ADHD

- » ADHD is severely impairing
- » It endures
- » ADHD patients remain impaired from infancy to old age
- » QALY will be very high
- » Treatments are efficient, efficacious and effective
- » ICER/QALY in ADHD favours provision of optimal treatment

Steps to Change

- » *Recognize ADHD as common, impairing, and treatable*
- » *Identify current services*
- » *Identify where there are no services*
 - ↳ *There is not a single centre of excellence for ADHD in adults in Canada*
- » *Assign responsibility to care*
- » *Develop interministerial services*
- » *Example: National Institute for Health and Clinical Excellence has produced a practice guideline which mandates centres of excellence for ADHD throughout the UK including adult ADHD*

Research Objectives

- » Measure direct and indirect costs of ADHD in Canadian dollars
- » Measure current pharmacoepidemiology of treatment
- » Identify epidemiology of what patients are receiving and compliance with treatment
- » Identify patterns of insurance provision in Canada
- » ICER/QALY of medication treatments using a health utility for ADHD¹ based on the EurQoL-5D

Research Objectives II

- » Develop a health utility for the Child Health Illness Profile, a more appropriate quality of life measure for ADHD in children¹
- » Identify the psychiatric adverse events of medication
- » Measure the functional impairment and actual adaptive skills of children and adolescents with ADHD

Method

- » 200 sequentially identified clinic children with no exclusionary criteria apart from understanding English
- » Measures:
 - ↳ Child Health Illness Profile (quality of life – satisfaction, resilience, achievement, comfort, risk avoidance)
 - ↳ Adaptive Behavior Assessment System¹
 - ↳ Resource Utilization Questionnaire
 - ↳ Strengths and Difficulties Questionnaire²
 - ↳ Pediatric Adverse Events Rating Scale³
 - ↳ Diagnoses (K-SADS)

