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ORIGINAL ARTICLE

Healthcare utilization and costs of psychiatric and somatic comorbidities associated with newly diagnosed adult ADHD

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Abstract

Background: Psychiatric and somatic problems in young adulthood have been found to be main drivers of costs in individuals with childhood ADHD. However, knowledge of the patterns of healthcare utilization and costs of comorbidities in middle-aged adults with newly diagnosed ADHD is very limited.

Method: We studied individuals born 1966–1978 (from the Swedish Total Population Register) with newly diagnosed ADHD between the ages of 30–45 years and individuals without ADHD matched on birthdate, birth county, and sex. Healthcare utilization and expenditure for psychiatric and somatic disorders were obtained over four years (two years pre- and post-initial ADHD diagnosis).

Results: Middle-aged adults with newly diagnosed ADHD showed higher levels of healthcare utilization and costs (outpatient, inpatient, medications) for psychiatric and somatic comorbidities relative to adults without ADHD, both before and after the initial diagnosis. Females showed greater average group differences across the study period for medication prescriptions than males. Total incremental annual costs per capita were €2478.76 in adults with ADHD relative to those without, and costs were mainly driven by inpatient care. Psychiatric outpatient visits were statistically significantly higher the year before the ADHD diagnosis compared with two years before and after the diagnosis.

Conclusion: This study demonstrates the substantial burden of psychiatric and somatic comorbidities in middle-aged adults newly diagnosed with ADHD. Psychiatric outpatient visits peaked in the year leading up to the ADHD diagnosis. Findings further suggested that females with ADHD may seek more treatment for comorbidities than males, which may reflect a general female tendency.

Significant outcomes

- Adults newly diagnosed with ADHD showed increased levels of healthcare utilization and costs from both psychiatric and somatic disorders compared to adults without ADHD (average annual cost per capita €2,870 versus €394).
- Psychiatric outpatient visits peaked in the year leading up to the initial ADHD diagnosis.

- A greater amount of medication prescriptions was observed in females compared to males with ADHD relative to those without ADHD.

Limitations

- Cost estimates are expected to be underestimated as we did not have access to data on all healthcare services, such as emergency admission, outpatient primary care, and over-the-counter medications.
- Because of the limited time window of linkage to patient registers, we studied healthcare utilization and costs only two years before and after the initial ADHD diagnosis.

1 | INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is a common neurodevelopmental disorder, with a prevalence of 3–7% in childhood and adolescence.[1,2] Recent advances in research have shown that the disorder often persists into adulthood, in approximately 15–79% of cases,[3-5] and the prevalence in adulthood is around 3%.[6-8] Adults with ADHD often experience a range of behavioral (eg, injuries),[9] psychiatric (eg, autism spectrum disorders [ASD], depression, drug abuse),[10,11] and somatic (eg, obesity and asthma) health problems.[12,13]

This increased risk of health problems in adult ADHD poses significant clinical and public health problems.[14,15] Furthermore, recent studies suggest that adult ADHD is still substantially underdiagnosed, and that comorbidities may lead to misdiagnoses or delayed diagnoses (ie, "diagnostic overshadowing"), which subsequently can delay appropriate treatment.[16] Knowledge of common comorbidities that are present before an initial ADHD diagnosis would be informative in order to prevent diagnostic overshadowing of other disorders, and to highlight patients who may benefit from screening for ADHD.

Yet, little is known about the associated patterns of healthcare utilization and economic burden from comorbidity in adulthood, particularly in those who do not receive their ADHD diagnosis until middle adulthood. This is a serious concern because of the potential detrimental consequences of a delay in diagnosis and receiving appropriate treatment. Investigating disease-specific healthcare utilization is crucial for forecasting demands on medical infrastructure and for guiding policy and healthcare service planning. Recent statutory health insurance claims and nation-wide register studies, mainly in children or younger adults, have shown that individuals with ADHD show higher healthcare costs than those without ADHD, with costs largely driven by comorbid conditions.[17-19] It may be that early detection of adult ADHD would in turn improve the quality of life of those affected by preventing the development or at least reducing the severity of comorbidities[15,20,21] and may contribute to long-term cost savings for society.

