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TITLE PAGE

Predictors for receiving medication and/or psychotherapy in children newly diagnosed with ADHD: A longitudinal population-based cohort study

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Conflict of interest statement

O.R. has received unrestricted educational grants from Bayer AG outside the submitted work; O.S., B.K., E.E.Ö., and O.R. are working at the Leibniz Institute for Prevention Research and Epidemiology – BIPS. Unrelated to this study, BIPS occasionally conducts studies financed by the pharmaceutical industry. Almost exclusively, these are post-authorization safety studies (PASS) requested by health authorities. The studies and the resulting publications are not influenced by the pharmaceutical industry. J.M.F. and M.K. have declared that they have no competing or potential conflicts of interest to declare.

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TITLE

Predictors for receiving medication and/or psychotherapy in children newly diagnosed with ADHD: A longitudinal population-based cohort study

ABSTRACT

Objective: To identify characteristics predicting the use of medication and/or psychotherapy after a first ADHD diagnosis.

Method: This cohort study was based on German claims data including 12,250 treatment-naïve children aged 5–12 years with an incident ADHD diagnosis in 2010. Logistic regression models were used to estimate associations between children's characteristics at first diagnosis and the chosen treatment within the following five years.

Results: Medication use was associated with male sex, an ADHD diagnosis "with hyperactivity", comorbid depression, and comorbid developmental and conduct disorders. Male sex and comorbid neurotic and somatoform, conduct, and emotional disorders were associated with psychotherapy only. Receiving both treatments—instead of medication only—was associated with comorbid depression, neurotic and somatoform, conduct, and emotional disorders.

Conclusion: In case of equal access to both treatment options, patients, e.g., with externalizing symptoms were more prone to receive medication and/or psychotherapy than the average child diagnosed with ADHD.

Keywords: Attention-deficit/hyperactivity disorder; pediatrics; drug therapy; psychotherapy; longitudinal studies; population-based.

INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is a common neurodevelopmental disorder with a worldwide prevalence of 3.4% in children and adolescents (Polanczyk, Salum, Sugaya, Caye, & Rohde, 2015). Its core symptoms, inattention and hyperactivity-impulsivity, as well as associated impairments can be markedly reduced by evidence-based treatments (Faraone et al., 2015). Several studies have proven long-term consequences of ADHD including higher comorbidity in later life (Meinzer et al., 2016; Tandon, Tillman, Agrawal, & Luby, 2016). Hechtman et al. (2016) concluded that a successful treatment of ADHD symptoms might be protective against anxiety, depression, and substance use disorder.

Whereas the evidence for pharmacological treatment on ADHD symptom reduction is high, evidence for non-pharmacological interventions is controversially discussed (D. Daley et al., 2014; Sonuga-Barke et al., 2013). So far, the largest trial regarding the effectiveness of interventions was the multimodal treatment study of children with ADHD (MTA). This study showed that medication management was superior to only behavioral treatment (The MTA Cooperative Group, 1999). The findings further indicated that the combination of both treatments compared to pharmacological treatment only had benefits regarding non-ADHD symptoms, levels of functioning, and the need for lower drug doses (The MTA Cooperative Group, 1999; Vitiello et al., 2001).

The MTA long-term follow-up showed that the percentages of those with adequate medication declined by more than a quarter within less than one year after the RCT phase (Swanson et al., 2017). Conversely, in the group originally assigned to receiving only behavioral treatment, the proportion of those taking ADHD medication substantially increased from 14% to 31% in the same time period (Swanson et al., 2017). Most population-based studies on ADHD treatments only focused on medication and/or included prevalent

patients but did not show treatment trajectories or the mix of interventions in routine clinical practice. It is not well studied whether in routine care pharmacological and/or non-pharmacological interventions are initiated in children after a first diagnosis of ADHD. Additionally, factors influencing the decision as to which interventions are provided in the course of the disorder are understudied. Physicians' professional training (Kovshoff et al., 2012) and patients' characteristics (Sonuga-Barke, 2016) are suggested factors. Information on the treatment of children with ADHD in clinical routine from a longitudinal perspective is of high importance to also interpret prescription analyses, guideline adherence, and characteristics of health care systems.

Based on German claims data, this study aimed to (a) show the proportion of individuals with medication and/or psychotherapy over a five-year follow-up among treatment-naïve children with incident ADHD in routine care and to (b) find characteristics—at the first diagnosis—that are associated with the received treatments until end of follow-up. Importantly, both ADHD drugs and psychotherapy are fully reimbursed for underage children by the health insurance providers in Germany. Hence, the study population had equal access to both treatment options.

METHODS

Data source

This study was based on claims data from two nationwide statutory health insurance (SHI) providers included in the German Pharmacoepidemiological Research Database (GePaRD) (Pigeot & Ahrens, 2008). In addition to demographic data, the database contains information on dispensed drug prescriptions, outpatient and inpatient services and diagnoses. Drugs are

identifiable through the anatomical-therapeutic-chemical (ATC) code. Diagnoses are coded according to the German modification of the International Classification of Diseases and Related Health Problems, 10th Revision (ICD-10-GM). Outpatient services are recorded as billing codes included in the doctor's fee schedule.

Study Design

We conducted a cohort study and included children aged 5–12 years in 2010 and with a continuous insurance period from January 1, 2009 to December 31, 2015. Of these, children with an incident ADHD diagnosis (ICD-10-GM F90 and F98.8) in 2010 were identified using the following algorithm: children had to have either (i) one inpatient diagnosis, (ii) at least two outpatient diagnoses, or (iii) both, an outpatient diagnosis and a dispensation of an ADHD drug (codes see below). Cohort entry was defined as the date of the first ADHD diagnosis in 2010. Excluded were children with an ADHD diagnosis in 2009 and those who had psychotherapy before the ADHD diagnosis. Cohort exit was defined as the date five years after cohort entry.