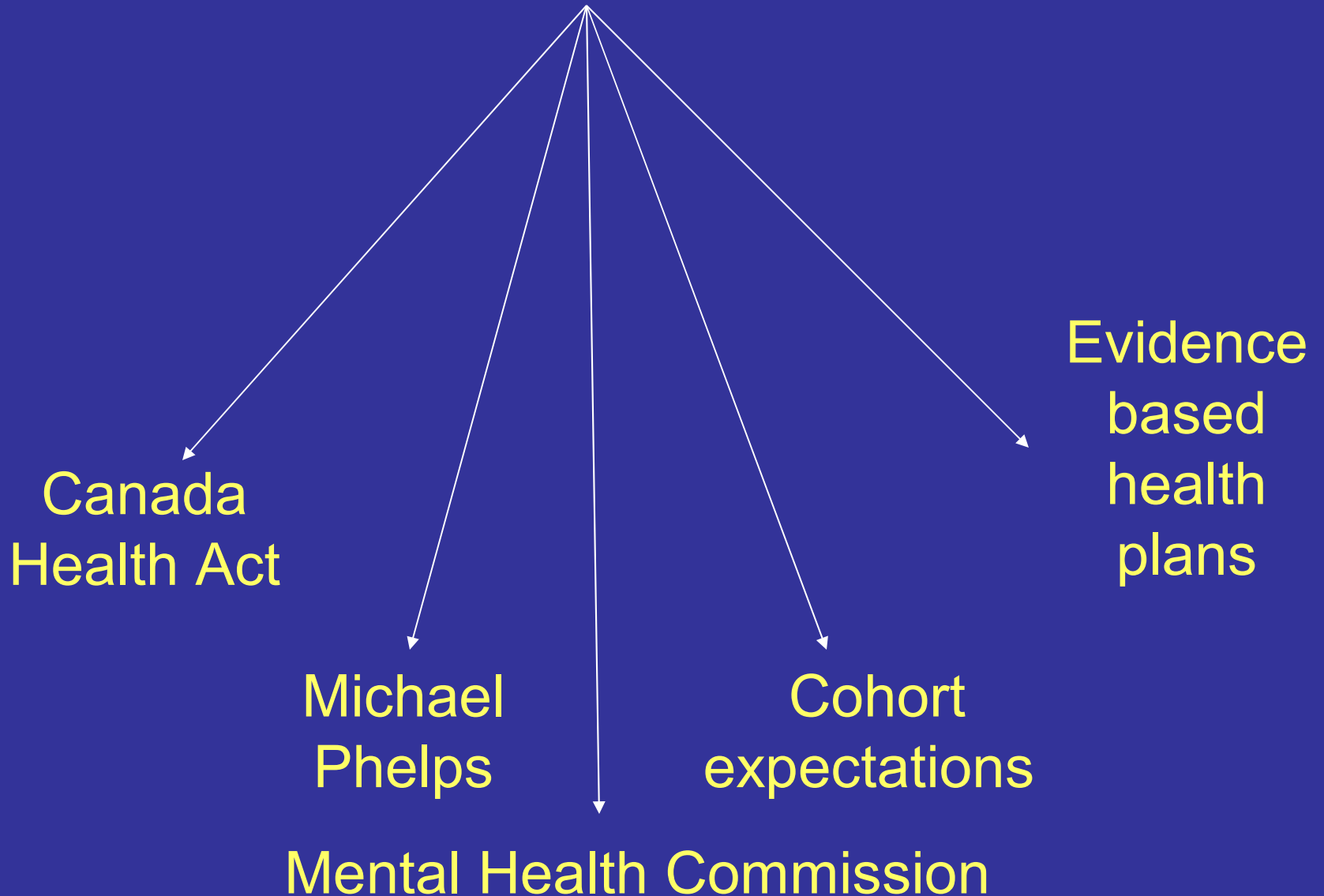
Analyses

- » CUA of current medication treatment and patterns of treatment, treatment duration and persistence
- » Direct and indirect costs of ADHD itself grouped by education, health, parental lost days of work, family costs, day care costs, tutors
- » Adaptive skills
- » Youth and parent report of impact on quality of life
- » Correlation of ADHD with broad spectrum psychopathology
- » Impact of ADHD on prosocial skills

Preparing the Future

- » Data lock 2010
- » ICER/QALY of ADHD treatment
- » The social costs of ADHD
- » The family costs of ADHD
- » The personal burden to the child with ADHD
- » Health utility of ADHD using EQ-5D and CHIP

Our Changing Social Context



Implications for allocation at federal and provincial levels

- » Legitimizes demands by public for expanded services within Canada
- » Suggests mechanisms for rationalization of planning and delivery
- » Optimistic approach to health care planning
 - Assumption that health care allocation will rise above politics
 - Health care allocation will rise above the stigma of mental illness
- » ADHD is an orphan condition
 - ↳ Pediatric illness is the orphan of medicine
 - ↳ Mental illness is the orphan of health care
 - ↳ ADHD is the orphan of mental illness
 - ↳ Adult ADHD requires expertise in developmental disorders (pediatric) but is mandated to be serviced in the adult system
 - ↳ The ADHD child/adult never made a great poster boy until Michael Phelps

Drugs and Psychological Intervention

- » Inability to purchase medically necessary drugs has allocation implications
 - Down-stream costs to system
 - » increased hospitalization rate
 - » increased acuteness at hospitalization
 - » decreased productivity
 - » Poor compliance
- » Unavailability of drugs has allocation implications
- » ADHD is a disorder of performance. It is a disorder of adaptive skills. Medication minimizes symptoms and provides the opportunity but not the guarantee for skill development
 - ↳ Pills do not build skills

Basic theses

- » A just society has an obligation to provide health care services to its members in order to remove or minimize health-based differences that might otherwise prevent the members from taking equal advantage of the opportunities that are available within that society.
- » Our health care system has to accommodate changes in disease, disease recognition, and emergent conditions
 - ↳ When PKU and CF became adult conditions it was initially serviced in pediatrics until adult services became available
 - ↳ When we had a SARS epidemic the health care system moved to accommodate the need
 - ↳ We cannot afford a stagnant budgetary process that does not reflect changing needs
- » *This means that provision for services in ADHD in pediatrics should include reasonable consideration of access to diagnoses with reasonable waits, school consultation, drug reimbursement, access to consultation for adults treated in primary care, and legally enforced adaptations for ADHD in schools and the work place.*

Steps to Change

- » *Recognize ADHD as common, impairing, and treatable*
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- » *Identify where there are no services*
 - ↳ *There is not a single centre of excellence for ADHD in adults in Canada*
- » *Assign responsibility to care*
- » *Develop interministerial services*
- » *It is happening*
 - ↳ *National Institute for Health and Clinical Excellence has produced a practice guideline which mandates centres of excellence for ADHD throughout the UK including adult ADHD (Philip Asherson)*
 - ↳ *Holland has a national adult ADHD centre (Sandra Kooij) which provides consultation to a regional expert in each area*