One German insurance claims-based study investigated healthcare costs of newly diagnosed ADHD in children and adults before and after the initial diagnoses.[22] The study found that average total costs (outpatient and inpatient care, surgery, medication, other treatments, and sick leave) in the ADHD group in the year after the diagnosis exceeded the costs before by 976 euros (€), implying that the burden of disease led to higher costs. However, little is known of specific trajectories of comorbidities before and after initial ADHD diagnoses. A recent German insurance claims-based study of adults with newly diagnosed ADHD (no prior diagnosis or medication within the last 1–4 years), found that more than 50% of individuals received anxiety and depression diagnoses, separately, within the same year as their initial ADHD diagnosis.[23] Further research is needed to extend our knowledge of the patterns of healthcare use and costs of both psychiatric and somatic disorders before and after initial adult ADHD diagnoses.

While ADHD is found to be more prevalent in boys than girls in childhood, this sex difference substantially attenuates in adult ADHD.[24] In a recent Swedish register-based study, we found that levels of healthcare utilization and associated costs in young adults with ADHD relative to those without was elevated more in females than in males for outpatient visits and somatic medication prescriptions, while it was similar for other (eg, inpatient visits, psychiatric medication) outcomes.[18] This study further found that incremental differences over time between young adults with and without ADHD increased significantly more (from 18 to 26 years) for females than males for psychiatric medication prescriptions. Another study showed higher incremental healthcare costs in relation to SUD and obesity in females than males with ADHD, whereas the opposite trend was found for mood and anxiety.[19] Further research is needed to outline the sex differences beyond young adulthood, and in females and males with a first diagnosis of ADHD in middle adulthood, in order to provide sex-specific guidance on preventative measures for comorbidities, and for diagnostic procedures of adult ADHD.

1.1 | Aims of the study

The aim of this study was to outline healthcare utilization and costs from psychiatric and somatic comorbidities in middle-aged adults with newly diagnosed ADHD, two years before and after the first ADHD diagnosis or medication prescription. The purpose was to outline these patterns of comorbidities separately in females and males to understand sex differences in incidence adult ADHD.

2 | METHODS

2.1 | Study population

A longitudinal matched cohort study design was employed using Swedish register data. The total population register was used to identify 1,931,857 subjects from a cohort born between the period 1966 and 1978, and only included individuals who were alive and residents in Sweden during the follow-up (until 2013).

Individuals with newly diagnosed ADHD were identified using the National Patient Register (NPR)[25] based on receiving an ADHD diagnosis (International Classification of Diseases [ICD-10] code F90)[26] through inpatient hospitalization or outpatient specialist care services, or at least two ADHD medication prescriptions during the index period 2008–2011 (cohort aged 30–45 years). In other words, both ADHD diagnosis and medication prescription were used as proxies for the first recorded diagnosis. Previous research has indicated high specificity for such register-based diagnoses of ADHD in Sweden.[27] In Sweden, assessment of ADHD in adults is performed at outpatient specialist clinics, and the National Patient Register covers psychiatric outpatient care from both public and private caregivers. The index period of 2008–2011 was selected as we aimed to study all individuals two years before and two years after the initial diagnosis, and all inpatient, outpatient and medication data was only available up to 2013. Furthermore, in 2008, a general license was provided for psychiatrists in Sweden to diagnose and treat adult ADHD for the first time, which may have led to increased numbers of adult ADHD diagnoses in Sweden.[28]

A total of 7362 adults with newly diagnosed ADHD were identified as fulfilling these criteria: (a) received an initial primary or secondary diagnosis or medication prescription for ADHD between 30 and 45 years of age between 2008 and 2011, (b) no medication prescription for a period of at least 2.5 years and no ADHD diagnosis for at least 11 years before 2008 (ie, data available for medication prescriptions from July 2005, outpatient specialist care from 2001, and inpatient care from 1997). Figure S1 displays a flowchart of the study design and exclusion criteria.

Each individual with ADHD was matched based on birthdate (year and month), sex, and birth county to 10 individuals without ADHD from the same cohort. The total of 73,260 individuals fulfilled the following criteria: (a) were alive and living in Sweden throughout the study period, and (b) were not diagnosed with ADHD and had no records of ADHD medication prescriptions until the end of the study period, that is, December 2013. The national personal identification number was used to link registers. The Regional Ethical Review Board in Stockholm, Sweden, approved this study, and the use of Swedish register data does not require informed consent.

