



ADHD across the lifespan – what are the costs to society?

Michael Schlander

Savoy Place, London, September 23, 2011



“The economic impact of ADHD” – United States

“A conservative estimate
of the annual societal
cost of illness
for ADHD in childhood
and adolescence is
\$45.5 billion...”¹

¹William E. Pelham et al. (2007)



So what?

Costs to society (United States):

- **US-\$ 45.5 billion attributable to ADHD (2005)**
in children and adolescents
 - Hereof, US-\$ 7.9 billion health and mental health services¹

Some comparative data:

- **US-\$ 14,000 billion Gross Domestic Product (USA, 2008)**
 - Hereof, 15.7% (US-\$ 2,200 billion) health spending (2008)²
- **US-\$ 65 billion Greek trade balance deficit (2008)²**
 - Greece's budget balance: debt 112.6% of GDP (2008)³
- **US-\$ 46.0 billion worldwide revenues Merck (2010)**
 - Hereof, US-\$ 39.8 billion "Human Health"⁴

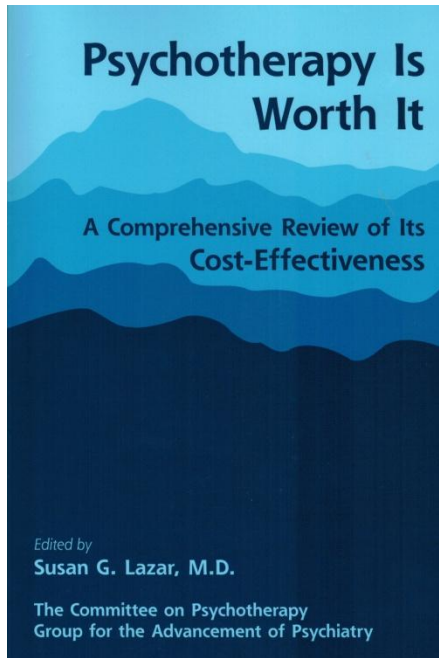
¹Estimates by William E. Pelham et al. (2007); ²The Economist, *World in Figures* (2011);

³The Economist, Feb. 4 2010; ⁴*Merck Annual Report 2010*, Whitehouse Station, NJ (2011)





So what?



Washington, DC, and London, England:
American Psychiatric Publishing (2010)

Some claims (1)

Children, referring to the NIMH MTA Study:¹

“Given **these considerations** [i.e., the broader societal costs incurred as a result of ADHD], the modest incremental costs for more effective versus less effective programs (the combination of medical management and behavioral treatment vs. the less costly medical management alone) should perhaps be considered.”

¹Peter S. Jensen et al. (2005)



So what?

Some claims (2)

Adult patients with ADHD:¹

“**Early medical treatment of ADHD** is highly relevant for health policy and for economics due to:

- the social drawbacks that impact many areas of daily life
- the high risk of developing further mental illnesses
and
- the costs to society.”

[...]

“Apart from the unquestionable mental indication, it is already **recommended by health economic reasons** to establish the conditions for an adequate treatment with these medicaments also for adults..”

¹A so-called “Health Technology Assessment” presented by Daniela Benkert et al. (2010) on behalf of DIMDI in Germany (a study initiated by Johnson & Johnson / Janssen-Cilag)



Economic evaluation

Cost analysis

- **Burden of Disease (BoD)**
 - Duration and quality of life lost
 - Measures: HALYs (DALYs, QALYs; unweighted)
- **Cost of Illness (CoI)**
 - Total (direct / indirect / ?) cost to society due to a disorder
- **Budgetary Impact Analyses (BIAs)**
 - Predicted impact of adopting a technology on a health care budget (payer's perspective)

Comparative analysis

- **Cost Benefit Analysis (CBA)**
- **Cost-Effectiveness Analysis (CEA)**
 - Cost Utility Analysis (CUA)
 - Cost Consequence Analysis (CCA)
- **Cost Minimization Analysis (CMA)**



Economic evaluation

Principles of costing

“Costs are not immutable facts

lying ripe in the field
waiting merely to be garnered,
or even selectively winnowed,
by diligent clerical officers.



The **nature of the decision** for which a
study is a managerial input will dictate
the likely **opportunity costs** ...”¹

¹**C.A. Blades et al. (1987)**
Social Science & Medicine 25 (5): 461-472

Opportunity cost definition: “the **value** of the best alternative that is foregone in order to produce the good under consideration”



Economic evaluation

Perspectives of costing studies

– Societal perspective

(all costs excluding transfer payments)

Opportunity costs are not the same as monetary flows:

- Transfers, taxes, insurance premiums (redistribution)
- Opportunity costs may occur without monetary flows:
e.g., voluntary work, air pollution
- Monetary flows are often different from opportunity costs:
distorted prices due to subsidies, incentives (tariffs, charges)

– Insurance (/ payer) perspective

– Employer perspective

– Individual (/ family / household) perspective



Economic evaluation

Types of costs in health economic evaluation

→ Direct costs

- Direct medical costs
- Direct nonmedical costs

→ Indirect costs

- Days off work due to illness
- Early retirement, premature death
- Human capital versus friction cost approach

→ Intangible costs

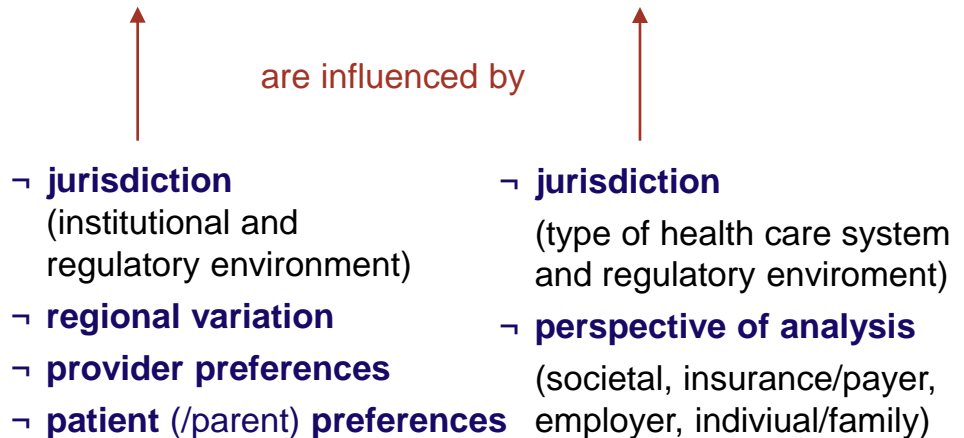
- Pain and suffering due to illness
- Pain and suffering due to treatment



Economic evaluation

Costing for analysis

Costs = Resource utilization X Unit costs





ADHD: Burden of disease (children and adolescents)

– Health care system

- Increased health care utilization and **direct medical costs** (reported to be comparable to children with asthma); including emergency room visits (...)
- Increased risk of **substance abuse disorders** (including earlier onset and lower probability to quit in adulthood)
- Increased risks of **injuries, bike and motor vehicle accidents**

– Peer relationships, school and occupation

- Frequent **peer problems** and difficulties interfering with **friendships**
- Many expelled; increased **drop-out rates**; special education programs; **impaired educational outcomes** and **lower occupational status**