Outcomes

Outcomes were defined as mutually exclusive treatment groups such as receiving treatment with ADHD medication and/or psychotherapy after cohort entry. Use of medication was identified based on the first ADHD drug dispensation. ADHD drugs comprised methylphenidate (ATC-code N06BA04), atomoxetine (N06BA09), lisdexamfetamine (N06BA12), and dexamfetamine (N06BA02). Psychotherapy was identified based on the first billing code. Included were trial sessions (code 35150), which can be considered the very first visits to a therapist, as well as psychotherapeutic sessions that were approved by the patient's insurance company (codes 35200–35225).

Characteristics potentially associated with the received treatment

The specialty of the diagnosing physician was based on information in the quarter of cohort entry. In GePaRD, information on the physician's specialty is only available in an outpatient setting, so that children diagnosed in an inpatient setting were assigned to a separate category. The category "psychotherapist" was aggregated using the following specialties: (child and adolescent) psychotherapists, medical psychotherapists, and specialists for psychosomatic medicine and psychotherapy. In contrast to psychotherapists, medical psychotherapists and specialists for psychosomatic medicine and psychotherapy are allowed to prescribe medication (IQWiG, 2016). However, as all three specialties are typically offering non-pharmacological treatment like psychotherapy, we grouped them into one category. The type of ADHD diagnosis was distinguished between with (ICD-10-GM F90) and without (ICD-10-GM F98.8) hyperactivity based on the recorded ADHD diagnosis at cohort entry. Psychiatric comorbidities were selected a priori based on suggestions from a clinical expert. They were queried in the cohort entry quarter and the preceding four quarters. Outpatient diagnoses coded as confirmed and inpatient discharge diagnoses were used. Psychiatric hospitalizations were defined using main discharge or secondary psychiatric diagnosis (ICD-10-GM F00-F99) in the one year baseline before and excluding cohort entry.

Ethical considerations

The use of SHI data for scientific research is regulated by the Code of Social Law (SGB X) in Germany. All involved SHIs and the competent authorities approved the use of the data for this study; no ethical approval was necessary. Informed consent of the involved insurants was not required by law.

Analyses

To identify statistical differences regarding the characteristics at first ADHD diagnosis between treatment groups, Pearson's χ^2 test at a 5% α level was used. Multinomial logistic regression was used to obtain odds ratios and corresponding 95% confidence intervals for the association between characteristics at the first ADHD diagnosis and the chosen treatment approach comparing children with "medication" and "only psychotherapy" to those with no treatment. In a logistic regression model, children with "medication and psychotherapy" were compared to those with "only medication" among those who ever received medication. Sex, age, and the specialty of the diagnosing physician were always included as independent variables. The other characteristics were only included if their frequency differed statistically significant between the treatment groups. All statistical analyses were conducted using SAS version 9.3.

RESULTS

The study cohort comprised 12,250 treatment-naïve children aged 5–12 years with a first diagnosis of ADHD (Figure 1). The prevalence for ADHD according to the algorithm was 5.3% (38,706/724,934).

Period prevalence of treatments

Within the first year after the first ADHD diagnosis, almost 25% of the cohort received medication and about 6% received only psychotherapy (Table 1). At the end of follow-up, more than one third was ever pharmacologically treated and more than one in ten was treated with psychotherapy only. About 27% of those with medication additionally had psychotherapy during the observation period. Added up in both groups—"medication" and "only psychotherapy"—21% (n = 2,572) of the cohort members ever received psychotherapy.

Of these, 59% ever had psychotherapeutic sessions which required an approval from the SHI. Among all patients who ever received psychotherapy, a diagnostic code of ADHD (particularly F90) was most frequently recorded by the treating therapist at their first psychotherapeutic session, followed by emotional disorders with onset specific to childhood (F93). This also applied for cohort members who received only psychotherapy.

Characteristics at first ADHD diagnosis

Stratified by the treatment received within five years, the characteristics of cohort members at cohort entry differed regarding sex, age groups, specialty of the diagnosing physician, type of ADHD diagnosis, and most of the a priori selected comorbidities (Table 2). The overall percentage of cohort members with an ADHD diagnosis without hyperactivity was 22%. This proportion was substantially lower in those with medication during follow-up (6.5%) and similar in those who received only psychotherapy (27%). The most frequent psychiatric comorbidities in all cohort members were, in decreasing order of frequency, specific developmental disorders (47.9%), conduct disorders (18.0%), emotional disorders with onset specific to childhood (11.1%), and any depression (8.0%).

Factors associated with receiving medication compared to receiving no treatment

Male sex and older age at the first ADHD diagnosis were associated with receiving medication within five years (Table 3). Children diagnosed by non-specialists (pediatricians and general practitioners) were less likely to be treated with medication as compared to those diagnosed by a child and adolescent psychiatrist. Having an ADHD diagnosis "with hyperactivity" increased the odds of receiving medication more than five-fold as compared to "without hyperactivity". Children with the following comorbidities at the first ADHD diagnosis were more likely to be prescribed medication within five years: depression, specific developmental disorders, and conduct disorders.

Factors associated with receiving only psychotherapy compared to receiving no treatment

Boys were more likely to receive only psychotherapy within five years from the first ADHD diagnosis (Table 3). Compared to being diagnosed by a child and adolescent psychiatrist, children who were diagnosed by a pediatrician were less likely and those diagnosed by a psychotherapist were substantially more likely to receive only psychotherapy. Children with the following comorbidities at the first ADHD diagnosis were more likely to receive only psychotherapy within five years: neurotic and somatoform disorders, conduct disorders, and emotional disorders with onset specific to childhood.