3 | MEASURES

Demographics were obtained from Sweden's Total Population Register and Longitudinal Integration database for Health Insurance and Labor Market Studies (LISA).

3.1 | Healthcare utilization and expenditure

Primary ICD-10 diagnostic codes from inpatient admissions (99% coverage) and hospital-based outpatient visits (70–96% coverage)[29] were coded from the NPR over a period of four years; two years before and two years after initial ADHD diagnoses or medication, when participants were between 28 and 47 years. Cost information according to the primary ICD diagnosis was obtained from Sweden's Cost Per Patient database.[30] All ICD diagnoses available in our register linkage (see Table S1) were classified into psychiatric (excluding ADHD) and somatic. The total number of inpatient hospitalization days, outpatient visits and costs were calculated for psychiatric and somatic disorders per person and year relative to the index date.[18,31]

The Swedish Prescribed Drug Register (>99% coverage)[32] was used to obtain data on utilization and expenditure for medication prescription fills (using the Anatomical Therapeutic Chemical classification). Medications were classified into psychiatric (excluding ADHD medications) and somatic. The total number of prescription fills and costs was calculated for psychiatric and somatic disorders per person and year relative to index date.[31] Costs were calculated as days × dose per day × corresponding unit total costs.

Expenditure was calculated in Swedish crowns (SEK) and inflated to 2019 Swedish prices. Costs are reported in euro (€) and additionally reported in US dollars ($) in the text (2019). The purchasing power parity-based exchange rate in 2019 was $1.00 = 8.746 SEK and €1.00 = 12.388 SEK.[33]

3.2 | Statistical analysis

Generalized estimating equations (GEEs)[34] were conducted to compare average annual healthcare utilization and

expenditure between the ADHD and non-ADHD groups and to compare the difference between the groups over four years time (two years before and after index date). Models were run separately in females and males. GEEs were run with the identity link function to model linear effects on the absolute scale (rather than the log-link function using a multiplicative scale) and yielded regression coefficients (B) of group differences with 95% confidence intervals (CIs). The GEE model was suitable for our data because of the lenient distributional assumptions, and the use of a working correlation matrix, which adjusts for incorrect standard errors caused by dependent observations on the same subjects (4 time points) and within each stratum. One stratum includes one individual with ADHD and the corresponding ten non-ADHD individuals matched on gender, birth date, and birth county. Data management was conducted using the Statistical Analysis System (SAS Institute Inc [version 9.1], 2016) and analyses using STATA (version 15, 2017).

Socioeconomic status and sex were added as covariates in the statistical models, as these factors have been found to explain variability in healthcare utilization.[35] Highest education level and disposable income (standardized per year of age) at year 2005 were obtained from LISA and used as proxies for socioeconomic status. We added year of birth as a covariate to adjust for birth cohort effects.

4 | RESULTS

The total sample consisted of 80,982 individuals. Among the 7362 individuals with newly diagnosed adult ADHD, 52% were males, and the average age at initial ADHD diagnosis (or medication prescription) was 37 years in both males and females ($M = 37.25$, SD = 3.89 and M = 37.51, SD = 3.77, respectively). Descriptive statistics for the study participants, annual healthcare utilization and expenditure are presented in Tables 1 and S3–S5, respectively.

4.1 | What are the patterns of healthcare utilization and expenditure from comorbidities in adults with a newly diagnosed ADHD diagnosis?

The overall mean annual expenditure per capita in the group of adults with newly diagnosed ADHD was €2870 and €394 for those without (€2802 versus €427 in females, €2911 versus €364 in males). Costs in the ADHD group for inpatient care was €1928 versus €191 (€1849 versus €187 in females, €1998 versus €194 in males), outpatient care was €455 versus €77 (€455 versus €84 in females, €436 versus €72 in males), and medication prescriptions was €487 versus €126 (€498 versus €156 in females, €477 versus €98 in males). The main cost driver for psychiatric and somatic disorders in both males and females were inpatient costs (Table S3).

Average annual healthcare utilization and expenditure for psychiatric and somatic disorders was statistically significantly greater for individuals with newly diagnosed adult ADHD compared to those without for all outcomes in females and males (Table 2). Group differences between those with and without adult ADHD were statistically significantly greater for psychiatric disorders than somatic disorders across all outpatient, inpatient, and medication outcomes (non-overlapping 95% CIs). Group differences in females and in males were similar in magnitude for most outcomes (non-overlapping 95% CIs), except for medication prescriptions for psychiatric ($B = 11.52$, 95% CIs = 10.67–12.37 versus $B = 9.75$, 95% CIs 9.03–10.47) and somatic ($B = 3.54$, 95% CIs 35.03–3.91 versus $B = 2.37$, 95% CIs = 2.13–2.62) disease, which were greater in females.

