

Getting to the real cost of ADHD in adulthood

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Conflicts of Interest

Dr. Daley has

- Provided educational talks for Eli Lilly, Medice and Shire.
- Attended advisory boards for Eli Lilly and Shire.
- Received support for educational travel from Eli Lilly, Shire, and Medice.
- He has also received royalties from the sale of a self-help version of the New Forest Parenting Programme.
- Research funding from NIHR, ESRC and Shire.

CASA Cost Analysis Study group for ADHD



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Costs of ADHD

- Both the symptoms and impairments associated with ADHD lead to a considerable cost burden for the disorder¹
- Meta-analyses have demonstrated that the economic burden of ADHD impacts on different outcomes for Adults and Children²
- For adults the greatest cost burden is productivity and income losses (\$87B_ \$138B),
- But for children, the largest cost categories are health care (\$21B_ \$44B) and education (\$15B_ \$25B)

¹D'Amico, F., Knapp, M., Beecham, J., Sandberg, S., Taylor, E., & Sayal, K. (2014). Use of services and associated costs for young adults with childhood hyperactivity/conduct problems: 20-year follow-up. *The British Journal of Psychiatry*, 204(6), 441-447. Doshi, J. A., Hodgkins, P., Kahle, J., Sikirica, V., Cangelosi, M. J., Setyawan, J., ... & Neumann, P. J. (2012). Economic impact of childhood and adult attention-deficit/hyperactivity disorder in the United States. *Journal of the American Academy of Child & Adolescent Psychiatry*, 51(10), 990-1002.

Costs of ADHD

- The costs of ADHD have been widely estimated and indicate that the economic burden is much greater in adulthood than in childhood¹
- The ADHD cost burden varies considerably between studies²
- These variations can be attributed to a number of methodological limitations within the current literature

Costs of ADHD

- Few studies explore costs beyond direct medical costs and only a minority include costs to the justice system¹
- Most are dependent on existing insurance company databases which usually hold information on health variables only.
- Most studies report poor control or comparison groups,
 - usually involving matched or non-matched typically developing individuals or other heterogeneous clinical groups with potentially overlapping difficulties.
 - or national estimates that fail to control for genetic and environmental differences between individuals.

¹Beecham, J. (2014). Annual Research Review: Child and adolescent mental health interventions: a review of progress in economic studies across different disorders. *Journal of child psychology and psychiatry*, 55(6), 714-732

Aims of the study

- A retrospective evaluation of the societal and family borne costs for individuals who receive an ADHD diagnosis in adulthood (>18).
- To address the many methodological limitations in the current economic literature on ADHD.
- To measure a broad spectrum of outcomes: occupational, education, crime, health and more.
- To tap into the unique Danish Central Person Registers (CPR) databases. Allows an estimate of purer and more unbiased values for the true impact of ADHD.

Identifying adults with ADHD

- Danish Central Psychiatric Research register
- ICD-10 diagnoses: F90.0, F90.1, F90.8, F90.9, og F98.8
- **5,331 people identified**
- Mohr-Jensen et al (2016) confirmed the validity of ADHD diagnosis in the Danish registers using a case note analysis

Data sources

- The Danish Registers cover entire Danish population
 - Labour market attachment.
 - Income and tax payments.
 - Educational attainment.
 - Health care utilization in primary and secondary health care.
 - Demographic background variables including. parental education, income and siblings
- All data were subject to strict anonymity rules and available only on a closed server at Statistics Denmark.

Methods and data

- But first...
- How do we measure the costs correctly?
- Let's start by looking at some basic statistics about adults with ADHD.