Factors associated with receiving medication and psychotherapy compared to receiving medication only

Compared to children aged 5–6 years, children aged 10–12 years at the first diagnosis were less likely to additionally receive psychotherapy (Table 4). Being initially diagnosed by a non-specialist and by a psychotherapist increased the odds of receiving medication and psychotherapy as compared to being diagnosed by a child and adolescent psychiatrist. In the group of patients with both treatments, 25% were initially diagnosed by a child and adolescent psychiatrist (30% of those with medication only). Children with the following comorbidities at the first ADHD diagnosis were more likely to receive both medication and psychotherapy within five years: depression, neurotic and somatoform disorders, conduct disorders, and emotional disorders with onset specific to childhood. Being diagnosed with mental retardation at cohort entry lowered the odds of receiving psychotherapy in addition to medication by 52%.

DISCUSSION

In this study, we investigated the initiation of pharmacological and psychotherapeutic treatments among children newly diagnosed with ADHD by using health insurance data. Moreover, we identified characteristics recorded at the first ADHD diagnosis that were associated with the received treatments. It is particularly noteworthy that—due to equal access to both treatment options—the population in this study was truly free to choose between medication and/or psychotherapy. Use of medication started early from the initial ADHD diagnosis and few patients started with psychotherapy. After five years from the first ADHD diagnosis, a substantial proportion of children received only psychotherapy and relatively few received both, medication and psychotherapy.

Medication versus no treatment

Our results indicated that the diagnosing person's specialty had an influence on prescribing ADHD medication, as suggested by Kovshoff et al. (2012). Children who were initially diagnosed by a non-specialist, i.e., pediatricians and general practitioners, were less likely to receive medication. It is possible that being diagnosed by a non-specialist hampered access to potentially needed interventions at least in some cases, or that at the patients' place of residence specialists were simply lacking. It is generally recommended that treatment with medication such as MPH must at least be under the supervision of a specialist (CHMP, 2009). In this study, we did not know whether non-specialists referred the child to a specialist to confirm the ADHD diagnosis and/or to check the need for interventions.

More severe ADHD cases, as indicated by the type of diagnosis "with hyperactivity" in our study, were far more likely to receive medication. Our results therefore confirmed the assumption made by Sonuga-Barke (2016) that patients with more severe presentations are particularly more likely to be prescribed medication. Furthermore, children with certain comorbid psychiatric disorders—considered as a proxy for a more complex presentation of

ADHD—were more likely to receive medication, which was also assumed by Sonuga-Barke (2016). Especially comorbid conduct disorders—representing externalizing symptoms—showed the strongest association by increasing the odds to receive medication by 35%. This indicates that the severity of ADHD symptoms and comorbidities are part of the decision to initiate medication, which is in line with recommendations from ADHD guidelines.

Only psychotherapy versus no treatment

The relatively high proportion of patients who received only psychotherapy was surprising; there were even more children with a diagnosis of ADHD who received only psychotherapy rather than medication and psychotherapy. ADHD symptoms might not have been the most impairing factors in these cases. In fact, comorbid psychiatric disorders that were associated with receiving only psychotherapy—namely neurotic and somatoform disorders (including anxiety and obsessive-compulsive disorder), conduct disorders (including oppositional defiant disorders), and emotional disorders with onset specific to childhood (also including anxiety)—are accompanied by impairing internalizing and externalizing symptoms for which psychotherapeutic interventions have sound evidence (D. Daley et al., 2014; Seidman, 2014). However, the frequencies of these comorbidities in our study did not explain the therapeutic approach with only psychotherapy in all of the cases. Notably, although depressive disorders are typical indications for psychotherapy, comorbid depression was not associated with receiving only psychotherapy. Additionally, although four times more patients with only psychotherapy compared to those receiving medication were classified as ADHD "without hyperactivity", still about three-quarters of those receiving only psychotherapy had ADHD "with hyperactivity". More importantly, ADHD was the most frequent reason for the first psychotherapeutic visit of these patients, as measured by the recorded diagnoses of the treating therapist. In fact, the most frequent diagnostic code was "hyperkinetic disorder" (F90), which is considered to be an even narrower and more severe subtype of the DSM-IV

"attention-deficit/hyperactivity disorder" (Bachmann et al., 2017b). Being diagnosed by a psychotherapist was strongly associated with receiving only psychotherapy. As this non-pharmacological treatment is the typical—for non-medical psychotherapists the only available—therapeutic method of these therapists, higher odds for receiving only psychotherapy were expected. It is unknown whether attending these specialists was initiated by the parents or a potentially referring physician.

Our results suggest that ADHD symptoms were in some cases treated with psychotherapy only, although blinded evidence for the efficacy of psychotherapy on ADHD symptoms is lacking (D. Daley et al., 2014; Sonuga-Barke et al., 2013). However, the decision on the type of intervention may depend on several further factors this study could not measure such as treatment perceptions by patients, parents, health professionals and teachers (Bussing et al., 2012). Additionally, comorbid disorders may have developed at some point after the initial diagnosis. Whether the psychotherapy only group was sufficiently treated remains unsolved in our study. It should be noted that treatment of ADHD with only psychotherapy may be in line with ADHD guidelines in cases where families decide against medication. However, medication should be advised if psychological treatment did not lead to substantial improvement within a few weeks (Taylor et al., 2004).