TABLE 1 Characteristics of study participants

	Individuals newly diagnosed with adult ADHD (7362)		Matched individuals with no recorded ADHD ($n = 73,620$)	
	Male ($n = 3857$, 52%)	Female ($n = 3505$, 48%)	Male ($n = 38,570$, 52%)	Female ($n = 35,050$, 48%)
Age at index date (years) (Mean [SD])	37.25 (3.89)	37.51 (3.77)	37.25 (3.89)	37.51 (3.77)
Birthyear (Mean [SD])	1972 (3.73)	1972 (3.68)	1972 (3.73)	1972 (3.68)
Disposable income (SEK) (Mean [SD])	138,244 (88,252)	147,316 (61,752)	201,996 (171,330)	164,388 (188,565)
Highest education level (*n*, %)				
Primary/Lower-Secondary Education	1,192 (31%)	881 (25%)	3,878 (10%)	2,579 (7%)
Upper-Secondary Education	2,031 (53%)	1,848 (53%)	20,722 (54%)	16,383 (47%)
Post-Secondary Education	601 (16%)	755 (22%)	13,395 (35%)	15,671 (45%)
Postgraduate Education	9 (0.23%)	3 (0.14%)	340 (0.89%)	240 (0.68%)

Note: The ADHD and non-ADHD groups were matched on birthdate, sex, and birth county. SD, Standard deviation. SEK, Swedish kronor. Disposable income is defined as total income received (measure from registers) minus taxes paid.

TABLE 2 Modelled annual differences in healthcare utilization and costs between adults with and without newly diagnosed ADHD

	Somatic		Psychiatric	
	Males	**Females**	**Males**	**Females**
Outpatient visits	0.31 (0.27–0.34)	0.30 (0.26–0.34)	1.10 (1.03–1.18)	1.22 (1.15–1.29)
Outpatient costs (€)	72.73 (64.64–80.83)	72.54 (63.30–81.78)	277.89 (258.47–297.30)	292.66 (274.92–310.39)
Inpatient days	0.28 (0.21–0.34)	0.20 (0.14–0.25)	1.70 (1.35–2.05)	1.81 (1.37–2.25)
Inpatient costs (€)	304.49 (231.65–377.33)	217.49 (149.91–285.06)	1328.57 (1066.50–1590.64)	1360.24 (1023.55–1696.92)
Medication prescriptions	2.37 (2.13–2.62)	3.54 (3.18–3.91)	9.75 (9.03–10.47)	11.52 (10.67–12.37)
Medication prescription costs (€)	65.84 (40.64–91.04)	63.51 (35.71–91.31)	282.53 (257.13–307.96)	268.71 (245.23–292.20)

Note: Regression coefficients with 95% confidence intervals after adjustment of covariates. Outpatient primary care/emergency admissions/over-the-counter was not available.