– Family and employers

- Parental **divorce** (or separation) rates increased; sibling fights
- Parental **absenteeism** and **productivity loss**

– Society

- **Criminal behavior; justice and legal system costs**



“The economic impact of ADHD” – United States

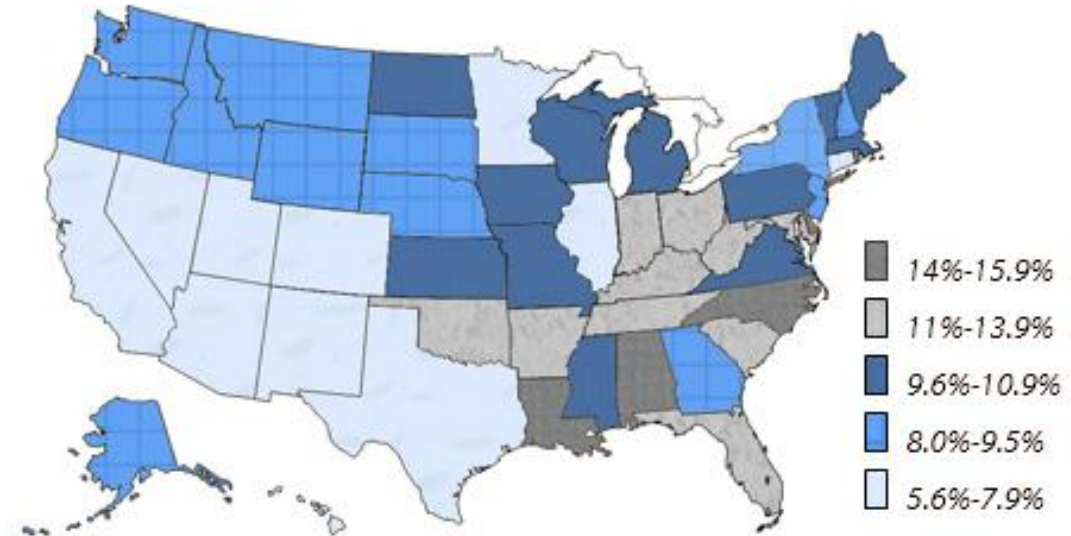
Sector	Per-child	Number	Aggregate
Health and mental health services	\$ 2,636	3 million (assuming ADHD prevalence of 5% and 60 million school aged children based on US census 2000)	\$ 7.9 billion
Education	\$ 4,900		\$ 13.6 billion
Crime and delinquency	\$ 7,040		\$ 21.1 billion
Total	\$ 14,576	?	\$ 42.5 billion

¹Estimates presented by William E. Pelham et al. (2007)



Regional variation of ADHD diagnosis rates

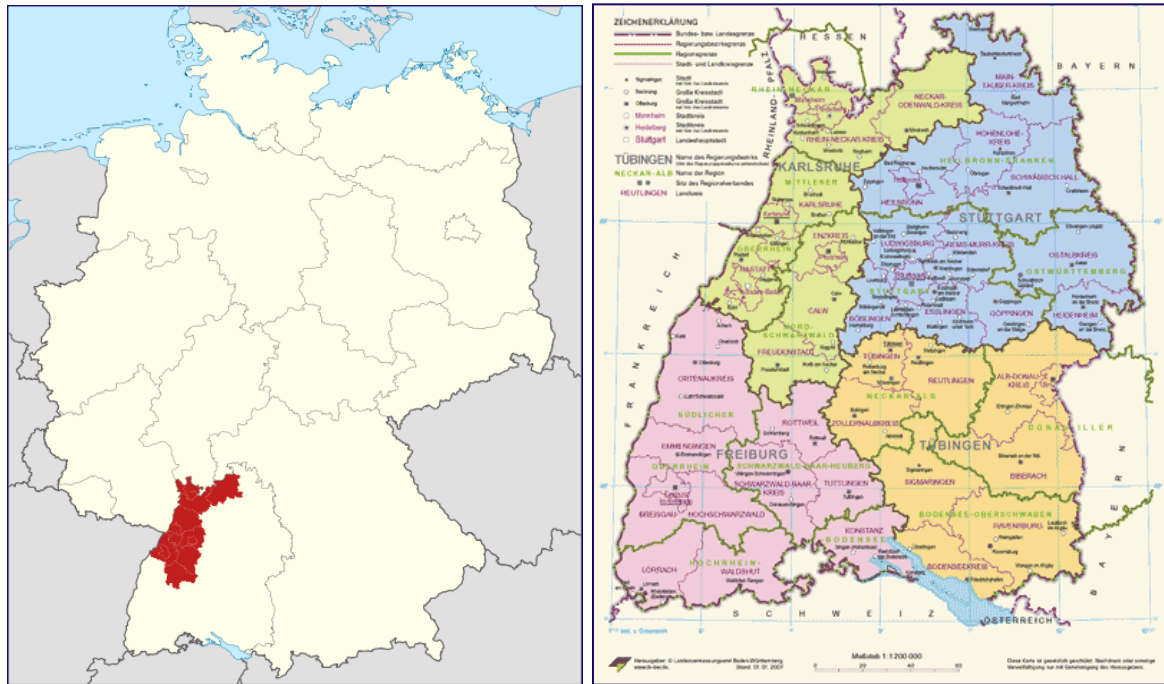
State-based prevalence of ADHD among children (age 4-7 years, ever diagnosed, parent-reported)¹



United States, 2007. The percentage of children with a parent-reported ADHD diagnosis increased by 22% between 2003 and 2007. There was substantial variation by state, with prevalence rates ranging from 5.6% in Nevada to 15.6% in North Carolina. Source: National Survey of Children's Health (NSCH); Centers for Disease Control and Prevention, Atlanta, GA: November 12, 2010



ADHD in Nordbaden, Germany



Nordbaden (left, red; right, green), the administrative district of “Karlsruhe” (*Regierungsbezirk Karlsruhe*) in the German state of Baden-Wuerttemberg, comprises of major parts of the Metropolitan Area Rhine-Neckar (*Metropolregion Rhein-Neckar*) including the cities of Mannheim and Heidelberg, as well as the urban areas (*Stadtkreise*) of Karlsruhe and Pforzheim.



