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Background

Attention-deficit/hyperactivity disorder (ADHD) is a common neurodevelopmental disorder frequently co-occurring with many other psychiatric and medical conditions. Although psychiatric comorbidity among patients with ADHD has been very well documented, few large systematic studies had assessed the link between ADHD and somatic comorbidities. In this study, we utilized US electronic health records (EHR) from the TriNetX Research Network to investigate the association between cardiometabolic disorders and diagnosis of ADHD.

Study Cohort

The data used in this study was collected on Aug 11, 2021 from the TriNetX Research Network, which provided access to de-identified electronic medical records from patients from the contributing healthcare organizations, as per the de-identification standard defined in Section §164.514(a) of the HIPAA Privacy Rule.

A total of 1,034,532 patients with diagnosis of ADHD (ICD-9 314 or ICD-10 F90) and 3:1 matched cohort of non-ADHD patient (N = 3,103,491) were used for the analysis. Patients were matched by race, ethnicity, sex, US regions, year and age at the first visit. Only those who were entered the EHR system after Jan 1, 1978 and those who had no missing year of birth, dates of the first and last visits were used.

Total Patient N = 4,138,023			
Numbers of ADHD Patients	1,034,532 (25%)	Male %	55.54%
Numbers of Non-ADHD Patients	3,103,491 (75%)		
		Race	
Year of the first visit	1978~2021	White	70.79%
Age at the first visit	0~88	Black or African American	11.95%
		Asian	0.97%
Region		Others or unknown	16.29%
Midwest	23.69%		
Northeast	17.44%	Ethnicity	
South	48.04%	Hispanic or Latino	7.09%
Unknown	3.08%	Not Hispanic or Latino	63.82%
West	7.75%	Unknown	29.09%

Table 1. Characteristics of the matched cohorts

Methods

Cox proportional-hazards (Cox PH) regression model was used to estimate the hazard ratios (HR) with 95% confidence intervals (CI) for the risk of developing cardiometabolic diseases in individuals with ADHD, compared with individuals without ADHD, using the follow-up year as the underlying time scale. ADHD was modelled as a time-invariant variable, that is, individuals with a diagnoses of ADHD were considered as exposed from the index event until the last visit, even before the diagnosis of ADHD was made. Main analyses consisted of comparing the overall risk of acquiring any cardiometabolic diseases between the ADHD and non-ADHD cohorts from the first visits until the last visits in the HER record. We also assess disorders in the three main categories of cardiometabolic disease: cardiovascular, cerebrovascular,

and metabolic diseases..

<u>Stratified Cox PH analyses</u> were conducted to assess different age periods (0~12, 13~21, 21~50 and >50) and comparing ADHD patients diagnosed before or after age 21 with the non-ADHD cohorts. Sequence analysis was used to identity sequence patterns of the onsets of the most common

cardiometabolic comorbidities in patients with ADHD.

Cardiometabolic Comorbidities of ADHD A Retrospective Cohort Study From Electronic Health Records

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Figure 1. Percentages of patients with outcomes in the ADHD and matched non-ADHD cohorts

Figure 4. Top 200 sequence of cardiometabolic comorbidities in patients with ADHD at different age period



Results

Figure 2. ADHD increased risk for all categories of cardiometabolic diseases when compared with the matched non-ADHD cohort.



Conclusions

• Overall, patients with ADHD have increased risk of cardiometabolic diseases compared with the non-ADHD patients. Significantly increased HRs were observed for all three main categories, including cardiovascular, cerebrovascular and metabolic diseases. • ADHD patients who were diagnosed later (after age 21) had significantly more increased risk of all cardiometabolic diseases compared to those who were diagnosed earlier (during childhood and adolescence, before age 21), compared to non-ADHD patients. • Highest risk for all three disease categories were observed during childhood for both ADHD and non-ADHD patients. The oldest age group who were >50 year old had the second highest risk of developing cardiovascular and cerebrovascular diseases, but not metabolic diseases. Sequence analysis reveals the most common patterns of cardiometabolic comorbidities in patients with ADHD and age dependent changes of specific comorbidities, notably obesity, arrhythmia and Type 1 diabetes in childhood, and hypertension, hyperlipidemia

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