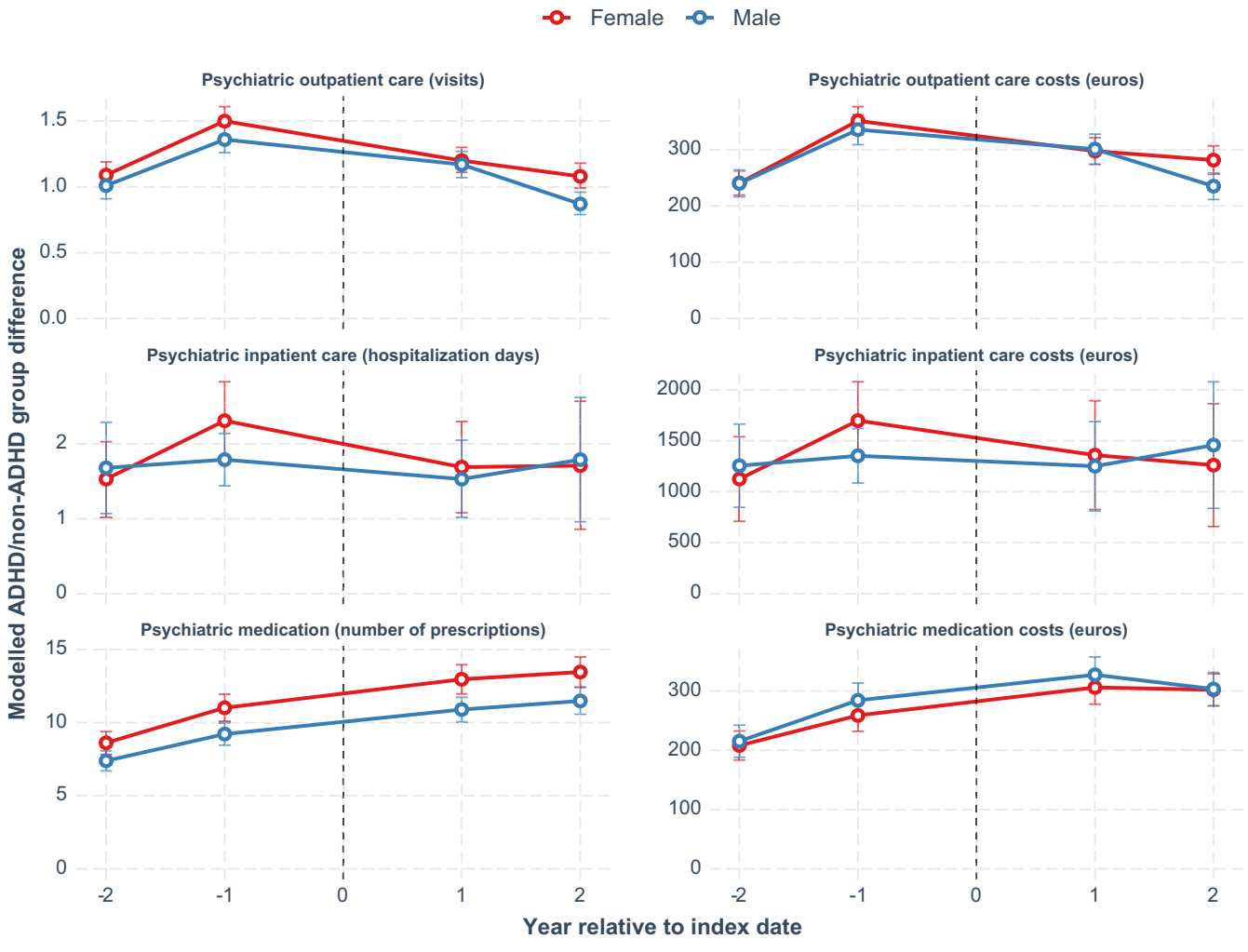

FIGURE 1 ADHD/non-ADHD group difference for psychiatric disorders over the four years (pre- and post-initial ADHD diagnosis) for outpatient visits, inpatient hospitalization days, number of prescriptions, outpatient care costs, inpatient care costs, and medication costs [Colour figure can be viewed at wileyonlinelibrary.com]

4.2 | Do the levels of healthcare utilization and expenditure from comorbidities change before and after the initial ADHD diagnosis in adulthood?

For psychiatric disorders, the group differences between adults with and without ADHD in both females and males were overall stable (overlapping CIs) over the four years (pre- and post-initial ADHD diagnosis) for inpatient days and costs, and medication prescription costs (Figure 1, Tables S6 and S7). However, group differences in females and males for outpatient visits and costs "peaked", that is, were statistically significantly higher (non-overlapping CIs), during the year leading up to the initial ADHD diagnosis compared with 2 years before

and one and two years after diagnosis. Furthermore, the group difference in medication prescriptions for psychiatric illnesses in females and males was smaller two years before the ADHD diagnosis compared with after receiving the diagnosis (Figure 1, Tables S6 and S7).

For somatic disease, group differences between adults with and without ADHD were stable (overlapping CIs) over the four years (pre- and post-initial ADHD diagnosis) for inpatient days and outpatient visits, and their associated cost, in both females and males (Figure 2, Tables S6 and S7). The group differences in number of medication prescriptions for somatic disease was, however, statistically significantly smaller the two years before compared with the two years after the initial ADHD diagnosis.