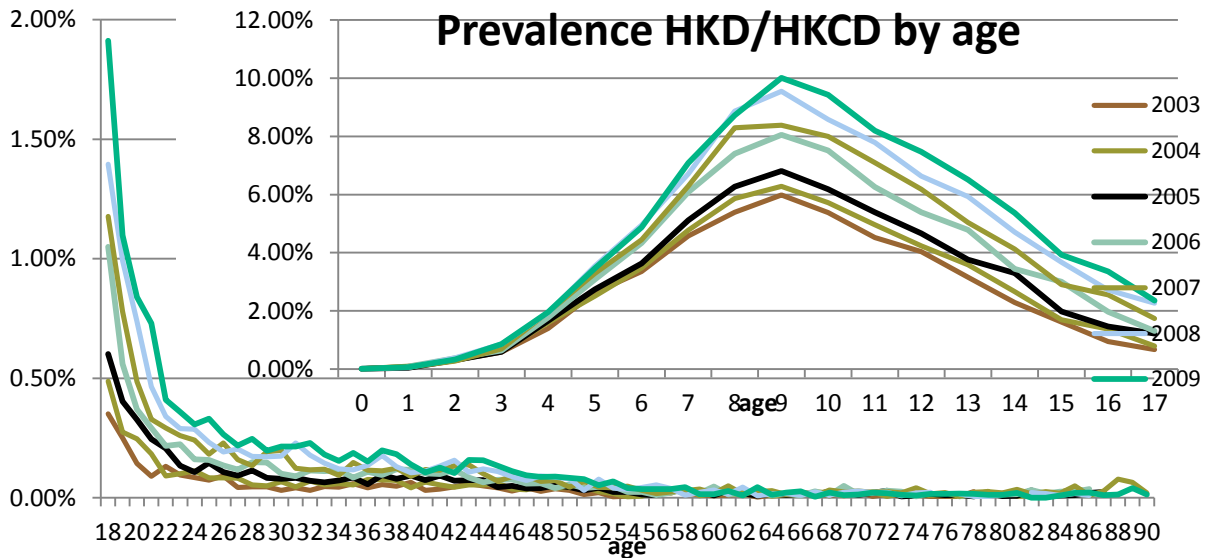
The Nordbaden Project at a glance:¹

- **Retrospective claims database analysis**
- **Population**
 - >2.2 million persons covered by Statutory Health Insurance (full coverage of the regional population insured by SHI)
 - representing 82% of the total population in Nordbaden
 - sample representing ~3% of the total population in Germany
- **Case control technique**
 - matched pairs (by age, gender, type of health insurance)
 - for examination of co-morbidity, utilization, and costs
- **Trends over time: longitudinal extension 2003 - 2009²**
 - including administrative prevalence, cost and quality
 - from the perspective of Statutory Health Insurance (only)

¹for a full description, cf. Study Protocols (“Projektbeschreibung”), InnoVal^{HC}, 2004 and 2010; longitudinal analyses ongoing



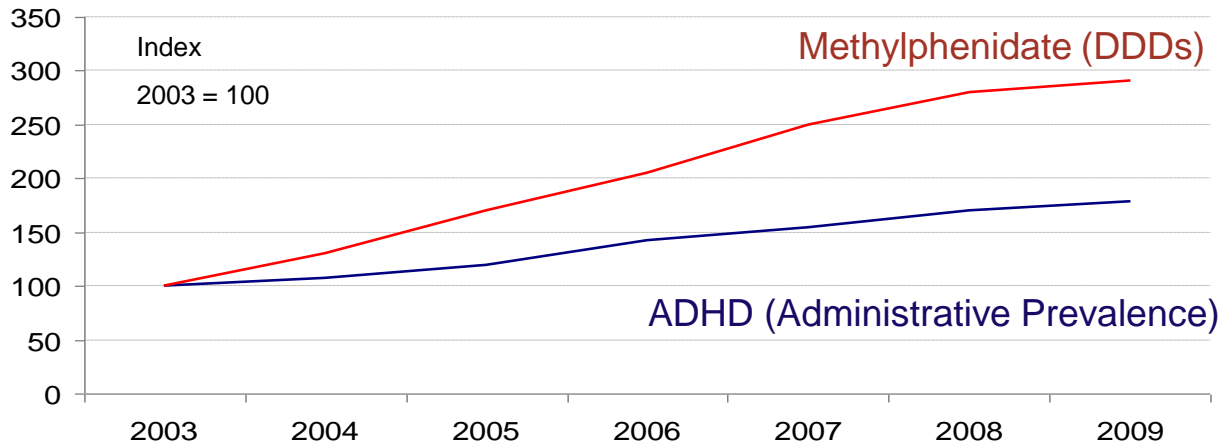
ADHD administrative prevalence 2003 - 2009 (Nordbaden, Germany)



Both in children and adolescents (a) and in the adult population (b) of Nordbaden / Germany, the administrative prevalence of ADHD (“hyperkinetic disorder,” with or without concomitant conduct disorder) increased continuously from 2003 to 2009. Age and gender related patterns remained stable during the observation period. Berlin, May 2011. M. Schlander et al. (2011).



ADHD administrative prevalence and stimulant prescription trends: 2003 - 2009

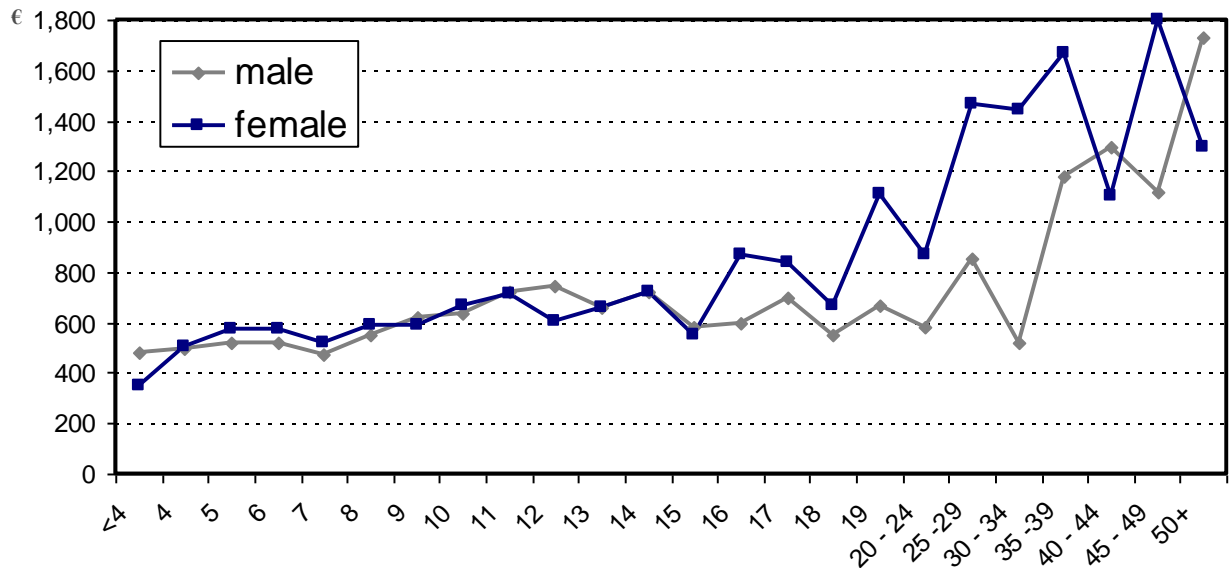


Number of cases with a diagnosis of ADHD in Nordbaden, 2003 to 2009 (blue; index [2003] = 100) and consumption of methylphenidate (red, DDDs; index [2003] = 100). Source of German methylphenidate consumption data: Schwabe and Paffrath, 2010; updated prescribing analyses for Nordbaden are currently underway. Berlin, May 2011. M. Schlander et al. (2011).