Medication and psychotherapy versus only medication

In our study, less than three in ten pharmacologically treated patients received additional psychotherapy. Low proportions of psychotherapy among children treated with ADHD medication were also found based on US claims data (Gellad et al., 2014). The authors assumed that apart from the availability of psychotherapeutic treatment—which also applies to our study—parents' or physicians' preferences for non-pharmacological care might influence receipt of psychotherapy as well (Gellad et al., 2014). In our study, the odds of

receiving both treatments were in fact higher when non-specialists or psychotherapists diagnosed ADHD first as compared to being diagnosed first by a child and adolescent psychiatrist. The lower odds of receiving combined therapy for patients initially diagnosed by child and adolescent psychiatrists in our study seems astonishing. Possible reasons may include that in Germany there is a unique model of outpatient social-psychiatric practices to improve community care. These are often run by child and adolescent psychiatrists. Psychotherapeutic treatments in these practices are not recorded through billing codes as used in this study, leading to an underestimation of the frequency of psychotherapy.

Notably, patients with psychiatric comorbidities which represent internalizing—such as depression and anxiety—as well as externalizing symptoms (conduct disorders) were more likely to receive psychotherapy in addition to medication. The lower odds of receiving additional psychotherapy when mental retardation was present may reflect the fact that the effectiveness of psychotherapy for this disorder is yet to be empirically confirmed (Lynch, 2004). An additional explanation may be the low proportion of psychotherapists who deal with the population of children with low IQs. Medication-only treatment for school-aged children with severe ADHD (i.e., "hyperkinetic disorder") as in our study is in line with ADHD guidelines (American Academy of Pediatrics, 2011; NICE, 2016; Taylor et al., 2004). However, given that psychological treatment plays an important role in guideline recommendations, our results suggest that adherence to ADHD guidelines regarding treatment with psychotherapy is suboptimal.

Strengths and limitations

A major strength of our study is the use of claims data as they represent routine care in a large population and recall bias can be ruled out. Furthermore, due to the applied algorithm to identify children with incident ADHD, potential case misclassification was minimized as

recommended by Daley et al. (2017). Another strength is that ADHD medication was identified based on dispensations in pharmacies and not on the fact whether a prescription was issued by a physician. Further, the billing codes used to identify psychotherapy are highly specific. In Germany, the SHIs need to approve psychotherapy for each patient—in cases with more than a few trial sessions—based on an evaluation before costs are covered. For this, the therapist must justify the need for psychotherapy. The application for psychotherapy also includes a doctor's report. Only if the evaluator—with special training—approves the application, the SHI will cover the costs (IQWiG, 2016).

Our study also has some limitations. First, it is unknown whether dispensed medication was taken by the patients. Second, the high specificity regarding the identification of psychotherapy in our study might underestimate the actual prevalence. However, the study covered all codes used by psychotherapists. Additionally, we did not directly assess parent-training/education programs, but these programs are substantial parts of psychotherapy in clinical practice in Germany. Fourth, test results on diagnostic instruments were lacking and we classified the type of ADHD diagnosis based on the recorded ICD-10 codes F90 or F98.8 as ADHD with or without hyperactivity, respectively. Although F98.8 is a rather unspecific code, we considered it a valid ADHD-identifying measure as used in other studies (Bachmann, Philipsen, & Hoffmann, 2017a; Dalsgaard, Østergaard, Leckman, Mortensen, & Pedersen, 2015) due to the following reasons: (a) the estimated prevalence for ADHD as defined in our study is as expected according to DSM criteria based on a field study in a representative sample in Germany (Döpfner et al., 2008) and (b) the proportion of all ADHD cases who were classified as "without hyperactivity" (22%) was similar to results from a general community-based study (28%) with children in a similar age range based on diagnostic interviews (Counts, Nigg, Stawicki, Rappley, & Eye, 2005) as well as to results from Germany (17%) based on clinical records from treating physicians (Setyawan et al.,

2018). Fifth, although we tried to minimize case misclassification as described above, the severity of ADHD symptoms of the subjects with an ADHD diagnosis in our cohort may vary. The group who received no treatment may include children with very mild ADHD symptoms. Therefore, there may be a selection bias for this group. Nevertheless, all children included in the cohort had received the ADHD diagnosis by their physician/psychotherapist. As the diagnosis potentially leads to substantial stigmatization (Lebowitz, 2016) it requires sound consideration. Furthermore, as we aimed to illustrate the actual situation in routine care, we deemed it important to include all children with an ADHD diagnosis—even those with very mild symptoms. Thus, we were able to interpret guideline adherence, e.g., by showing that patients with more severe/complex presentations were more likely to receive treatment.

CONCLUSION

This study identified characteristics predicting whether a child newly diagnosed with ADHD—and with free access to medication and psychotherapy—receives pharmacological and/or psychotherapeutic treatment in routine care. In the German health system, patients with externalizing symptoms were more prone to receive any of the studied treatments than the average child diagnosed with ADHD. Comorbid internalizing symptoms were predictors for psychotherapy—both as monotherapy and in addition to medication. A first diagnosis with ADHD by a specialist and a more severe ADHD presentation were predictors for drug treatment. Our results indicate that treatment initiation is in line with recommendations from ADHD guidelines. However, treatment with psychotherapy appears to be suboptimal.

Future research is needed to address the questions raised by this study, e.g., (a) what are the characteristics of longitudinal treatment trajectories, (b) why and how do parents decide to

visit a certain physicians or psychotherapists, (c) which recommendations are given by the diagnosing person, (d) did children who received only psychotherapy see a child and adolescent psychiatrist with expertise in the diagnosis and treatment of ADHD?