Adults with ADHD vs general population (aged 18 – 65)

Table 1 Comparison of individuals with ADHD and the general adult population

	Individuals diagnosed with ADHD as adults		Non-ADHD adults
Demographic background			
Percentage aged 18-25	38.2		14.2
Percentage aged 26-40	47.7		31.0
Percentage aged 40+	14.1		54.8
Percentage male	64.0		51.1
Percentage immigrants	4.6		15.8
Labour market			
Average annual wage income (€)	18,661		41,458
Total annual income (€)	23,897		43,078
Percentage wage employed	25.0		67.1
Education			
Percentage Only Minimum Level	67.1		38.3
Percentage Obtained Third Level	4.9		19.3

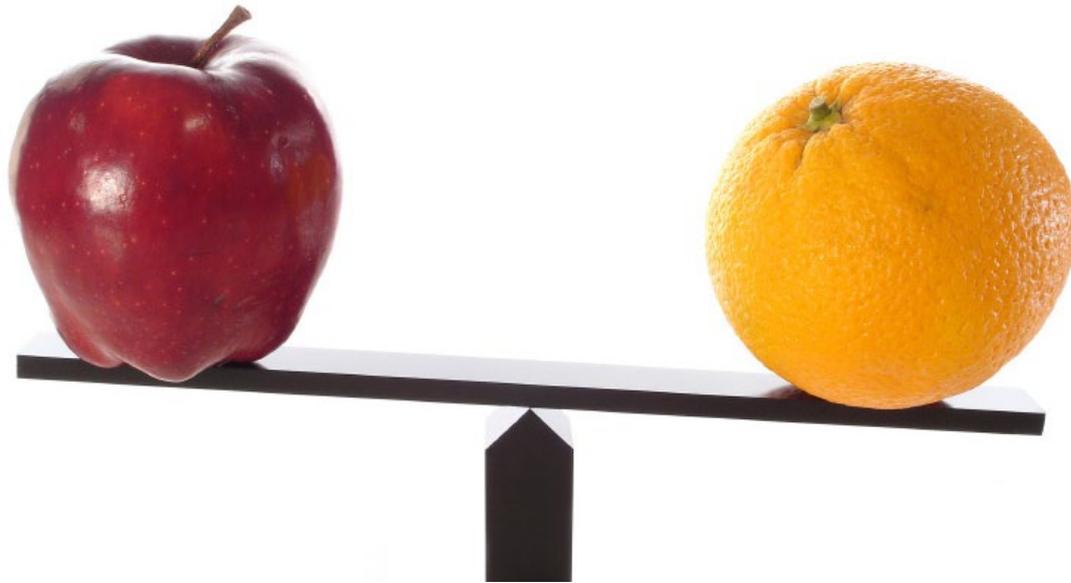
Adults with ADHD vs general population (aged 18-65)

Table 1 Comparison of individuals with ADHD and the general adult population

	Individuals diagnosed with	
	ADHD as adults	Non-ADHD adults
Stable childhood*	57.0	78.0
Percentage having been placed away from home	28.7	3.1
Average Yearly Parental Income (€)**	57,135	63,660
Share of Parents with only Minimum Education	43.0	35.6
Health		
Average number of Comorbid Psychiatric Diagnoses***	4.3	0.3
Percentage receiving ADHD-Medicine	85.2	-
Average Spending on Medicine (€)	1,528	209
Average Number of Primary Care Services	30.7	16.5
Average Number of Secondary In-Patient Days	4.0	2.4
Crime and Traffic		
Percentage with Conviction or Fine****	60.3	19.7
Hereof Road Traffic Act	13.9	11.4
Percentage having been in Traffic Accident*****	8.4	2.2
Age at diagnosis (percentage)		
18 - 20	23.6	-
21 - 25	23.4	-
26 - 30	17.7	-
31 +	35.3	-

Adults with ADHD are *very different* from the general population

Are we just comparing apples with oranges?