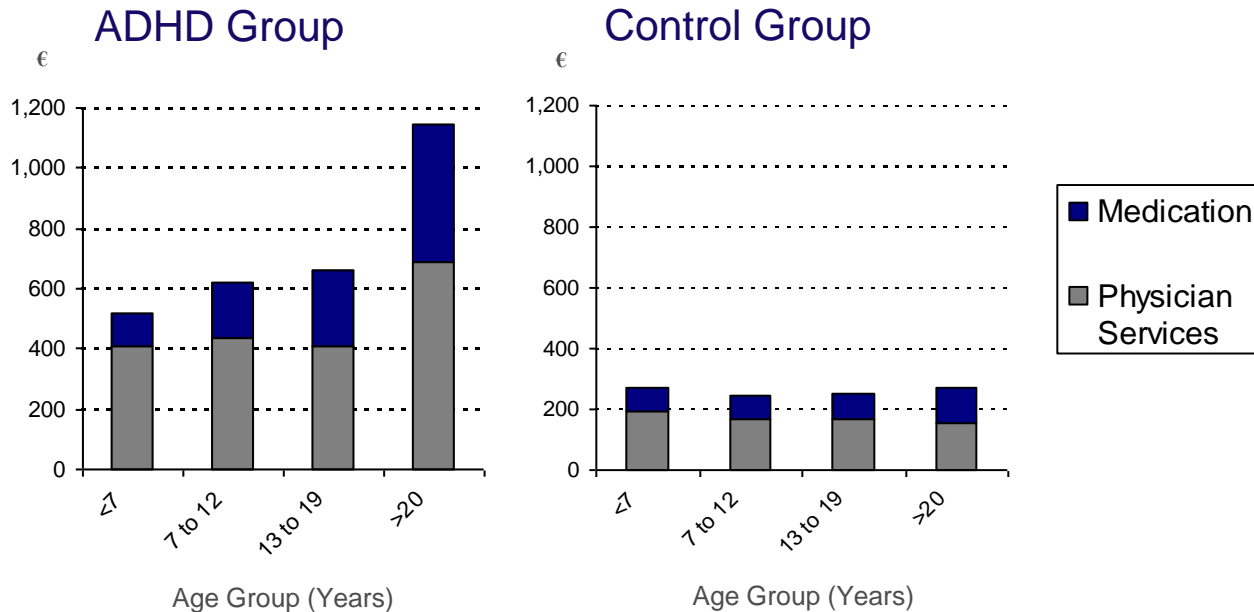
ADHD-related direct health care expenditures Average cost per patient (Nordbaden, 2003)¹

Impact of age and gender

¹Schlender et al. (2008)



ADHD-related direct health care expenditures Average cost per patient (Nordbaden, 2003)¹

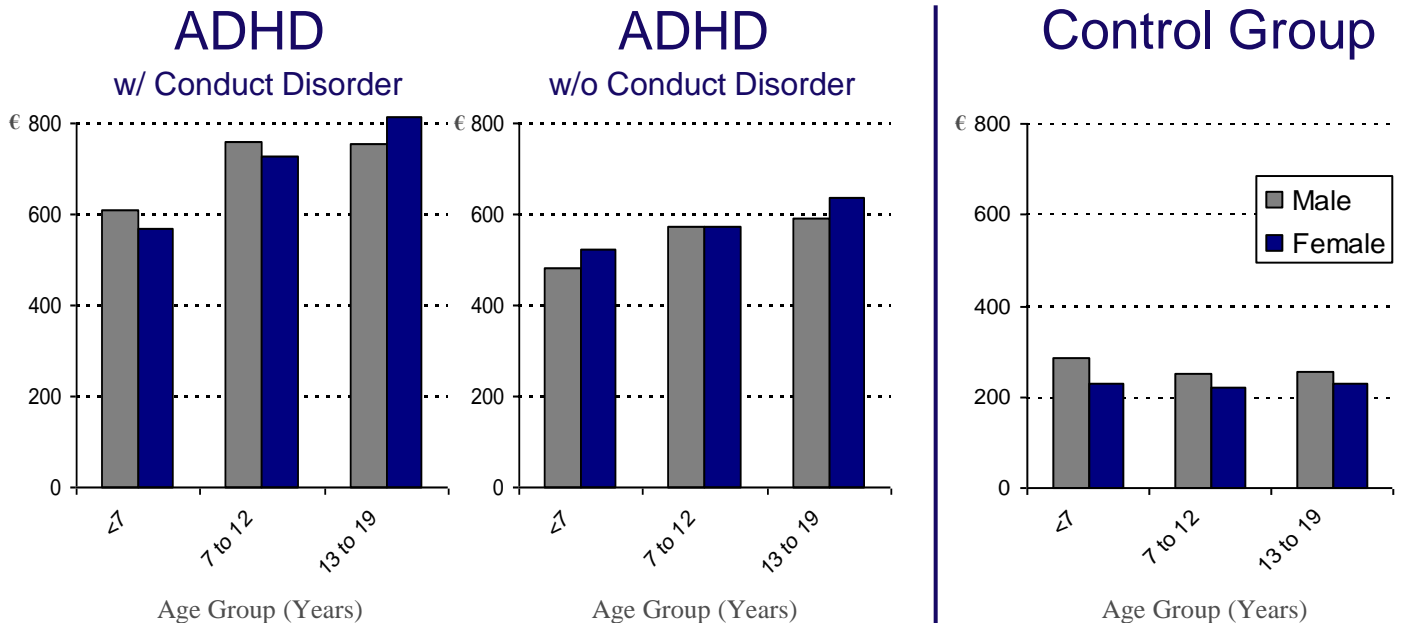


¹M. Schlander et al. (1008 and unpublished data)



ADHD-related direct health care expenditures

Average cost per ADHD patient
in the presence or absence of **Conduct Disorder**¹