4.3 | Secondary analyses

As the number of psychiatric outpatient visits "peaked" in the year before and leading up to the initial ADHD diagnosis, we further investigated the reasons for these visits in the ADHD group. We calculated the extent to which each disease group (primary ICD-code coded during visit, see Table S1) explained the overall number of outpatient visits in the year before initial ADHD diagnosis, separately in females and males (Figure S2). The three most frequent reasons for the outpatient visits in females were depression (28%), anxiety (24%), and bipolar disorder (16%), whereas in males these were drug abuse (25%), anxiety (21%), and depression (20%) (Figure S2). Among these three most frequent reasons for seeking outpatient care, the majority of individuals (>97%) received the same diagnosis again (primary or secondary) up to two years after ADHD diagnosis.

5 | DISCUSSION

In this large-scale and longitudinal register-based study, we showed that adults who had a first-time diagnosis of ADHD between 30 and 45 years had persistently higher levels of

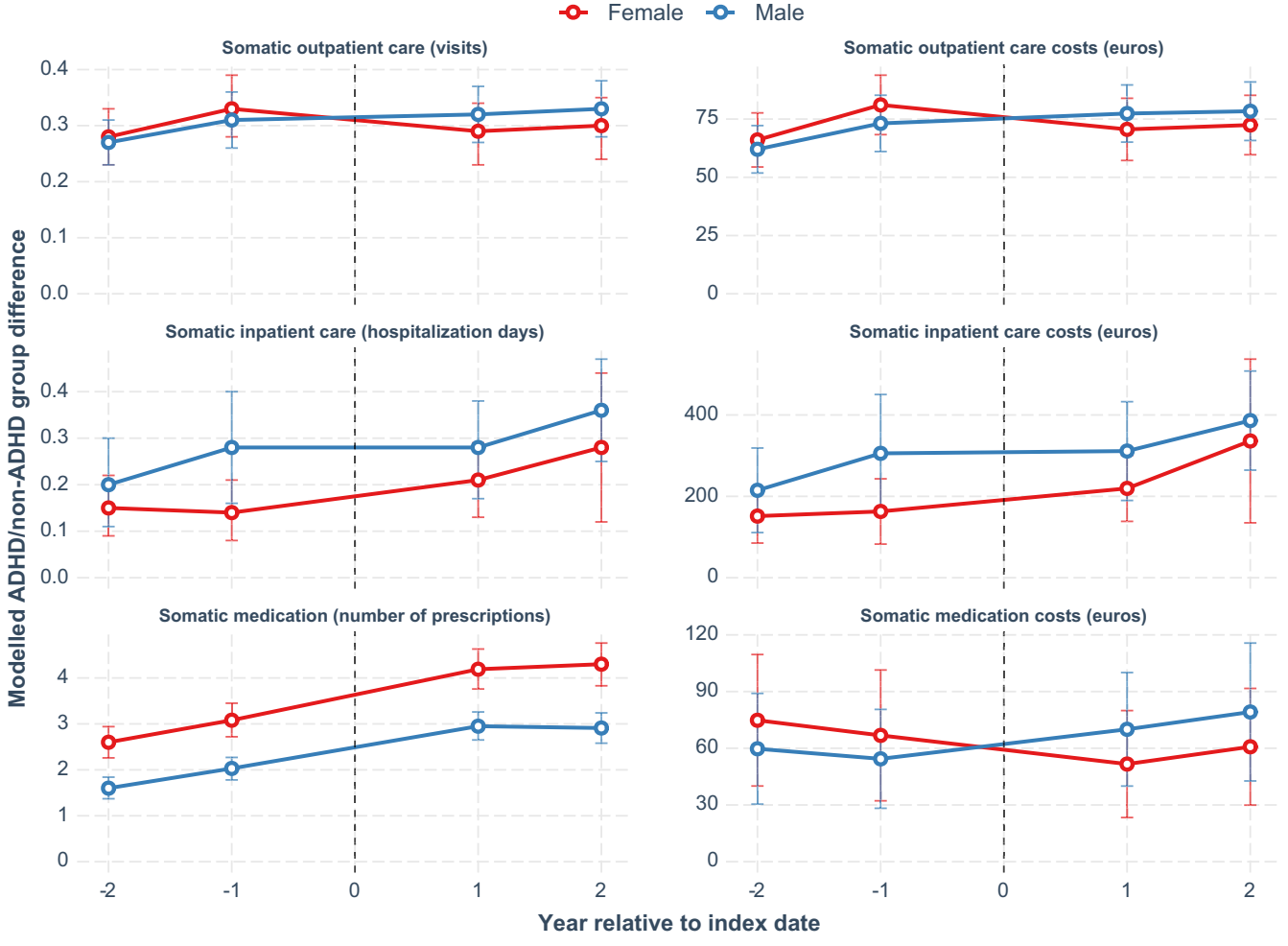

FIGURE 2 ADHD/non-ADHD annual group differences for somatic disorders over the four years (pre- and post-initial ADHD diagnosis) for outpatient visits and costs, inpatient hospitalization days and costs, and number of medications prescriptions and costs [Colour figure can be viewed at wileyonlinelibrary.com]

health utilization and costs from both psychiatric and somatic disorders compared to matched individuals without ADHD. Inpatient care was the main cost driver for psychiatric and somatic comorbidities. These findings are in line with previous research, mostly in younger adult cohorts with childhood ADHD diagnoses.[17-19]

The increased levels of healthcare use and costs in adults with ADHD were generally comparable in males and females, except for the amount of medication prescriptions which was higher in females. A previous study in young adults with childhood ADHD, also using Swedish register-based data, found similar results in that females showed greater ADHD/non-ADHD differences than males for somatic medication prescriptions, and also outpatient visits.[18] Our findings suggest that such sex differences were present also in later adulthood. Findings may potentially reflect a more severe pattern of comorbidities in females with ADHD[36-38] or a general tendency for adult females to be more likely to seek for and adhere treatment, as suggested in the literature. [39,40]

Furthermore, the total incremental annual costs from psychiatric and somatic disorders in the newly diagnosed adult ADHD group relative to controls was estimated at €2476 (€2870 versus €394). This is substantially higher than in our previous register-study in young adults with childhood ADHD, using the same outcome measures, which estimated the incremental annuals cost at €586.[18] The findings suggest that adults who do not receive an ADHD diagnosis until mid-adulthood require more healthcare support for psychiatric and somatic health issues, compared to adults diagnosed with ADHD in childhood.