Sharpening our focus

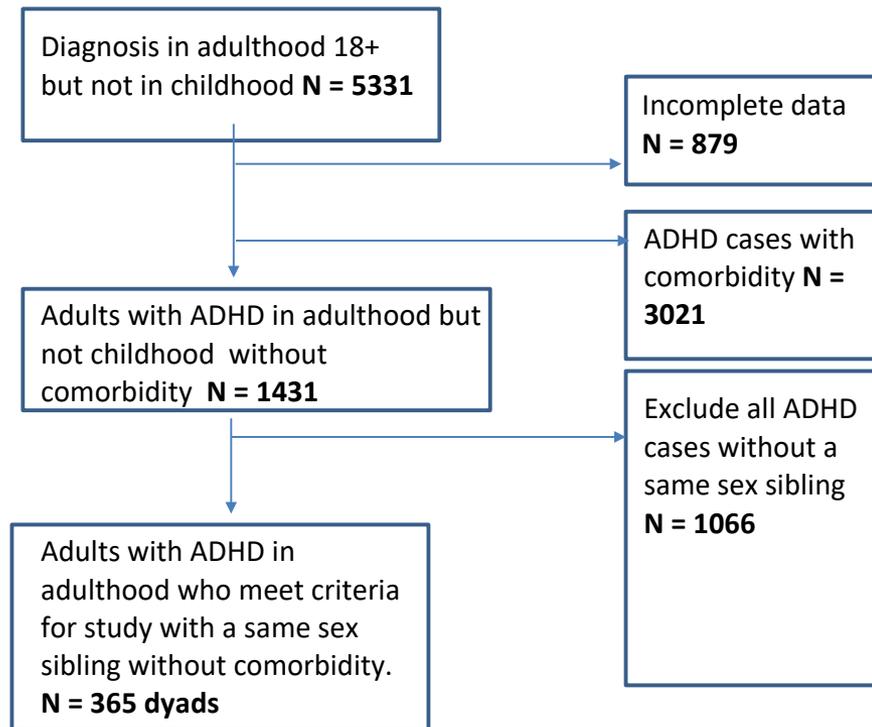
- Are differences due to ADHD? **OR** Due to other underlying factors?
- We need to control for these differences when measuring the economic impact of ADHD.
- If we fail to control for the background differences, we cannot say whether the resulting differences in outcomes are due to other characteristics of the groups (other illnesses, social background etc.)

Matching and sampling

- *We used a sibling comparison design.*
- In our study we use same sex sibling as the control group
- The hypothesis then is that – having controlled for all other differences – the only thing that separates the ADHD-group from the control is the ADHD diagnosis.

Identification of participants

Figure One: Showing identification of participants



We need to isolate the effect of ADHD

We use siblings as a comparison group, thus eliminating familial background variables and shared environment