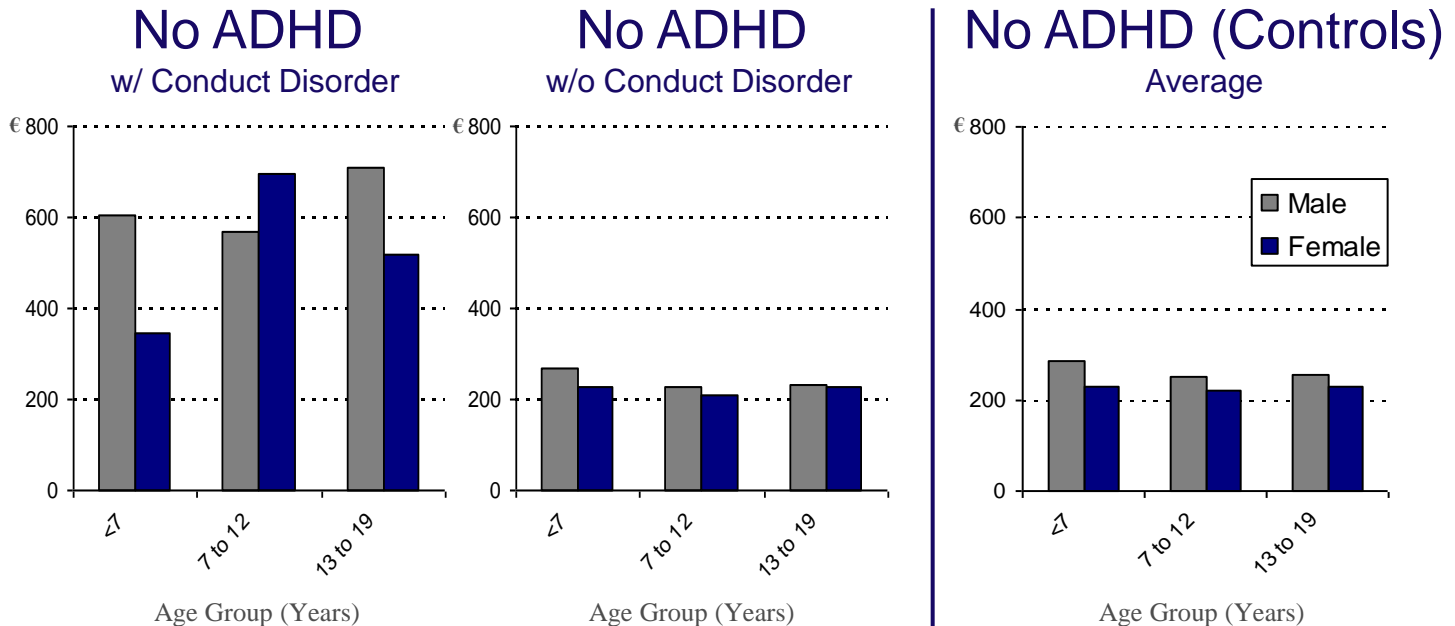


¹Nordbaden 2003



ADHD-related direct health care expenditures

Average cost per patient without ADHD
in the presence or absence of **Conduct Disorder**¹



¹Nordbaden 2003



ADHD: Co-existing conditions I (children) (administrative data from Nordbaden, 2003)¹

- **Conduct & personality disorders**
 - 39.3% vs. 3.9%
- **Mood and affective disorders**
 - 38.0% vs. 8.9%
 - Emotional disorders, neurotic disorders, depression, phobia, anxiety
- **Specific development disorders**
 - 37.4% vs. 13.4%
- **Specific developmental disorders of scholastic skills**
 - 23.0% vs. 2.8%

¹in children adolescents (n=11,245), compared to control group matched by age, gender, and type of health insurance.
M. Schlander, O. Schwarz, G.-E. Trott, et al. (2006)



ADHD: Co-existing conditions II (adults) (administrative data from Nordbaden, 2003)¹

Key findings

(Prevalence rates >1% only, RR>3 only)

- **Mood / affective disorders (61.8% vs. 14.3% in control group)**
- **Conduct & personality disorders (33.2% vs. 0.6%)**
- **Adjustment disorders (18.9% vs. 3.0%)**
- **Sleep disorders (11.3% vs. 2.3%)**
- **Disorders due to substance abuse (7.8% vs. 1.9%)**
- **Disorders due to brain damage (5.1% vs. 0.6%)**
- Eating disorders (4.3% vs. 0.3%)
- Specific developmental disorders (3.8% vs. 0.6%)
- Mental retardation (2.4% vs. 0.2%)
- Developmental disorders of scholastic skills (2.2% vs. 0.3%)
- Habit and impulsive disorders (1.4% vs. 0.0%)

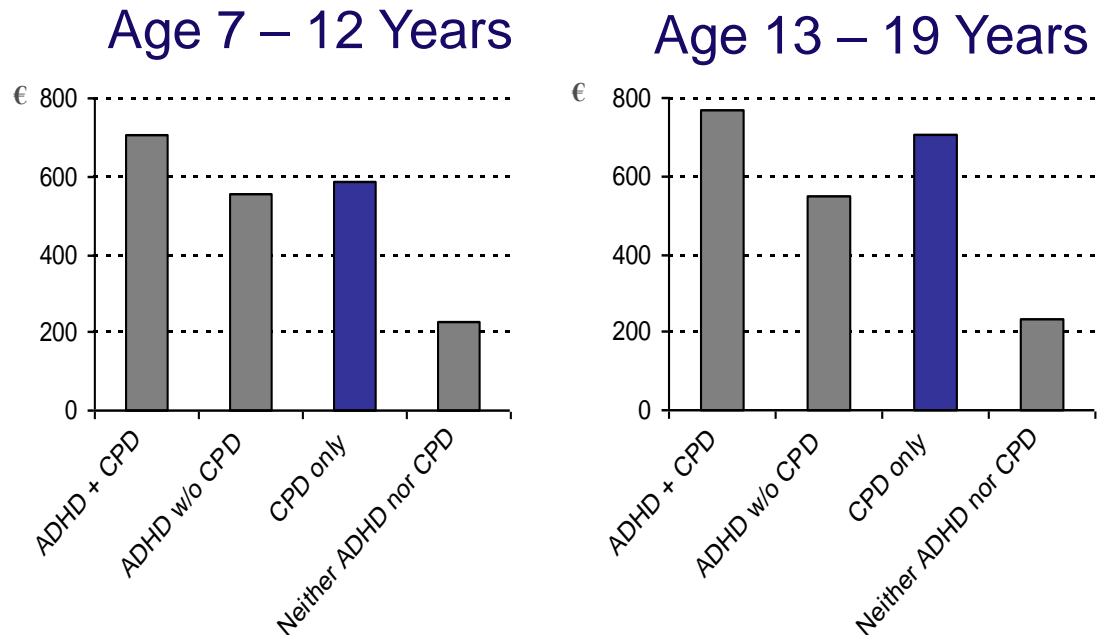
¹in adults (n=630),
compared to control group
(n=630) matched by age, gender,
and type of health insurance.

M. Schlander, O. Schwarz, G.-E. Trott, et al. (2006)



ADHD-related direct health care expenditures

Impact of ADHD and Conduct & Personality Disorders¹

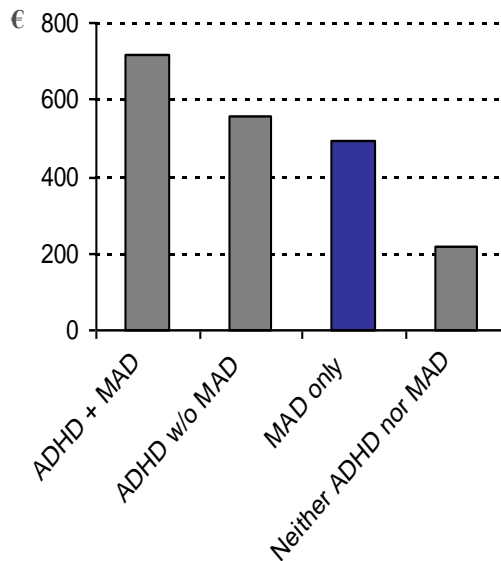
¹Nordbaden 2003



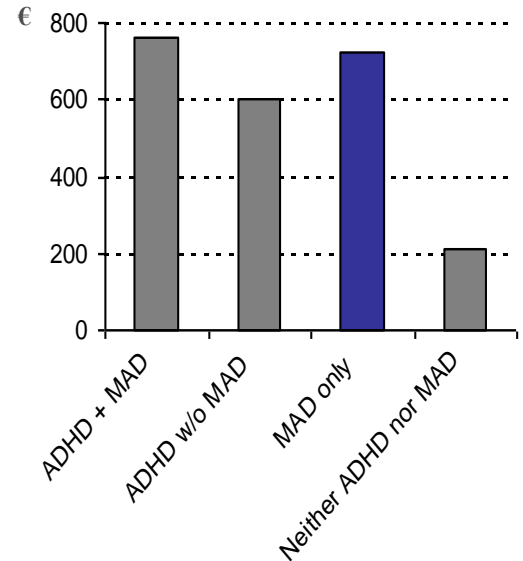
ADHD-related direct health care expenditures