REFERENCES

American Academy of Pediatrics, Subcommittee on Attention-Deficit/Hyperactivity Disorder, Steering Committee on Quality Improvement. (2011). ADHD: clinical practice guideline for the diagnosis, evaluation, and treatment of attention-deficit/hyperactivity disorder in children and adolescents. *Pediatrics*, *128*, 1–14.

Bachmann, C. J., Philipsen, A., & Hoffmann, F. (2017a). ADHD in Germany: Trends in Diagnosis and Pharmacotherapy. *Deutsches Ärzteblatt International*, *114*, 141–148.

Bachmann, C. J., Wijlaars, L. P., Kalverdijk, L. J., Burcu, M., Glaeske, G., Schuiling-Veninga, C. C. M., ... & Zito, J. M. (2017b). Trends in ADHD medication use in children and adolescents in five western countries, 2005-2012. *European Neuropsychopharmacology*, *27*, 484–493.

Bussing, R., Koro-Ljungberg, M., Noguchi, K., Mason, D., Mayerson, G., & Garvan, C. W. (2012). Willingness to use ADHD treatments: A mixed methods study of perceptions by adolescents, parents, health professionals and teachers. *Social Science & Medicine*, *74*, 92–100.

CHMP. (2009, January 22). Elements recommended for inclusion in Summaries of Product Characteristics for methylphenidate-containing medicinal products authorised for the treatment of ADHD in children aged six years and above and adolescents. Retrieved February 19, 2018, from http://www.ema.europa.eu/docs/en_GB/document_library/Referrals_document/Methylphenidate_31/WC500011184.pdf

Counts, C. A., Nigg, J. T., Stawicki, J. A., Rappley, M. D., & Eye, von, A. (2005). Family adversity in DSM-IV ADHD combined and inattentive subtypes and associated disruptive behavior problems. *Journal of the American Academy of Child and Adolescent Psychiatry*, *44*, 690–698.

Daley, D., van der Oord, S., Ferrin, M., Danckaerts, M., Doepfner, M., Cortese, S., ... & on behalf of the European ADHD Guidelines Group (2014). Behavioral interventions in attention-deficit/hyperactivity disorder: a meta-analysis of randomized controlled trials across multiple outcome domains. *Journal of the American Academy of Child and Adolescent Psychiatry*, *53*, 835-847.e5.

Daley, M. F., Newton, D. A., DeBar, L., Newcomer, S. R., Pieper, L., Boscarino, J. A., ... & Bussing, R. (2017). Accuracy of Electronic Health Record-Derived Data for the Identification of Incident ADHD. *Journal of Attention Disorders*, *21*, 416–425.

Dalsgaard, S., Østergaard, S. D., Leckman, J. F., Mortensen, P. B., & Pedersen, M. G. (2015). Mortality in children, adolescents, and adults with attention deficit hyperactivity disorder: a nationwide cohort study, *385*, 2190–2196.

Döpfner, M., Breuer, D., Wille, N., Erhart, M., Ravens-Sieberer, U., BELLA study group. (2008). How often do children meet ICD-10/DSM-IV criteria of attention deficit-/hyperactivity disorder and hyperkinetic disorder? Parent-based prevalence rates in a national sample--results of the BELLA study. *European Child & Adolescent Psychiatry*, *17*(Suppl 1), 59–70.

Faraone, S. V., Asherson, P., Banaschewski, T., Biederman, J., Buitelaar, J. K., Ramos-Quiroga, J. A., ... & Franke, B. (2015). Attention-deficit/hyperactivity disorder. *Nature Reviews. Disease Primers*, *1*, 15020.

Gellad, W. F., Stein, B. D., Ruder, T., Henderson, R., Frazee, S., Mehrota, A., & Donohue, J. (2014). Geographic variation in receipt of psychotherapy in children receiving attention-deficit/hyperactivity disorder medications. *JAMA*, *168*, 1074–1076.

Hechtman, L., Swanson, J. M., Sibley, M. H., Stehli, A., Owens, E. B., Mitchell, J. T., ... & for the MTA Cooperative Group (2016). Functional Adult Outcomes 16 Years After Childhood Diagnosis of Attention-Deficit/Hyperactivity Disorder: MTA Results. *Journal of the American Academy of Child and Adolescent Psychiatry*, *55*, 945–952.e2.

IQWiG. (2016). A guide to psychotherapy in Germany: Where can I find help? Retrieved February 19, 2018, from https://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0072697/

Kovshoff, H., Williams, S., Vrijens, M., Danckaerts, M., Thompson, M., Yardley, L., ... & Sonuga-Barke, E. J. S. (2012). The decisions regarding ADHD management (DRAMa) study: uncertainties and complexities in assessment, diagnosis and treatment, from the clinician's point of view. *European Child & Adolescent Psychiatry*, *21*, 87–99.

Lebowitz, M. S. (2016). Stigmatization of ADHD: A Developmental Review. *Journal of Attention Disorders*, *20*, 199–205.

Lynch, C. (2004). Psychotherapy for persons with mental retardation. *Mental Retardation*, *42*, 399–405.

Meinzer, M. C., Pettit, J. W., Waxmonsky, J. G., Gnagy, E., Molina, B. S. G., & Pelham, W. E. (2016). Does Childhood Attention-Deficit/Hyperactivity Disorder (ADHD) Predict Levels of Depressive Symptoms during Emerging Adulthood? *Journal of Abnormal Child Psychology*, *44*, 787–797.

