



## Original article

# Attention-deficit/hyperactivity disorder and physical multimorbidity: A population-based study



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## ABSTRACT

**Background:** There has been little research on the association of attention-deficit/hyperactivity disorder (ADHD) with co-occurring physical diseases. The aim of this study was to examine the association between possible ADHD and physical multimorbidity (i.e.  $\geq 2$  physical diseases) among adults in the English general population.

**Methods:** Data were analyzed from 7274 individuals aged  $\geq 18$  years that came from the Adult Psychiatric Morbidity Survey 2007. ADHD symptoms were assessed with the Adult Self-Report Scale (ASRS) Screener. Information was also obtained on 20 self-reported doctor/other health professional diagnosed physical health conditions present in the past 12 months. Multivariable logistic regression and mediation analyses were conducted to assess the associations.

**Results:** There was a monotonic relation between the number of physical diseases and possible ADHD (ASRS score  $\geq 14$ ). Compared to those with no diseases, individuals with  $\geq 5$  diseases had over 3 times higher odds for possible ADHD (odds ratio [OR]: 3.30, 95% confidence interval [CI]: 2.48–4.37). This association was observed in all age groups. Stressful life events (% mediated 10.3–24.3%), disordered eating (6.8%), depression (12.8%), and anxiety (24.8%) were significant mediators in the association between possible ADHD and physical multimorbidity.

**Conclusion:** Adults that screen positive for ADHD are at an increased risk for multimorbidity and several factors are important in this association. As many adults with ADHD remain undiagnosed, the results of this study highlight the importance of detecting adult ADHD as it may confer an increased risk for poorer health outcomes, including physical multimorbidity.

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## 1. Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a child-onset neurodevelopmental disorder characterized by persistent and inappropriate levels of inattention and/or hyperactivity-impulsivity that negatively affect development and functioning [1]. It has been estimated that in 40–60% of childhood cases, the

condition persists into adulthood [2] with 2.5% of adults having ADHD [3]. Adults with ADHD are known to be at an increased risk for some physical diseases. For example, adult ADHD has been linked to an increased prevalence of asthma [4,5], migraine [6], injuries [7], chronic non-specific lung disease and cardiovascular disease [8]. Moreover, a recent systematic literature review found an association between adult ADHD and several somatic conditions such as asthma and celiac disease [9].

Although studies exist on the relation between individual physical diseases and ADHD, to the best of our knowledge, there has been only one previous study that has examined the association between ADHD and the number of chronic diseases. However, that population-based study was restricted to older

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adults (average age 71.6 years) and contained relatively few participants with an ADHD diagnosis ( $n = 23$ ) [8]. Thus, as yet, there has been no large-scale research on the association between adult ADHD/ADHD symptoms and physical multimorbidity [i.e., multiple co-occurring acute/chronic diseases] [10] in the general population or studies on this topic which include younger adults. This is an important research gap given that there is some evidence that multimorbidity may be highly prevalent among those aged less than 60 [11], while other studies have highlighted that it is associated with a variety of negative outcomes including poorer physical function [12], worse quality of life [13], higher health care utilization and increased health care costs [14] as well as an increased mortality risk [15]. Furthermore, how various risk factors for physical disease affect the association between ADHD and physical multimorbidity has not been studied to date. For example, individuals with ADHD are known to be at higher risk of engaging in risky health behaviors (e.g. use/risky use of tobacco, alcohol, and drugs) [16–18], have a higher likelihood of having mental disorders [19,20] and of being obese [21,22], while they are also known to experience many stressful events across the life course [23–25] – all of which are risk factors for a variety of somatic disorders.

The current study thus had two aims:

- to examine the association between possible ADHD and multimorbidity among adults in a general population sample;
- to assess the degree to which various risk factors explain this association.

As both ADHD, and multimorbidity [26] have been linked to poorer outcomes, including an increased risk of mortality [27–29], elucidating this association and its mediators may have important public health implications.