Impact of **ADHD** and **Mood & Affective Disorders**¹

Age 7 – 12 Years



Age 13 – 19 Years

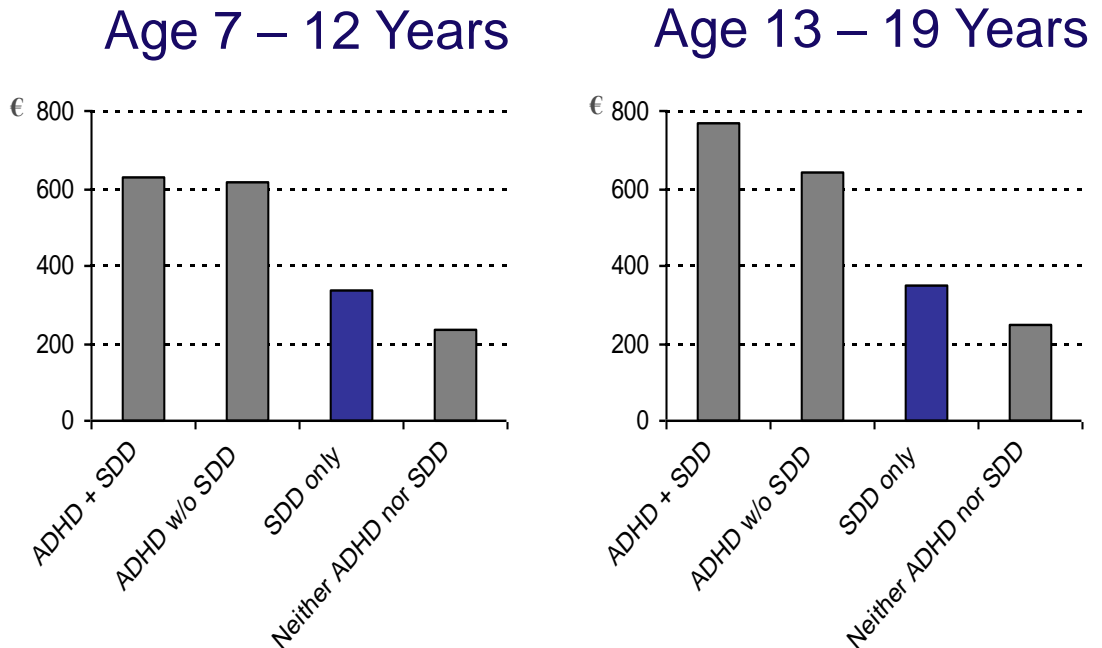


¹Nordbaden 2003



ADHD-related direct health care expenditures

Impact of ADHD and Specific Development Disorders¹



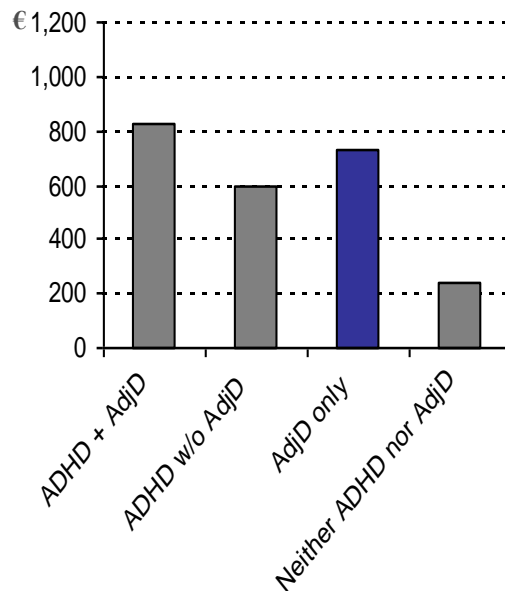
¹Nordbaden 2003



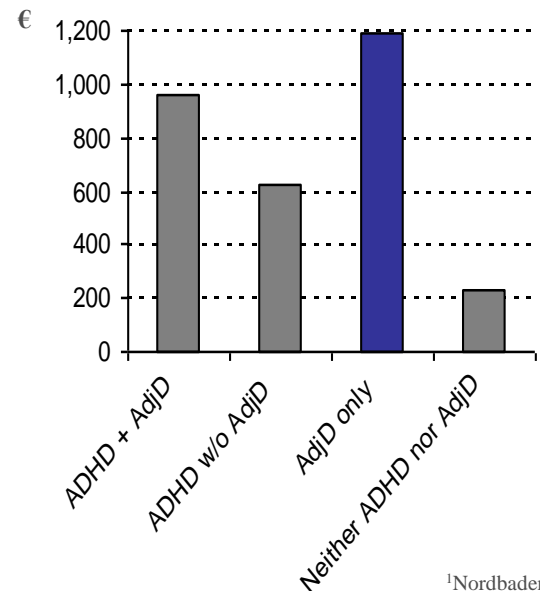
ADHD-related direct health care expenditures

Impact of ADHD and Adjustment Disorders¹

Age 7 – 12 Years



Age 13 – 19 Years

¹Nordbaden 2003



ADHD: Cost of illness (recent international studies)

– Service utilization in preschool children¹ (3- and 4-year-old, United States)

- Recruited in New York, NY, local area public and private preschools
- Sample size n = 109 (plus n = 97 control children without ADHD)
- ADHD diagnosis established based on parent interviews applying the Kiddie-SADS-PL diagnostic tool

– Methods

- Parent interviews on duration and frequency of service use
- **Services covered in study:**
occupational therapy, physical therapy, speech therapy, special education

– Calculated aggregate cost of services

- Preschoolers with ADHD were significantly more likely than controls to have received any **adjunctive support** ($p < 0.001$) and incurred costs of
- **US-\$ 16,000 per child with ADHD, i.e.,**
- **four times higher than for preschool children without ADHD**

¹Marks et al., 2009



ADHD: Cost of illness (recent international studies)

– Prevalence and workplace costs of adult ADHD¹ (in a large manufacturing firm, United States)

- Employees recruited in a large US manufacturing firm in 2005 and 2006
- Sample size n = 4,140 in 2005 and n = 4,423 in 2006
- ADHD diagnosis established based interviews applying the Adult ADHD Self-Report Scale (of the WHO)

– Methods

- Respondents represented 35-38% of the workforce of the firm (estimated ADHD prevalence, 1.9%, mostly untreated)

– Reductions in work performance

- ADHD was associated with a 4-5% reduction in work performance,
- a 2.1 relative-odds of sickness absence, and
- a 2.0 relative-odds of workplace accidents / injuries
- **The human capital value of the lost work performance totaled US-\$ 4,336 per worker with ADHD in the year before interview**

¹Kessler et al., 2009



ADHD: Cost of illness (recent international studies)

– Health benefit costs, absence days, and turnover among employees with children with ADHD¹

(multi-employer database study, United States)

- Regression modeling used to analyze the employer economic burden of ADHD for employees with ADHD and for employee caregivers with ADHD

– Methods

- Employees with ADHD (n = 539) and without ADHD (n = 93,722) were identified, also caregivers of children with ADHD

– Increased health benefit costs, absence days, and turnover

- Annual health benefit costs US-\$ 6,885 vs. US-\$ 4,242 (p<0.01)
- Absence days 8.86 vs. 7.16 (p<0.01)
- Turnover 8.99% vs. 5.26% (p<0.01)
- **Similar results were found for employee caregivers of children with ADHD**

¹Kleinman et al., 2010



A tentative summary of key observations

- Without any reasonable doubt, ADHD is associated with **staggering social costs**.
- Apparently, the societal costs associated with ADHD **dwarf the costs of health care interventions**.
- However, despite some preliminary estimates, the **economic burden** associated with ADHD **has not yet been properly quantified**.
 - Reliable studies of the cost of ADHD are cumbersome and should
 - address the impact of severity and coexistent conditions on resource use and long-term consequences and
 - take into account international and regional differences.
- As a matter of principle, **cost of illness studies cannot prove the value of interventions**.
 - They may nevertheless be politically useful.