NICE. (2016). Attention deficit hyperactivity disorder: diagnosis and management. Retrieved February 19, 2018, from https://www.nice.org.uk/guidance/cg72

Pigeot, I., & Ahrens, W. (2008). Establishment of a pharmacoepidemiological database in Germany: methodological potential, scientific value and practical limitations. *Pharmacoepidemiology and Drug Safety*, *17*, 215–223.

Polanczyk, G. V., Salum, G. A., Sugaya, L. S., Caye, A., & Rohde, L. A. (2015). Annual research review: A meta-analysis of the worldwide prevalence of mental disorders in children and adolescents. *Journal of Child Psychology and Psychiatry*, *56*, 345–365.

Seidman, L. J. (2014). Neuropsychologically informed strategic psychotherapy in teenagers and adults with ADHD. *Child and Adolescent Psychiatric Clinics of North America*, *23*, 843–852.

Setyawan, J., Fridman, M., Grebla, R., Harpin, V., Korst, L. M., & Quintero, J. (2018). Variation in Presentation, Diagnosis, and Management of Children and Adolescents With ADHD Across European Countries. *Journal of Attention Disorders*, *22*, 911–923.

Sonuga-Barke, E. J. S. (2016). Can Medication Effects Be Determined Using National Registry Data? A Cautionary Reflection on Risk of Bias in "Big Data" Analytics. *Biological Psychiatry*, *80*, 893–895.

Sonuga-Barke, E. J. S., Brandeis, D., Cortese, S., Daley, D., Ferrin, M., Holtmann, M., ... & European ADHD Guidelines Group (2013). Nonpharmacological interventions for ADHD: systematic review and meta-analyses of randomized controlled trials of dietary and psychological treatments. *The American Journal of Psychiatry*, *170*, 275–289.

Swanson, J. M., Arnold, L. E., Molina, B. S. G., Sibley, M. H., Hechtman, L. T., Hinshaw, S. P., ... & for the MTA Cooperative Group (2017). Young adult outcomes in the follow-up of the multimodal treatment study of attention-deficit/hyperactivity disorder: symptom persistence, source discrepancy, and height suppression. *Journal of Child Psychology and Psychiatry*, *58*, 663–678.

Tandon, M., Tillman, R., Agrawal, A., & Luby, J. (2016). Trajectories of ADHD severity over 10 years from childhood into adulthood. *Attention Deficit and Hyperactivity Disorders*, *8*, 121–130.

Taylor, E., Döpfner, M., Sergeant, J., Asherson, P., Banaschewski, T., Buitelaar, J., ... & Zuddas, A. (2004). European clinical guidelines for hyperkinetic disorder – first upgrade. *European Child & Adolescent Psychiatry*, *13*(Suppl 1), i7–i30.

The MTA Cooperative Group. (1999). A 14-Month Randomized Clinical Trial of Treatment Strategies for Attention-Deficit/Hyperactivity Disorder. *Archives of General Psychiatry*, *56*, 1073–1086.

Vitiello, B., Severe, J. B., Greenhill, L. L., Arnold, L. E., Abikoff, H. B., Bukstein, O. G., ... Cantwell, D. P. (2001). Methylphenidate dosage for children with ADHD over time under

controlled conditions: lessons from the MTA. *Journal of the American Academy of Child and Adolescent Psychiatry*, *40*, 188–196.

TABLES

Table 1. Period prevalence of medication and psychotherapy among treatment-naïve children after first ADHD diagnosis over five years.

	Time since first ADHD diagnosis (n = 12,250)				
Treatment received	≤1 year	≤2 years	≤3 years	≤4 years	≤5 years
Medication[a] (%)	24.5	30.7	33.8	35.8	36.8
Medication and psychotherapy (%)	2.9	5.1	7.1	8.7	10.1
Only psychotherapy[b] (%)	6.4	7.9	9.1	9.8	10.9

Note. Treatment categories are mutually exclusive except "medication and psychotherapy", which is a subgroup of "medication". ADHD = attention deficit hyperactivity disorder; n = sample size.

[a]Includes methylphenidate, atomoxetine, lisdexamfetamine, and/or dexamfetamine.

[b]Including trial sessions.

Table 2. Characteristics at first ADHD diagnosis by treatment ever received within five years from the first ADHD diagnosis.