[18] One possible explanation for these higher costs for newly diagnosed adult ADHD may be the late diagnosis of ADHD, which could have resulted in untreated ADHD symptoms or a wrong prioritization on which disorder to treat first. This finding seems to suggest the importance of assessment and treatment of adult ADHD to prevent the development or deterioration of other psychiatric and somatic comorbidities, however, this hypothesis should be formally tested in future research. It is also important to note that these high costs from comorbid conditions reflect costs in adult ADHD patients who seek/receive help in the healthcare system and may be more likely to present with multiple diagnoses compared to adults with ADHD who do not receive a formal diagnosis. Furthermore, the higher costs in the mid-adulthood cohort of this study compared with the young adult cohort in the previous study[18] may also reflect the general increase in healthcare costs with age.[41]

The ADHD/non-ADHD group differences of healthcare indicators and their associated costs were generally stable across the two years before and two years after initial ADHD diagnosis, in both females and males. There were, however, exceptions for psychiatric outpatient care and medication. Psychiatric outpatient visits and associated costs "peaked" during the year leading up to the ADHD diagnosis compared with two years before and after the diagnosis, in both females and males. This finding is in line with findings from a recent German study showing that more than half of individuals with newly diagnosed adult ADHD receive a mood or anxiety disorder within the year of their ADHD diagnosis.[23] Our finding suggests that individuals seek help for other psychiatric problems through outpatient services just before receiving their ADHD diagnosis. We found that the most common reasons for the outpatient visits in the year prior to the initial ADHD diagnosis were depression, bipolar disorder, anxiety, and drug abuse (in females: depression, anxiety, bipolar disorder; in males: drug abuse, anxiety, depression). Thus, practitioners may wish to screen for ADHD in adults who present with these other psychiatric disorders, especially in treatment-resistant patients. Earlier identification of patients with undiagnosed ADHD is an important goal, as suitable treatment and support for ADHD may prevent the development or reduce the severity of other comorbid disorders. These psychiatric problems (depression, bipolar disorder, and anxiety) may possibly either reflect true comorbidities or misdiagnoses in the work-up before receiving the ADHD diagnosis. We found that the majority (>97%) of individuals who received one of these psychiatric diagnoses were diagnosed again within the following two years, which suggests that these conditions may reflect true comorbidities rather than misdiagnosis. However, more research is needed, with longer follow-up, to investigate this hypothesis further.