Adults with ADHD



Siblings without
ADHD

Results



Yearly public cost differences between ADHD adults and their siblings in euros

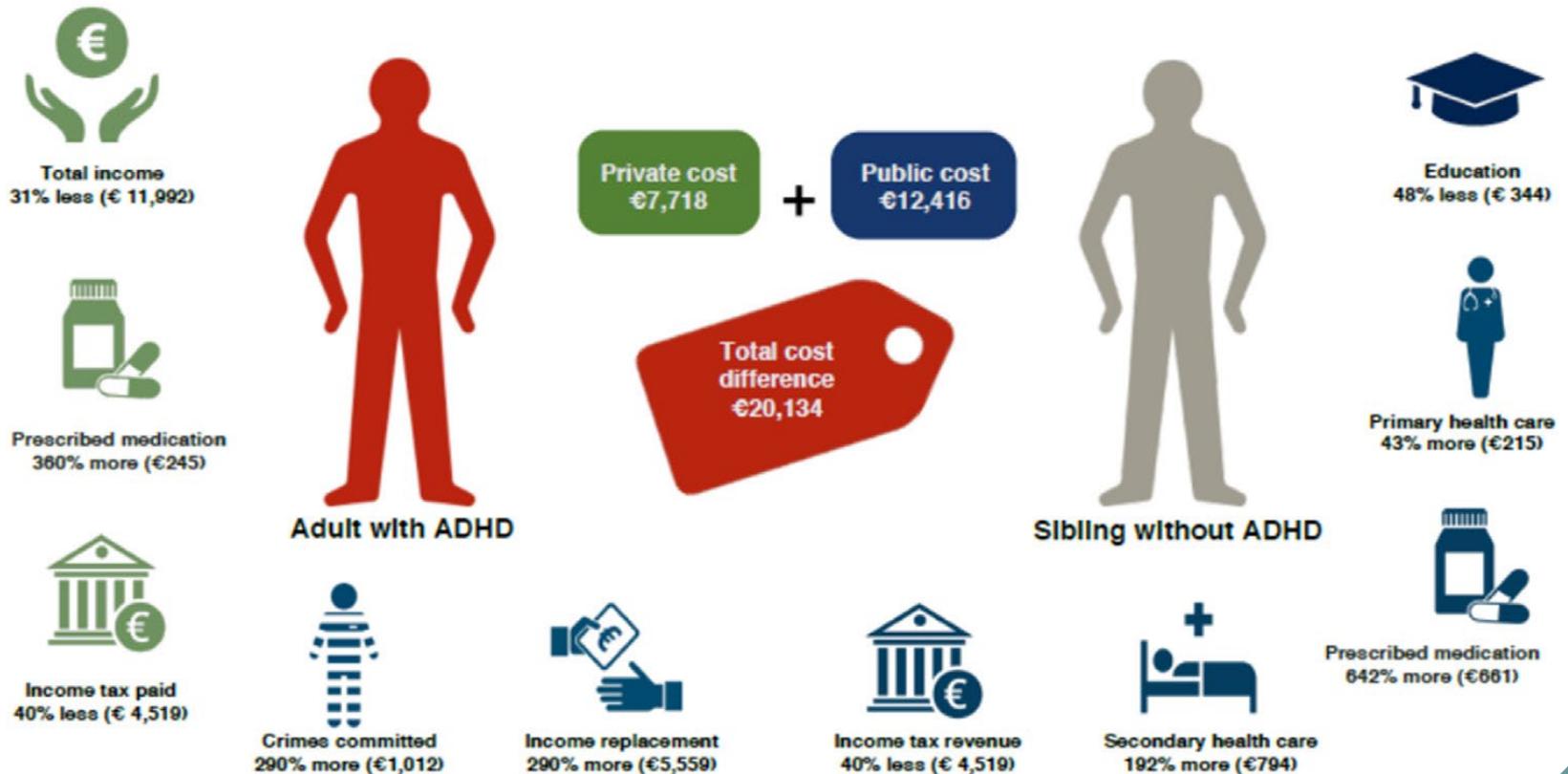
	Adults with ADHD	Siblings	Cost Difference €	% ^c
Individual or family borne costs				
Disposable income				
Total work income and public transfers	26,259	38,252	-11,992	-31%
Income tax payment ^b	6,887	11,406	4,519	40%
Other costs to the individual				
Patient cost of prescribed medication	313	68	-245	-360%
Costs of being a victim of a crime			0	N.A.
Total cost to the individual			-7,718	
Public costs				
Public transfers and income tax				
Income replacement transfers	7,476	1,917	-5,559	-290%
Income tax revenue to the state ^b	6,887	11,406	-4,519	-40%
Crime, traffic, foster care and education				
Costs of being in a traffic accident ^a			0	N.A.
Costs of crimes committed (investigation, sentencing)	1,361	349	-1,012	-290%
Education costs (direct costs)	367	711	344	48%
Adult continuation of foster care ^a			0	N.A.
Medical expenses				
Secondary health care	1,207	414	-794	-192%
Primary health care (GP and other primary care)	713	498	-215	-43%
Public subsidy to prescribed medication	764	103	-661	-642%
Total cost to the public sector			-12,416	
TOTAL COST (INDIVIDUAL + PUBLIC)			-20,134	

TOTAL COSTS TO SOCIETY

- EVEN THOUGH SIBLINGS HAVE RATHER WEAK OUTCOMES
- **ADULTS with ADHD have even weaker outcomes,**
 - lower income
 - lower employment rate
 - lower educational attainment
 - higher propensity to receive public income support
 - higher likelihood to have committed a crime
 - higher likelihood to have been the victim of a crime
 - larger health care costs
 - larger costs of prescription medication

Let's look at those cost differences in percentage terms

Yearly cost difference between individual with ADHD and their similar sibling (%, €)



The cost of ADHD in Adulthood



Total cost difference
€20,134

How do the costs compare to data from other countries?