Characteristics at first ADHD diagnosis	Treatment received within five years: No treatment (*n* = 6,411)	Medication[a] (*n* = 4,506)	Only psychotherapy (*n* = 1,333)	*p*-value
Male sex (*n*, %)	4,418 (68.9)	3,450 (76.6)	952 (71.4)	<0.001
Age in years (*n*, %)				<0.001
5–6	1,498 (23.4)	691 (15.3)	252 (18.9)	
7–9	3,236 (50.5)	2,486 (55.2)	689 (51.7)	
10–12	1,677 (26.2)	1,329 (29.5)	392 (29.4)	
Specialty of the diagnosing person (*n*, %)				<0.001
Pediatrician	3,838 (59.9)	2,255 (50.0)	646 (48.5)	
Child and adolescent psychiatrist	1,202 (18.7)	1,292 (28.7)	282 (21.2)	
General practitioner	1,019 (15.9)	437 (9.7)	172 (12.9)	
Psychotherapist	11 (0.2)	78 (1.7)	156 (11.7)	
Physician in inpatient unit (without specialty)	117 (1.8)	161 (3.6)	39 (2.9)	
Other/unkown	224 (3.5)	283 (6.3)	38 (2.9)	
Type of ADHD diagnosis (*n*, %)				<0.001
Without hyperactivity (F98.8)	2,015 (31.4)	292 (6.5)	356 (26.7)	
With hyperactivity (F90)	4,396 (68.6)	4,214 (93.5)	977 (73.3)	
Psychiatric comorbidities (*n*, %)[b]				
Any depression (F20.4; F31.3/4/5; F32-F39; F41.2; F43.2)	416 (6.5)	423 (9.4)	141 (10.6)	<0.001
Neurotic and somatoform disorders (F40-F48 except F41.2 and F43)	473 (7.4)	324 (7.2)	152 (11.4)	<0.001
Reaction to severe stress (F43 except F43.2)	103 (1.6)	96 (2.1)	37 (2.8)	0.0084
Sleep disorders (F51; G47)	228 (3.6)	166 (3.7)	57 (4.3)	0.4467
Mental retardation (F70-F79)	117 (1.8)	100 (2.2)	21 (1.6)	0.2000
Specific developmental disorders (F80-F83)	3,024 (47.2)	2,253 (50.0)	596 (44.7)	<0.001
Pervasive developmental disorders (F84)	105 (1.6)	100 (2.2)	19 (1.4)	0.0420
Conduct disorders (F90.1; F91; F92)	892 (13.9)	1,031 (22.9)	288 (21.6)	<0.001
Emotional disorders with onset specific to childhood (F93)	599 (9.3)	540 (12.0)	219 (16.4)	<0.001
Disorders of social functioning (F94)	63 (1.0)	84 (1.9)	25 (1.9)	<0.001
Eating disorders (F50)	38 (0.6)	32 (0.7)	13 (1.0)	0.2848
Sexual dysfunction (F52)	1 (0.0)	0 (0.0)	0 (0.0)	–
Tic disorders (F95)	149 (2.3)	123 (2.7)	45 (3.4)	0.0668
Psychiatric hospitalization (*n*, %)[c]	63 (1.0)	66 (1.5)	19 (1.4)	0.0566

Note. ADHD = attention-deficit/hyperactivity disorder; *n* = sample size.

[a]The group "medication" included individuals with additional psychotherapy (27%); it was further stratified for the comparison "medication and psychotherapy" versus "only medication" in Table 4.

[b]One child could have more than one comorbidity.

[c]Defined as inpatient treatment with a main or secondary psychiatric diagnosis (ICD-10 F00-F99) in the one year baseline before and excluding cohort entry.

Table 3. Adjusted odds ratios for characteristics at the first ADHD diagnosis associated with the received treatment within five years.

	Adjusted odds ratios (95% CI) for received treatment within five years[a]	
	Compared to no treatment[b]	
Characteristics at first ADHD diagnosis	Medication[c] (*n* = 4,506)	Only psychotherapy (*n* = 1,333)
Male sex	1.41 (1.28 to 1.55)*	1.17 (1.02 to 1.34)*
Age in years		
5–6	Ref.	Ref.
7–9	1.53 (1.36 to 1.71)*	1.15 (0.97 to 1.35)
10–12	1.55 (1.37 to 1.76)*	1.15 (0.95 to 1.38)
Specialty of the diagnosing person		
Child and adolescent psychiatrist	Ref.	Ref.
Pediatrician	0.73 (0.66 to 0.81)*	0.84 (0.71 to 0.99)*
General practitioner	0.56 (0.48 to 0.64)*	0.85 (0.68 to 1.05)
Psychotherapist	8.06 (4.24 to 15.32)*	63.96 (34.15 to 119.8)*
Physician in inpatient unit (without specialty)	1.25 (0.96 to 1.62)	1.17 (0.79 to 1.73)
Other/unkown	1.45 (1.18 to 1.77)*	0.83 (0.57 to 1.20)
Diagnosis with hyperactivity (ref.: without)	5.67 (4.97 to 6.48)*	1.13 (0.98 to 1.30)
Any depression	1.19 (1.02 to 1.38)*	1.24 (1.00 to 1.55)
Neurotic and somatoform disorders	0.91 (0.78 to 1.07)	1.38 (1.12 to 1.70)*
Reaction to severe stress	1.11 (0.83 to 1.49)	1.48 (0.99 to 2.20)
Specific developmental disorders	1.13 (1.04 to 1.23)*	0.95 (0.83 to 1.07)
Pervasive developmental disorders	1.17 (0.87 to 1.58)	0.81 (0.49 to 1.34)
Conduct disorders	1.35 (1.22 to 1.51)*	1.45 (1.23 to 1.70)*
Emotional disorders with onset specific to childhood	1.01 (0.89 to 1.16)	1.51 (1.26 to 1.82)*
Disorders of social functioning	1.39 (0.98 to 1.97)	1.54 (0.95 to 2.51)

Note. ADHD = attention deficit hyperactivity disorder; CI = confidence interval; *n* = sample size.

[a]The multinomial logistic regression model is adjusted for all variables in this table.

[b]Children who received neither ADHD medication nor psychotherapy served as the reference group (*n* = 6,411).

[c]The group "medication" included individuals with additional psychotherapy (27%); it was further stratified for the comparison "medication and psychotherapy" versus "only medication" in Table 4.

*$p < .05$.

Table 4. Comparison of those with versus without psychotherapy among children with ADHD diagnosis who received medication.