So what?

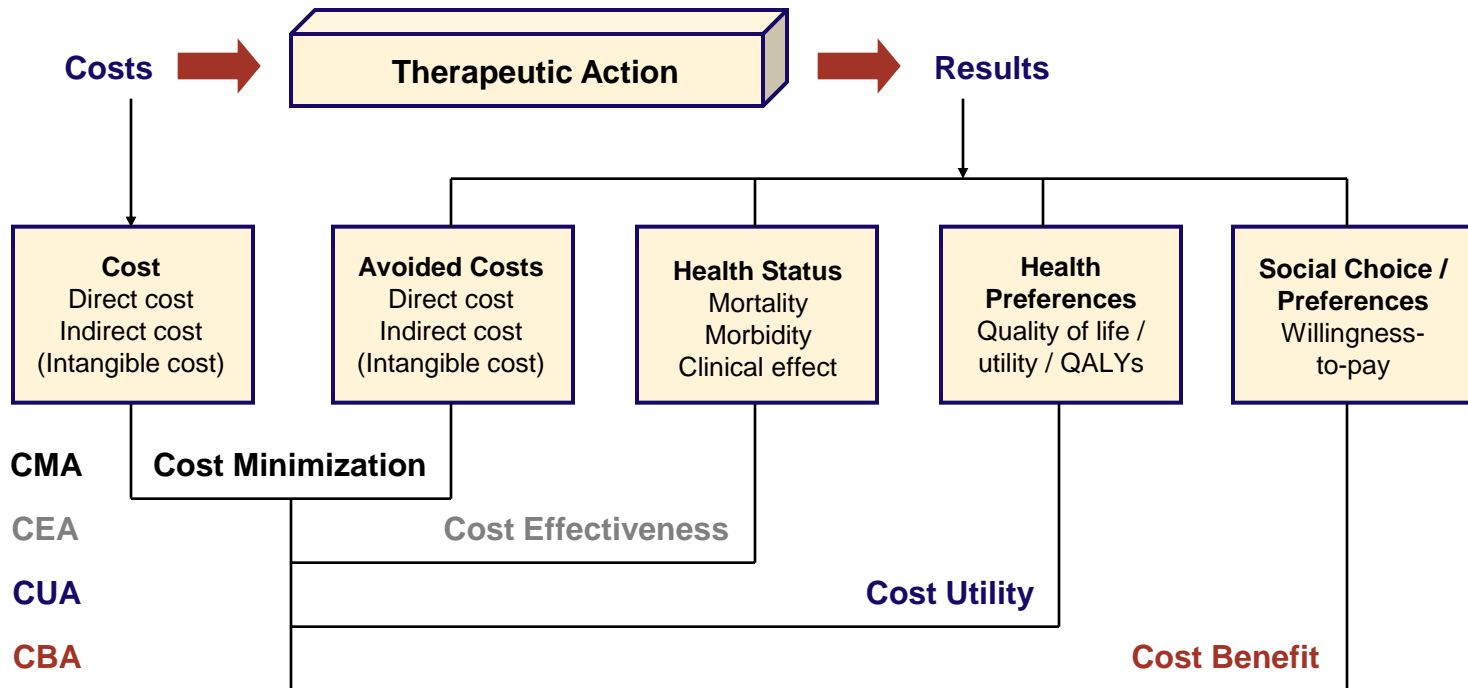
**Health care, educational, social
services for patients with ADHD**

Are they worth it?



Economic Evaluation

“A comparative analysis of alternative courses of action in terms of their costs and consequences”





Evidence-based ADHD treatments – how should they be sequenced?

- **Begin medication first?**
 - Predominant physician practice in USA
- **Begin behavior therapy first?**
 - Apparently (many) parents' (and patients') preference
- **Begin simultaneously?**
 - Predominant physician preference in some European countries



Evidence-based ADHD treatments – how should they be sequenced?

- **Begin medication first?**
 - Predominant physician practice in USA
- **Begin behavior therapy first?**
 - Apparently (many) parents' (and patients') preference
- **Begin simultaneously?**
 - Predominant physician preference in some European countries
- **What would you prefer for yourself / to do with your own child?**
- **What are we willing to pay as a society?**
- **What can we afford as a society?**
- **What is the cost-effectiveness of these options?**

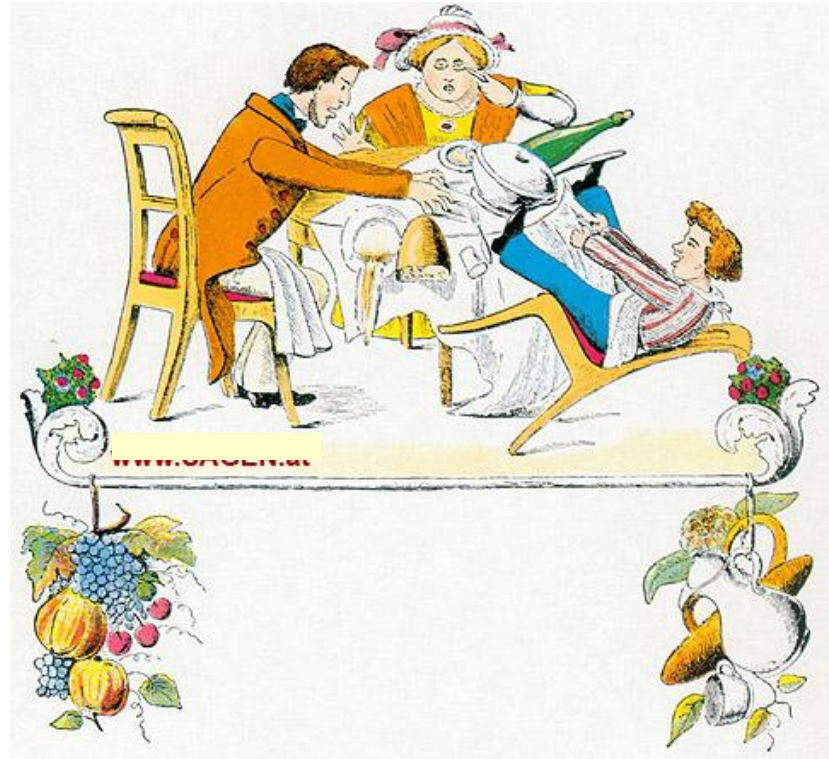


Attention-Deficit/Hyperactivity Disorder (ADHD)

→ Core symptoms

...