Aggregate social cost for ADHD-individuals for different countries, million Euros

	Canada	Denmark	France	Holland	United Kingdom	United States
						

Prevalence rate from:	Cost estimates from sibling-analysis <u>in millions of Euros</u>						
		Canada	Denmark	France	Holland	United Kingdom	United States
This study:	0,8%	2439	381	4417	1174	4361	21697
Simons et al (2009):	2,5%	11171	1746	20227	5375	19974	99365

Invest to save



Recommendations based on results

Is it possible for individuals with ADHD to achieve a better life than what the results show? **YES**

Interventions should focus on:

- Employment: Focus on educational needs to improve employment
- Education: Focus on school readiness
- Early intervention: would reduce disease burden and associated costs – **INVEST TO SAVE**

Employment

- Adults with ADHD experience impairment in all aspects related to employment from the initial job search, to job interviews and then in employment¹
- We need to better understand the barriers to employment for adults with ADHD, but also the mediating processes that lead to successful employment.
- We need effective employment schemes for individuals with ADHD.
- We need to develop reasonable adjustments for adults with ADHD

¹Adamou, M., Arif, M., Asherson, P., Aw, T. C., Bolea, B., Coghill, D., ... & Young, S. (2013). Occupational issues of adults with ADHD. *BMC psychiatry*, 13(1), 59.

Education

- ADHD results in considerable impairment in educational development and achievement In the short ¹ And long term²
- Effective education programmes should be implemented to secure educational attainment for individuals with ADHD³
- Parent attendance at intervention sessions and Homework Adherence predicted response to a Family–School Intervention. Clarke et al (2015)⁴
- The extent to which parents actively engage with treatment was predictive of academic outcomes.

1. Tarver J, Daley D, Sayal K. Attention-deficit hyperactivity disorder (ADHD): an updated review of the essential facts. *Child Care Health Dev.* 2014;40(6):762-774.

²Arnold LE, Hodgkins P, Kahle J, Madhoo M, Kewley G. Long-term outcomes of ADHD academic achievement and performance. *Journal of attention disorders.* 2015

³DuPaul GJ, Stoner G. *ADHD in the schools: Assessment and intervention strategies.* 2014.⁴Clarke, A. T., Marshall, S. A., Mautone, J. A., Soffer, S. L., Jones, H. A., Costigan, T. E., ... & Power, T. J. (2015). Parent attendance and homework adherence predict response to a family–school intervention for children with ADHD. *Journal of Clinical Child & Adolescent Psychology, 44*(1), 58-67.

Driving

- Adults with ADHD are more likely to have traffic accidents. Their higher driving rates further compounds road safety threat¹
- Adults with ADHD should be made more aware of the potential impact of their ADHD on driving performance to help reduce traffic offences.
- Bruce, Unsworth & Tay (2013)² reviewed behavioural interventions for novice drivers with ADHD. Awareness training, such as commentary driving, shows promise.
- Chang et al (2014)³ using the Swedish registers showed that 41 - 49% of the accidents in male patients with ADHD could have been avoided if they had been receiving treatment during the entire follow-up.

¹Vaa, T. (2014). ADHD and relative risk of accidents in road traffic: A meta-analysis. *Accident Analysis & Prevention*, 62, 415-425

²Bruce, C., Unsworth, C., & Tay, R. (2014). A systematic review of the effectiveness of behavioural interventions for improving driving outcomes in novice drivers

³Chang, Z., Lichtenstein, P., D'Onofrio, B. M., Sjölander, A., & Larsson, H. (2014). Serious transport accidents in adults with attention-deficit/hyperactivity disorder and the effect of medication: a population-based study. *JAMA psychiatry*, 71(3), 319-325.ith attention deficit hyperactivity disorder (ADHD). *British Journal of Occupational Therapy*, 77(7), 348-357.

Crime

- A Danish follow-up study of children with ADHD reported that 47% had a criminal conviction in adulthood¹
- Better ways to treat ADHD in prisons and young offenders should be explored in order to:
 - break the cycle of reoffending
 - and reduce the high costs associated with the systems.
 - Using the Swedish registers Lichtenstein et al (2012) demonstrated that Among patients with ADHD, rates of criminality were lower during periods when they were receiving ADHD medication.
 - These findings raise the possibility that medication reduces the risk of criminality among patients with ADHD.