Furthermore, the ADHD/non-ADHD group difference in the number of medication prescriptions for psychiatric and somatic diseases was statistically significantly smaller two years before the initial ADHD diagnosis compared with after receiving the diagnosis, in both females and males. The increasing trend in the number of prescriptions provides evidence of a high comorbidity and management of co-existing conditions in individuals when they receive their ADHD diagnosis in middle adulthood. Additionally, this might point to a potential undertreatment of comorbidities before ADHD has been recognized. With physicians being aware of ADHD and potential adherence problems to long-term treatment for somatic and psychiatric comorbidities because of ADHD, findings may reflect an increased effort to help patients to manage comorbidities.

6 | STRENGTHS AND LIMITATIONS

This large-scale and longitudinal register study used comprehensive and objective assessments of healthcare utilization and expenditure. Through register linkage to patient registers, we were also able to use long wash-out periods to ensure that the adults were unlikely diagnosed with ADHD prior to the index date. However, we need to consider the study findings in light of some limitations.

Firstly, we did not have access to data on all healthcare services, such as emergency admission, outpatient primary care, and over-the-counter medications (eg, sumatriptan, omeprazole), and somatic disorders (eg, not cancers, cerebral palsy, osteopathies); thus, our cost estimates are expected to be underestimated. Secondly, we relied on register-based records of adult ADHD and other co-occurring disorders, thus, results depend on diagnosed patients who might be more severely affected than individuals with ADHD who do not seek or receive healthcare support. Individuals with multiple diagnoses may also be more likely to get in contact with the healthcare system, which can lead to an overestimation of associations among disorders and associated costs. Furthermore, because of the limited time window of linkage to patient registers and that the general license was provided for psychiatrists in Sweden to diagnose and treat adult ADHD for the first time in 2008, we only studied healthcare utilization and costs two years before and after the initial ADHD diagnosis, as we aimed for full coverage of participants during all time points of the follow-up. Moreover, given the lack of prescription data before 2005, there are inherent differences in wash-out periods for identifying first diagnoses of ADHD based on ADHD medication prescriptions. Future research, using data with longer follow-up and with complete coverage of individuals, should aim to outline the healthcare utilization and costs of individuals for a longer time period in order to gain more detailed knowledge of the trajectories and long-term effects in patients before and after their initial ADHD diagnosis.

7 | CONCLUSION

This study provides important insights into the healthcare patterns and costs of newly diagnosed ADHD in middle-aged adults. Adults newly diagnosed with ADHD showed increased levels of healthcare utilization and costs from both psychiatric and somatic disorders compared to adults without ADHD, with comparable levels in females and males, except for medication prescriptions that were greater in females. We found generally stable patterns of healthcare utilization and costs over time, before and after the initial ADHD diagnosis, in females and males, although psychiatric outpatient visits peaked in the year before the ADHD diagnosis.

ETHICAL STANDARDS

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

CONFLICTS OF INTEREST

HL reported receiving grants from Shire Pharmaceuticals during the conduct of the study; personal fees from and serving as a speaker for Shire Pharmaceuticals and Evolan Pharma AB outside the submitted work; and sponsorship for a conference on attention-deficit/hyperactivity disorder from Shire Pharmaceuticals outside the submitted work. EDR has served as a speaker for Shire Sweden AB, a Takeda Company, outside the submitted work. EA is a former employee and LMA is a current employee of Shire Sweden AB, a Takeda company. TWK is a former employee of Shire International GmbH, a Takeda Company, and holds Takeda stock and/or stock options. The remaining authors declare no competing or potential conflicts of interest.

DATA AVAILABILITY STATEMENT

The data analyzed in this study were obtained from the Swedish National Board of Health and Welfare and Statistics Sweden and because of Swedish privacy laws we cannot make the data publicly available. Requests to access these datasets should be directed to the Swedish National Board of Health and Welfare and Statistics Sweden after obtaining an ethical approval from a regional ethics review board.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

Figure S1. Flowchart of the study design and inclusion/exclusion criteria

Figure S2. Percentage of psychiatric outpatient visits in the year before the initial ADHD diagnosis explained by each disease group

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