Characteristics at first ADHD diagnosis	Treatment received within five years		Adjusted odds ratios (95% CI)[a] for medication and psychotherapy compared to only medication
	Only medication (*n* = 3,267)	Medication and psychotherapy (*n* = 1,239)	
Male sex (*n*, %)	2,495 (76.4)	955 (77.1)	0.99 (0.85 to 1.17)
Age in years (*n*, %)			
5–6	480 (14.7)	211 (17.0)	Ref.
7–9	1,786 (54.7)	700 (56.5)	0.91 (0.75 to 1.09)
10–12	1,001 (30.6)	328 (26.5)	0.73 (0.59 to 0.90)*
Specialty of the diagnosing person (*n*, %)			
Child and adolescent psychiatrist	980 (30.0)	312 (25.2)	Ref.
Pediatrician	1,640 (50.2)	615 (49.6)	1.30 (1.10 to 1.53)*
General practitioner	319 (9.8)	118 (9.5)	1.29 (1.01 to 1.66)*
Psychotherapist	7 (0.2)	71 (5.7)	34.47 (15.61 to 76.10)*
Physician in inpatient unit (without specialty)	115 (3.5)	46 (3.7)	1.01 (0.69 to 1.46)
Other/unkown	206 (6.3)	77 (6.2)	1.34 (1.00 to 1.80)
Diagnosis with hyperactivity (*n*, %)	3,055 (93.5)	1,159 (93.5)	NA
Psychiatric comorbidities (*n*, %)[b]			
Any depression	278 (8.5)	145 (11.7)	1.41 (1.13 to 1.77)*
Neurotic and somatoform disorders	212 (6.5)	112 (9.0)	1.31 (1.02 to 1.68)*
Reaction to severe stress	68 (2.1)	28 (2.3)	NA
Mental retardation	83 (2.5)	17 (1.4)	0.48 (0.28 to 0.83)*
Specific developmental disorders	1,653 (50.6)	600 (48.4)	NA
Pervasive developmental disorders	77 (2.4)	23 (1.9)	NA
Conduct disorders	676 (20.7)	355 (28.7)	1.52 (1.29 to 1.78)*
Emotional disorders with onset specific to childhood	343 (10.5)	197 (15.9)	1.48 (1.21 to 1.81)*
Disorders of social functioning	54 (1.7)	30 (2.4)	NA

Note. ADHD = attention deficit hyperactivity disorder; CI = confidence interval; *n* = sample size; NA = not applicable as these variables were not included in the respective model.

[a]The model is adjusted for all variables in this table (except "NA").

[b]One child could have more than one comorbidity.

*$p < .05$.

FIGURES

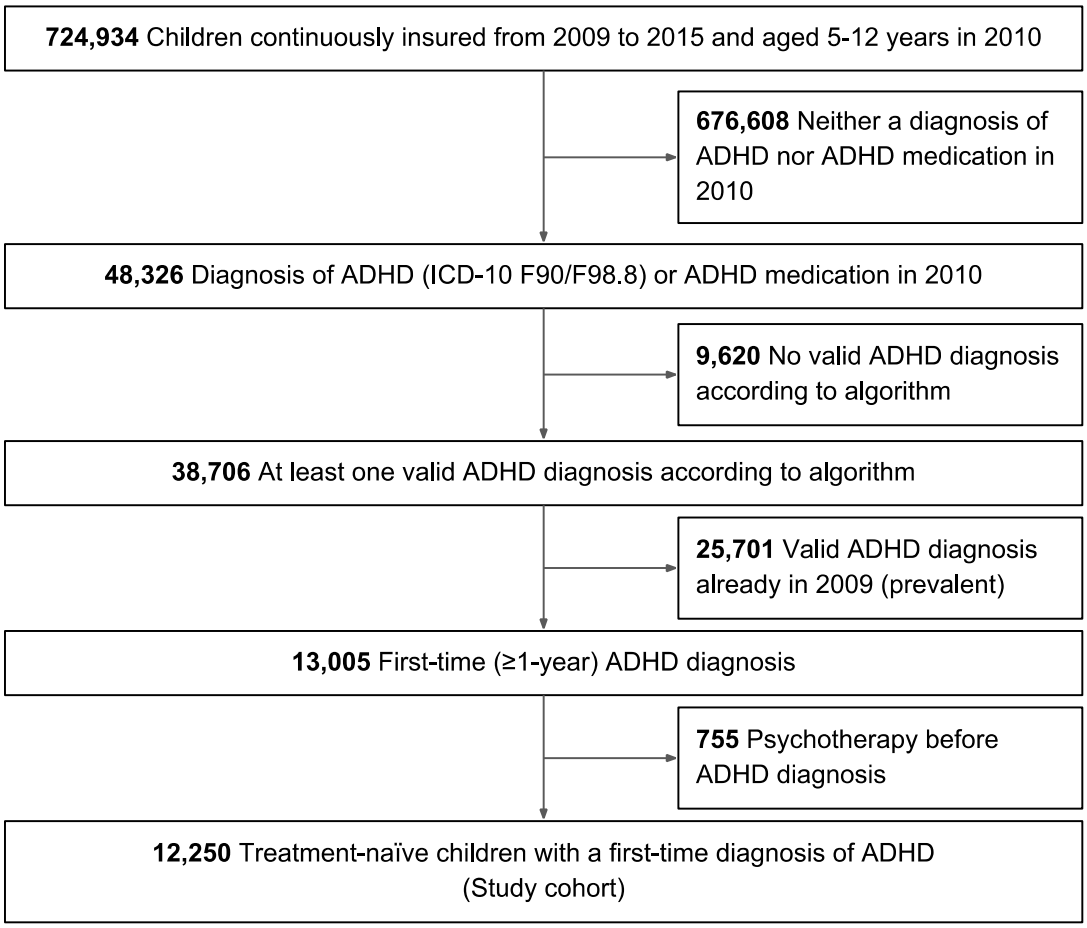

Figure 1. Flow diagram.

Note. ADHD = attention-deficit/hyperactivity disorder; ICD-10 = International Statistical Classification of Diseases and Related Health Problems, 10th Revision.