¹Dalsgaard, S. (2013). Attention-deficit/hyperactivity disorder (ADHD). *European child & adolescent psychiatry*, 22(1), 43-48

Health care use

- Some of the healthcare costs can be attributed:
 - a. Assessment and treatments related to ADHD¹
 - b. Accidents that result from impulsivity and poor attention²
 - c. Physical and mental health problems that may arise as a result of having ADHD
- The relationship between ADHD and healthcare use warrants further exploration.
- Research should explore how to improve healthcare outcomes for individuals with ADHD and reduce the burden of care

The family

- Children with ADHD have an impact on their families and vice versa (Tarver et al 2014).
- The best ways to support families of children with ADHD should be identified,
 - promoting familial stability
 - reduce costs associated with respite and foster care.
- Helping parents to learn new parenting strategies specifically tailored for children with ADHD may be one way to promote familial stability.

Comorbidity

- 70 – 80% of Adults with ADHD have at least one comorbid disorder¹
- Individual with ADHD suffer more often from other psychiatric difficulties and are often more impaired in areas of psychosocial functioning²

¹Kessler, R. C., Adler, L. A., Berglund, P., Green, J. G., McLaughlin, K. A., Fayad, J., ... & Zaslavsky, A. M. (2014). The effects of temporally secondary co-morbid mental disorders on the associations of DSM-IV ADHD with adverse outcomes in the US National Comorbidity Survey Replication Adolescent Supplement (NCS-A). *Psychological medicine*, 44(08), 1779-1792.

²Gjervan, B., Hjemdal, O., & Nordahl, H. M. (2013). Functional Impairment Mediates the Relationship Between Adult ADHD Inattentiveness and Occupational Outcome. *Journal of Attention disorders*, 1087054712474689.

Comorbidity

- The best ways to identify and manage ADHD in the context of substance abuse disorders should be investigated, to ensure effective treatment options are available.
- Recent guidelines need to be considered and implemented¹
- Earlier access to care for children at risk of ADHD² could also help to reduce the development of associated problems and comorbidity.

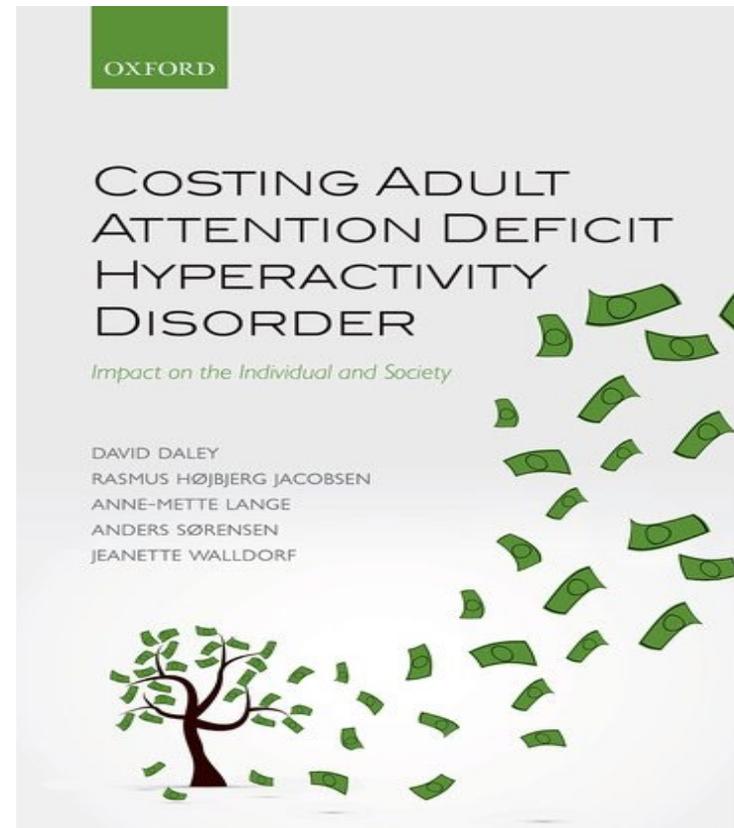
Costing Adult Attention Deficit Hyperactivity Disorder

Impact on the Individual and Society

'CASA':
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Thank you for your attention!



Q please