- inattention
- Impulsivity
- hyperactivity

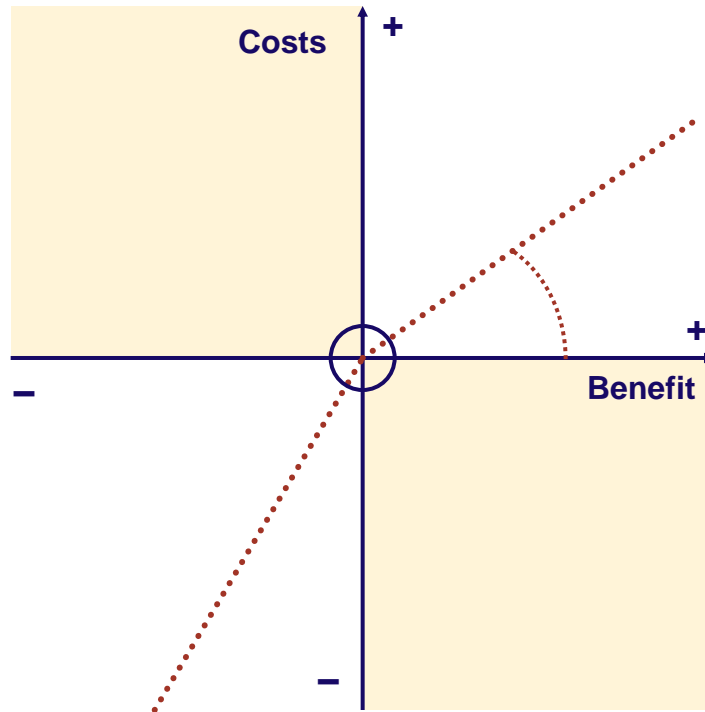


→ ...
and beyond?

Source: www.sagen.at



The Logic of Cost-Effectiveness: The C/E Plane¹



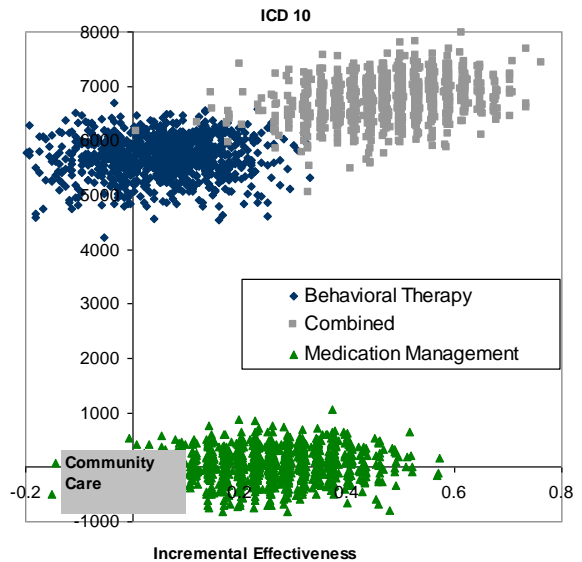
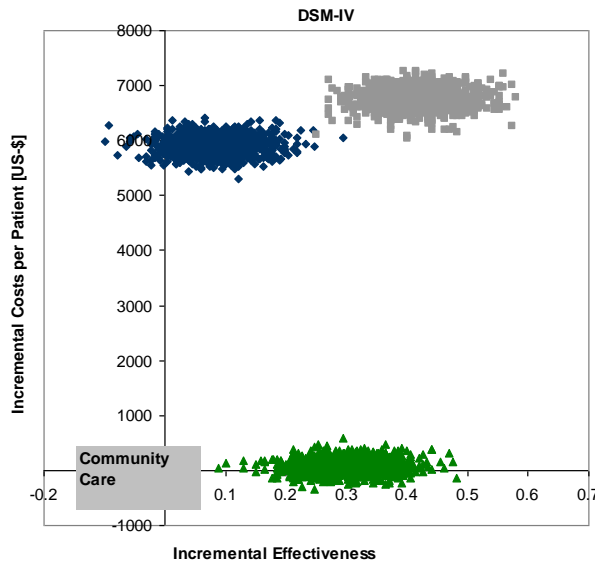
¹W.C. Black (1990)



NIMH MTA Study: Primary Economic Evaluation (United States)

ADHD (n=579)

HKD (n=145)





Estimates: Cost per QALY Gained: Incremental Cost-Effectiveness (Germany)¹

		ADHD all	ADHD only	HKD / HKCD	HKD only
MedMgt versus Do Nothing	Best Case	€ 20,138	€ 18,956	€ 22,620	€ 20,467
	Worst Case	€ 36,787	€ 34,627	€ 41,320	€ 37,387
Comb versus MedMgt	Best Case	€ 731,774	€ 637,102	€ 422,613	€ 299,124
	Worst Case	€ 1,336,707	€ 1,163,773	€ 771,973	€ 546,400

¹M. Schlander et al., 2005, 2006a, 2006b, 2006c



What Have We Learnt?

Currently Available Evidence (1)

– Medication Management¹

- Generally acceptable to attractive cost-effectiveness ratios
- Most attractive options may differ locally
- Long-acting stimulants appear broadly acceptable in terms of cost-effectiveness
 - Providing compliance advantages translate into superior effectiveness¹
- Noradrenergic drugs supported by less compelling data
 - Most likely economically inferior to MPH-MR

Data from

- USA, UK, D, S, NL, CAN, AUS, FIN, ...
- [product availability and unit costs?]
- CAN, UK, D, FIN, ...
- US data strongly suggestive¹
- CAN, Sweden?
- England +?; Scotland (SMC), AUS (PBAC)

¹For a recent review, cf. M. Schlander, *Current Pharmaceutical Design* 16 (2010) 2443-2461



What Have We Learnt? Currently Available Evidence (2)

- **Psychosocial Interventions**
 - **Few robust data available**
 - Mostly disappointing cost-effectiveness:
 - Appears to be inferior to intense medication management in terms of symptomatic normalization
 - Appears to be mostly inferior to intense medication management in terms of functional improvement
 - **May be a cost-effective option for children and adolescents with co-existing internalizing and (in combination with medication management) externalizing conditions, at least at higher levels of willingness-to-pay**
 - **Data needed ...**
 - **... on better targeted psychosocial interventions**
 - **... on long-term outcomes**



Towards a More Complete Analysis: What We (Still) Do Not Know

- **Virtually no robust data on cost effectiveness in adults**
- **Children: effect of treatment on long-term outcomes**
 - Evaluation of economic implications
- **Surrogate parameters: which variables might be useful predictors of long-term outcomes (and treatment success)**
- **Psychosocial Interventions**
 - Compelling data on cost-effectiveness urgently needed
 - Assess (better) targeted interventions (compared to MTA protocol)
- **Analyses from the perspectives of individuals (patients), families (caregivers), economies and society as a whole**
 - Treatment preferences of patients and caregivers?
- **Currently, still insufficient data for most jurisdictions**
 - Need to consider transferability of existing economic data



Thank you for your attention!

Prof. Michael Schlander, M.D., Ph.D., M.B.A.

Contact

www.innoval-hc.com

www.michaelschlander.com

michael.schlander@innoval-hc.com

michael.schlander@medma.uni-heidelberg.de

Address

An der Ringkirche 4

D-65197 Wiesbaden / Germany

