

Attention-Deficit/Hyperactivity Disorder (ADHD) in Children and Adolescents: Mental Health and Physical Co-Morbidity in Nordbaden / Germany

Michael Schlander^{1,2}, Oliver Schwarz^{1,3}, Goetz-Erik Trott^{1,4}, Michael Viapiano⁵, Norbert Bonauer⁵

¹Institute for Innovation & Valuation in Health Care (INNOVAL^{HC}), Aschaffenburg and Eschborn (Germany);

²University for Applied Economic Sciences Ludwigshafen; ³University of Cooperative Education Mannheim, ⁴University of Wuerzburg, ⁵KV Baden-Wuerttemberg, Karlsruhe (all in Germany)

Abstract

With reported prevalence rates of 2-10%, ADHD is one of the most common disorders of childhood and adolescence. Only recently, comorbidity has been recognized as one of the most important aspects of the disorder.

Objectives: To determine real-world prevalence rates for psychiatric and non-psychiatric comorbid conditions in children and adolescents with a diagnosis of ADHD according to ICD-10 criteria (Hyperkinetic [Conduct] Disorder, HKD/HKCD, F90.0/F90.1), using the Nordbaden claims database covering 2.238m insured persons in South-Western Germany (82% of the regional population).

Methods: n=11,245 ADHD patients age 19 or less were identified. The ADHD group was matched with a non-ADHD cohort (n=11,228) on a 1:1 ratio based on age and gender, and the rate of co-existent conditions was compared between both groups. Chi-square statistics was used to explore levels of significance.

Results: The most frequent psychiatric comorbidities (in 20-40% of patients, each; all p<0.001; relative risks compared to control cohort 3-8) included mood and affective disorders, conduct disorders, specific developmental disorders, including those of scholastic skills. Significant associations (similar magnitude) were also found for ADHD and adjustment disorders, habit and impulse disorders, tic disorders, sleep disorders, disorders associated with sexual development, maltreatment syndromes, mental retardation, lack of expected normal physiological development and disorders due to brain damage – though these occurred less commonly (<10% of patients each). The analyses also revealed significantly increased relative risk (25-100%) for non-psychiatric disorders involving immune mechanisms, neurological disorders, metabolic disorders, diseases of the skin and ear, pulmonary and upper respiratory diseases, certain gastrointestinal disorders, diseases of the blood and blood-forming organs, and accidents and injuries (all p<0.001).

Conclusions: These data indicate substantial comorbidity associated with ADHD in children and adolescents. They provide a basis for further epidemiological research and for analyses of the cost associated with ADHD.

Key Findings & Observations

Key Findings: Co-Existing Psychiatric Conditions¹

- 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 11vs. 0.4%)
- Pervasive development disorders (1.6% vs. 0.5%)
- Disorders due to substance use (0.4% vs. 0.1%)

Conspicuous Observations: Co-Existing Somatic Conditions¹

- 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%)

¹Note that clusters reported here were defined on the basis of clinical judgment. For further information on cluster definitions, please (a) see below, or (b) contact us at www.innovat-hc.com.

Patient Population

ADHD Group

- All SHI insured patients age 0-19 years in the region of Nordbaden with at least one diagnosis F90.0 and/or F90.1 in 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)

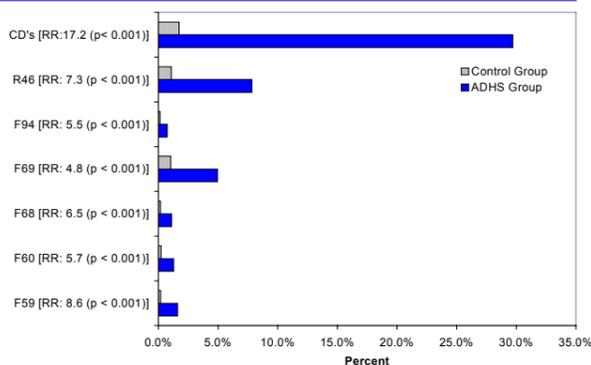
| Patients Identified with ADHD | | | |
|-------------------------------|-----------|--------|----------|
| Age group | Overall n | Male n | Female n |
| 0-6 Years | 1,893 | 1,329 | 564 |
| 7-12 Years | 7,046 | 5,215 | 1,831 |
| 13-19 Years | 2,306 | 1,789 | 517 |
| Total | 11,245 | 8,333 | 2,912 |

| Patients with Co-Existing Conduct Disorder | | | |
|--|-------|------|--------|
| Age Group [Years] | Total | Male | Female |
| 0-6 | 24% | 24% | 22% |
| 7-12 | 29% | 30% | 25% |
| 13-19 | 38% | 39% | 33% |
| All | 30% | 31% | 26% |

Psychiatric Comorbidity and Implications

Conduct & Personality Disorders²

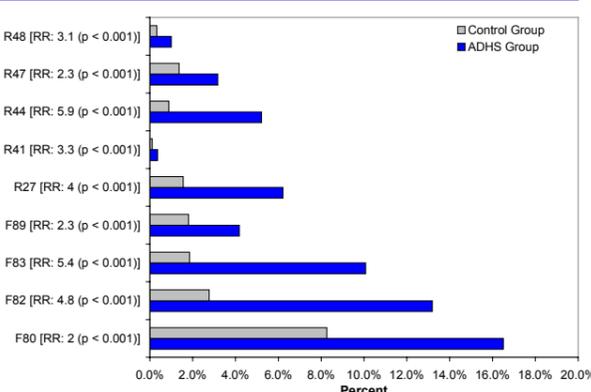
ADHD Group: 39.3% Control Group: 3.9% Ratio: 10.1 (p < 0.001)



