

Administrative Prevalence and Comorbidity of Attention-Deficit/Hyperactivity Disorder (ADHD) in Children and Adolescents: Evidence from Nordbaden / Germany

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Abstract

Objective: To determine administrative prevalence and comorbidity of ADHD (Hyperkinetic [Conduct] Disorder, ICD-10 F90.0/F90.1) in children and adolescents in the region of Nordbaden in South West Germany.
Methods: Using the Nordbaden claims database for 2003, covering 2.238m insured persons, n=11,245 ADHD patients age 19 or less were identified. The ADHD group was matched with a non-ADHD cohort on a 1:1 ratio based on age and gender, and the rate of co-existent conditions was compared between both groups.
Results: ADHD 12-month prevalence rates were 1.26% (boys 1.72% / girls 0.77%) for age 0-6, 4.97% (7.15%/2.66%) for age 7-12, and 1.31% (1.99%/0.60%) for age 13-19; diagnosis prevalence was highest at age 9 (peak: 6.1%; 8.4%/3.6%). Psychiatric comorbidity (relative risk [RR], 3-8) included mood and affective disorders, conduct disorders, specific developmental disorders; also adjustment disorders, habit and impulse disorders, tic disorders, sleep disorders, disorders associated with sexual development, maltreatment syndromes, and mental retardation.
 RR was also increased (25-100%) for non-psychiatric disorders such as neurological (including hearing disorders but not visual problems) and metabolic disorders, diseases of the immune system, skin and ear, pulmonary and upper respiratory diseases, and accidents and injuries.
Conclusion: These data indicate higher than expected diagnostic prevalence of and substantial comorbidity associated with ADHD in this German population.

Design

- Retrospective Database Analysis**
 - Comprehensive claims database from Nordbaden / South West Germany
 - N=2.238m individuals covered by Statutory Health Insurance (SHI)
- Case Control Technique**
 - For examination of co-morbidity, utilization, and costs
 - Matched pairs (by age, gender, type of health insurance)
- Cross-Sectional Study**
 - Integrating patient-related data from four quarters of 2003
- Study Protocol**
 - Including prospectively defined Data Analysis Plan
- Data Transfer Protocol**
 - Approved by KVNB Data Protection Officer

Population

[2003]	Nordbaden	Germany
Population		
Total number	2.723m	82.537m
Insured by SHI ("GKV")	2.238m (82.2%)	70.422m (85.3%)
Of those:		
Male/female ratio	0.88 / 1	0.88 / 1
Age 0-6 years	150,476 (6.7%)	4.470m (6.4%)
Age 7-12 years	141,857 (6.3%)	4.166m (5.9%)
Age 13-19 years	175,663 (7.9%)	5.722m (8.1%)
Age ≥20 years	1.770m (79.1%)	56.064m (79.6%)

[2003]	Nordbaden	Germany
Physicians (g.p.'s & all specialties)		
Total number	4,905	127,711
No. / 100,000 insured persons	219.1	181.4
Practitioners ("APs")		
Total number	2,102	70,747
No. / 100,000 insured persons	93.9	86.3
Pediatricians		
Total number	211	6,093
No. / 100,000 insured persons	9.3	8.7
Child & Adolescent Psychiatrists		
Total number	30	519
No. / 100,000 insured persons	1.3	0.7

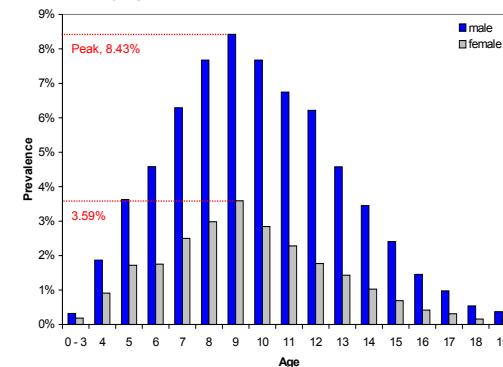
Data

- ADHD Group**
 - All SHI insured patients in the region of Nordbaden with at least one diagnosis "Hyperkinetic Disorder" (ICD-10, F90.0) and/or "Hyperkinetic Conduct Disorder" (ICD-10 F90.1) during 2003
- Control Group (Matched Pairs Technique)**
 - For each F90.0/F90.1 patient, a control patient with similar demographic characteristics (age, gender, type of statutory health insurance) was randomly identified
- For both patient groups,**
 - the complete claims dataset was available from the KV database (including demographic data, diagnoses, all medical services rendered by physicians [by specialization] and psychologists and covered by SHI)

Prevalence

Age group	Overall		Male		Female	
	%	n	%	n	%	N
0-6 Years	1.26%	1,893	1.72%	1,329	0.77%	564
7-12 Years	4.97%	7,046	7.15%	5,215	2.66%	1,831
13-19 Years	1.31%	2,306	1.99%	1,789	0.60%	517
≥20 Years	0.04%	630	0.04%	345	0.03%	285
Total	0.53%	11,875	0.83%	8,678	0.27%	3,197

Prevalence by Age and Gender:



Share of Patients with Conduct Disorder:

Age Group [Years]	Total	Male	Female
0-6	24%	24%	22%
7-12	29%	30%	25%
13-19	38%	39%	33%
≥20	16%	15%	16%
All	29%	30%	25%

Physicians Involved

Age group	Subjects with ADHD seen in 2003 by a Child & Adolescent Psychiatrist			Subjects with ADHD seen in 2003 by a Pediatrician			
	n	%	95% CI	n	%	95% CI	
0 - 6	1,893	15.3%	13.7% - 17.0%	1,308	69.1%	67.0% - 71.2%	
hereof: male	1,331	219	16.5%	14.5% - 18.6%	920	69.1%	66.6% - 71.6%
hereof: female	562	71	12.6%	10.0% - 15.7%	388	69.0%	65.0% - 72.8%
7 - 12	7,046	2,283	32.4%	31.3% - 33.5%	3,487	49.5%	48.3% - 50.7%
hereof: male	5,220	1,734	33.4%	32.1% - 34.7%	2,548	48.8%	47.4% - 50.1%
hereof: female	1,826	538	29.5%	27.4% - 31.6%	941	51.5%	49.2% - 53.8%
13 - 19	2,306	783	34.0%	32.0% - 35.9%	793	34.4%	32.4% - 36.4%
hereof: male	1,791	600	33.5%	31.3% - 35.7%	617	34.5%	32.2% - 36.7%
hereof: female	515	183	35.5%	31.4% - 39.8%	176	34.2%	30.1% - 38.5%
Age group	Subjects with ADHD seen at least once in 2003 by a physician specialist			Subjects with ADHD seen at least four times in 2003 by a physician specialist			
[years / gender]	n	%	95% CI	n	%	95% CI	
0 - 6	1,893	338	17.9%	16.2% - 19.7%	97	5.1%	4.2% - 6.2%
hereof: male	1,331	251	18.9%	16.8% - 21.1%	70	5.3%	4.1% - 6.6%
hereof: female	562	87	15.5%	12.6% - 18.4%	27	4.8%	3.2% - 6.9%
7 - 12	7,046	2,773	39.4%	38.2% - 40.5%	1,049	14.9%	14.0% - 15.7%
hereof: male	5,220	2,123	40.7%	39.3% - 42.0%	814	15.6%	14.6% - 16.6%
hereof: female	1,826	650	35.6%	33.4% - 37.8%	235	12.9%	11.4% - 14.5%
13 - 19	2,306	939	40.7%	38.7% - 42.8%	314	13.6%	12.2% - 15.1%
hereof: male	1,791	723	40.4%	38.1% - 42.7%	241	13.5%	11.9% - 15.1%
hereof: female	515	216	41.9%	36.6% - 46.3%	73	14.2%	11.3% - 17.5%
20 +	630	211	33.5%	29.8% - 37.3%	79	12.3%	10.1% - 15.4%
hereof: male	354	130	36.9%	31.5% - 41.8%	53	14.6%	11.1% - 18.7%
hereof: female	274	81	29.6%	24.2% - 35.3%	27	9.9%	6.6% - 14.0%
total	11,875	4,261	35.9%	35.0% - 36.8%	1,539	13.0%	12.4% - 13.6%
hereof: male	8,698	3,227	37.1%	36.1% - 38.1%	1,177	13.5%	12.8% - 14.3%
hereof: female	3,177	1,034	32.5%	30.9% - 34.2%	362	11.4%	10.3% - 12.6%

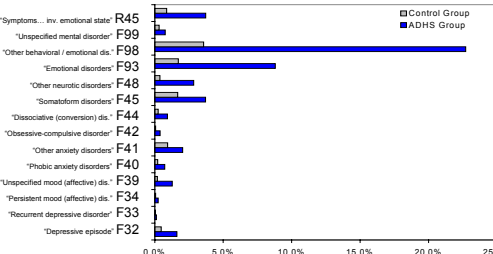
Discussion (I)

- Key Observations**
 - High administrative prevalence in children and adolescents compared to "true prevalence" estimates based on ICD-10
 - Most patients (>64%) were not seen (at least once) by a specialist
 - A small number of patients (only ~13%) were treated by – or under continuous supervision of – a specialized physician (despite an above-average number of specialists in the Nordbaden region)
 - Among adults, ADHD was rarely diagnosed (recognized)
- Hypothesis**
 - "German physicians use DSM-IV criteria but are required by administrative system to code according to ICD-10"
 - Hypothesis receives some preliminary support from statements elicited from a convenience sample of six German pediatricians
- Some Research Needs**
 - Quality of diagnosis (and reporting) in routine clinical care
 - Quality of care (actual treatment compared to guidelines)
 - Health care resource utilization and direct medical cost
- Some Project Limitations**
 - "Reporting bias": underreporting unlikely, given the fee-for-service reimbursement system; "compliant" reporting (incentives by system)?
 - "Formulary bias", representing SHI insured patients only
 - Database limited to the range of services covered by SHI
 - Need to interpret data cautiously
 - Claims databases do not provide information on clinical outcomes