²F59: Unspecified behavioural syndromes associated with physiological disturbances and; F60: Specific personality disorders; F68: Other disorders of adult personality and behaviour; F69: Unspecified disorder of adult personality and behaviour; F94: Disorder of social functioning with onset specific to childhood and adolescence; R46: Symptoms and signs involving appearance and behaviour; CD's: Conduct disorders

Specific Developmental Disorders⁴

ADHD Group: 37.4% Control Group: 13.4% Ratio: 2.8 (p < 0.001)



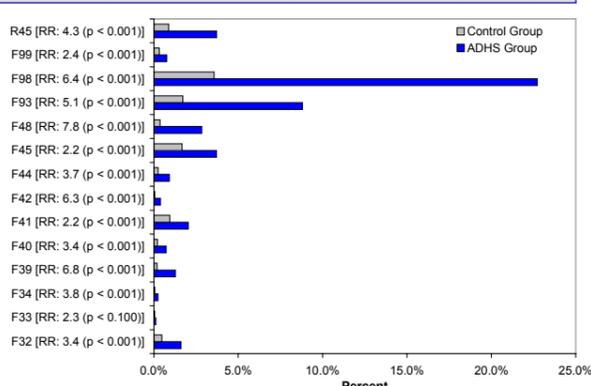
⁴F80: Specific developmental disorders of speech and language; F82: Specific developmental disorder of motor function; F83: Mixed specific developmental disorders; F89: Unspecified disorder of psychological development; R27: Other lack of coordination; R41: Other symptoms & signs involving cognitive function and awareness; R44: Other symptoms & signs involving general sensation and perceptions; R47: Speech disturbances, not elsewhere classified; R48: Dyslexia and other symbolic dysfunctions NEC

Discussion & Conclusions

- The importance of co-existing conditions as a moderator of treatment response and long-term outcomes in patients with ADHD has been recognized only recently.
- A number of international epidemiological studies have reported surprisingly high rates of psychiatric comorbidity associated with ADHD in children and adolescents.
- This study presents evidence from Nordbaden / Germany on administrative prevalence of co-existing psychiatric and somatic conditions in a large sample of patients with ADHD. To the best of our knowledge, these data are the first report on co-existing conditions in a large ADHD patient group under community care in Germany.
- Comorbid psychiatric disorders such as conduct disorder, oppositional defiant disorder, depression, anxiety, and specific developmental disorders are frequently associated with ADHD and may be at least as important as ADHD in contributing to the long-term outcome in the individual child or adolescent (cf. Gillberg et al. 2004).
- Also somatic comorbidity was significantly more prevalent than in the control group. Although we observed patterns such as increased rates of hearing disorders but not visual disturbances, these findings should be interpreted with caution. In particular, we cannot rule out that they may be due to an increased number of contacts with the health care system of ADHD patients.
- There are far-reaching implications of the high rates of comorbidity observed. For instance, providers of care for ADHD patients need to have expertise in the diagnosis and treatment of these co-existing conditions as well. Further to this, response to treatment, long-term outcomes, cost, and cost-effectiveness of medical care will likely be influenced by comorbidity.
- Limitations: As with claims databases in general, reported diagnoses may be influenced, inter alia, by peculiarities of the reimbursement system.

Mood / Affective Disorders³

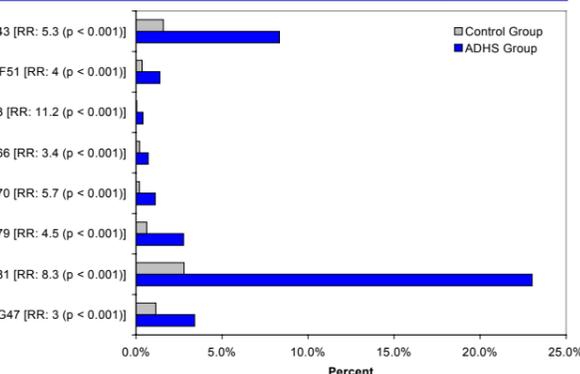
ADHD Group: 38.0% Control Group: 8.9% Ratio: 4.28 (p < 0.001)



³F32: Depressive episode; F33: Recurrent depressive disorder; F34: Persistent mood [affective] disorders; F39: Unspecified mood [affective] disorder; F40: Phobic anxiety disorders; F41: Other anxiety disorders; F42: Obsessive-compulsive disorder; F44: Dissociative [conversion] disorders; F45: Somatoform disorders; F48: Other neurotic disorders; F93: Emotional disorders with onset specific to childhood; F98: Other behavioural and emotional disorders with onset usually occurring in childhood and adolescence; F99: Mental disorder, not otherwise specified; R45: Symptoms and signs involving emotional state

Further Psychiatric Disorders⁵

ADHD Group: 33.8% Control Group: 6.2% Ratio: 5.4 (p < 0.001)



⁵F43: Reaction to severe stress and adjustment disorders; F51: Nonorganic sleep disorders; F63: Habit and impulse disorders; F66: Psychological and behavioural disorders associated with sexual development and e; F70: Mild mental retardation; F79: Unspecified mental retardation; F81: Specific developmental disorders of scholastic skills; G47: Sleep disorders