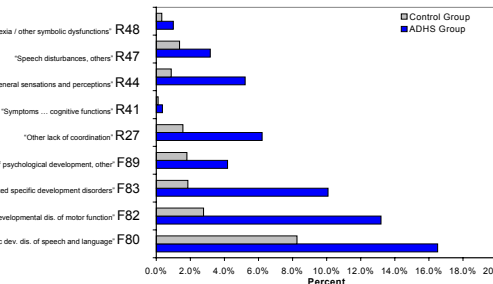
Psychiatric Comorbidity

- Clusters:**
- Conduct & personality disorders (39.3% vs. 3.9%)
 - Mood and affective disorders (38.0% vs. 8.9% in control group)
 - Emotional disorders, neurotic disorders, depression, phobia, anxiety, ...
 - Specific developmental disorders (37.4% vs. 13.4%)
 - Specific developmental disorders of scholastic skills (23.0% vs. 2.8%)
 - Adjustment disorders (8.3% vs. 1.6%)
 - Sleep disorders (4.5% vs. 1.3%)
 - Incontinence (4.4% vs. 2.3%)
 - Mental retardation (3.8% vs. 0.8%)
 - Tic disorders (2.4% vs. 0.7%)
 - Disorders due to brain damage (1.8 vs. 0.4%)
 - Pervasive developmental disorders (1.6% vs. 0.5%)
 - Disorders due to substance use (0.4% vs. 0.1%)
- *Note that diagnosis clusters were defined on the basis of clinical judgment. For a detailed description of clusters, please contact the authors: www.innovval-hc.com. All differences reported here were statistically significant (p<0.001, without adjustment for multiple testing).

Example 1: Diagnosis Cluster "Mood and Affective Disorders": 38.0%
 Control Group: 8.9%, Relative Risk: 4.3 (p<0.001)



Example 2: Diagnosis Cluster "Specific Developmental Disorders": 37.4%
 Control Group: 13.4%, Relative Risk: 2.8 (p<0.001)



Somatic Comorbidity

- Clusters:**
- Diseases of the upper respiratory tract (40.1% vs. 33.4% in control group)
 - Diseases of the skin (32.4% vs. 25.5%)
 - Diseases of the ear (31.3% vs. 23.7%)
 - Infectious diseases (31.2% vs. 25.9%)
 - Gastrointestinal disorders (30.4% vs. 24.3%)
 - Disorders involving immune mechanisms (26.3% vs. 19.0%)
 - Injuries, overall (23.2% vs. 18.4%)
 - Pulmonary diseases (17.7% vs. 12.9%)
 - Neurological disorders (15.4% vs. 11.6%)
 - Disorders of the genitourinary system (14.2% vs. 10.2%)
 - Diseases of the musculoskeletal system (13.9% vs. 10.8%)
 - Metabolic disorders (13.9% vs. 9.0%)
 - Lack of expected normal physiological development (7.4% vs. 3.3%)
 - Cardiovascular diseases (6.5% vs. 3.7%)
 - Diseases of the blood and blood-forming organs (4.9% vs. 2.6%)
 - Congenital disorders (2.0% vs. 1.2%)
 - Maltreatment syndromes (0.77% vs. 0.18%)
 - Infantile cerebral palsy (0.44% vs. 0.30%)

*Note that diagnosis clusters were defined on the basis of clinical judgment. For a detailed description of clusters, please contact the authors: www.innovval-hc.com. All differences reported here were statistically significant (p<0.001, without adjustment for multiple testing).

Discussion (II)

- Some General Observations**
 - This is the first presentation of scientific data from the Nordbaden Project.
 - A large enough integrated administrative database allows cross-sectional analyses of prevalence, health care utilization, and coexisting conditions associated with attention-deficit/hyperactivity disorder (ADHD).
- Some More Specific Observations**
 - Overall, there is substantial psychiatric comorbidity associated with ADHD.
 - Overall, psychiatric comorbidity in children and adolescents in Nordbaden in South West Germany seems to follow patterns described in large-scale epidemiological studies and systematic reviews.
 - Coexisting somatic conditions are encountered more frequently than commonly believed.
 - Observations support the notion of ADHD as an "international disease".
- Project Limitations – A "Null Hypothesis"**
 - "Coexisting disorders are diagnosed more frequently in patients with ADHD owing to their more intense health care utilization patterns."
 - However, there appear to be specific patterns of comorbidity:
 - Diseases of the ear (otitis externa, nonsuppurative otitis media, suppurative and unspecified otitis media, disorders of Eustachian tube, otalgia and effusion of ear) and conductive and sensorineural hearing loss (cf. cluster "diseases of the ear", above) are diagnosed significantly more frequently in ADHD patients.
 - In contrast, "diseases of the eye and adnexa" (ICD-10 H.00-H59) are diagnosed less frequently in ADHD patients compared to controls (RR 0.95; 95%-CI, 0.92-0.98%; p<0.05).
 - Further analyses are underway to characterize the statistical associations.
- Further Research Need**
 - Nature of the observed association of ADHD and coexisting conditions?