## 2. Material and methods

### 2.1. Study participants

This study used data from the 2007 Adult Psychiatric Morbidity Survey (APMS). Details of the survey have been published previously [30]. In brief, the survey was undertaken by the National Center for Social Research together with the University of Leicester in October 2006 to December 2007. A nationally representative sample of the English adult population aged  $\geq 16$  years old residing in private households was obtained with the use of multistage stratified probability sampling. In this process, the small user Postcode Address File served as the sampling frame with postcode sectors comprising the primary sampling units. Sectors were stratified by both (health authority) region and by socioeconomic status. One participant was recruited from each randomly selected household with information obtained through computer-assisted personal interviews (CAPI) and computer-assisted self-interviews (CASI). In total, interviews were obtained in 7461 of the 13,171 eligible households resulting in a survey response rate of 57%. To ensure that the obtained sample accurately represented its intended target population (i.e. to take account of survey non-response) sample weights were created. The Royal Free Hospital and Medical School Research Ethics Committee provided ethical approval for the survey with all participants providing written informed consent.

### 2.2. Main variables

#### 2.2.1. ADHD symptoms

The Adult ADHD Self-Report Scale (ASRS) Screener was used to assess ADHD symptoms. This is the 6-item version of a longer 18-item scale that is used to assess DSM-IV ADHD symptoms in

adults [31,32]. Questions inquired about inattention and hyperactivity in the previous six months. A 5-point response scale was used for the answers with options running from ‘never’ – scored 0, to ‘very often’ – scored 4, to give a total summed score that could range from 0 to 24. In this study, the scale scores were dichotomized with a score of 14 and above being used to signify the presence of possible ADHD [32]. In the original scale validation study that used data from subscribers to a managed health care plan, this dichotomous cut point had high specificity (94.0%) but lower sensitivity (64.9%) [32], while other studies have highlighted the scale’s clinical utility for identifying ADHD in subpopulations such as alcoholics [33] and adult forensic psychiatric outpatients [34].

#### 2.2.2. Physical diseases

Information was collected on 20 doctor/other health professional diagnosed physical health conditions that were present in the past 12 months (cancer, diabetes, epilepsy, migraine, cataracts/eyesight problems, ear/hearing problems, stroke, heart attack/angina, high blood pressure, bronchitis/emphysema, asthma, allergies, stomach ulcer or other digestive problems, liver problems, bowel/colon problems, bladder problems/incontinence, arthritis, bone/back/joint/muscle problems, infectious disease, and skin problems). The number of physical diseases was summed and categorized as 0, 1, 2, 3, 4, and  $\geq 5$ . Multimorbidity was classified as the presence of two or more physical diseases.

### 2.3. Mediation variables

#### 2.3.1. Smoking

Smoking was assessed by the question ‘Have you ever smoked a cigarette?’ with answer options, ‘yes’ or ‘no’.

#### 2.3.2. Alcohol dependence

Respondents’ alcohol consumption was assessed with the Alcohol Use Disorders Identification Test (AUDIT) [35]. Individuals with an AUDIT score of  $\geq 10$  were also assessed for alcohol dependence using the Severity of Alcohol Dependence Questionnaire (SADQ-C) [36]. Those who scored  $\geq 4$  (out of 60) were classified as having past 6-month alcohol dependence.

#### 2.3.3. Drug use

Information was collected on the use of any illicit drugs in the past year, i.e. cannabis, amphetamines, cocaine, crack, ecstasy, heroin, acid or LSD, magic mushrooms, methadone or phsyseptone, tranquilizers, amyl nitrate, anabolic steroids, and glues. Respondents who had taken any of these drugs were classified as past 12-month drug users.

#### 2.3.4. Disordered eating

Possible eating disorder was assessed with five items from the SCOFF eating disorder screening tool [37]. Respondents were asked whether, in the past year, they had: lost more than one stone (6.35 kg) in 3 months (weight loss); made him/herself be sick because he/she felt uncomfortably full (self-sick for feeling full); worried that he/she had lost control over how much he/she eats (uncontrolled eating); believed to be fat when others said that he/she was too thin (self-perceived fatness); and thought that food dominated his/her life (food dominance). Answering yes to two or more items was considered a positive screen [37].

#### 2.3.5. Obesity

Self-reported weight and height data were used to determine body mass index (BMI) which was calculated as weight in kilograms divided by height in meters squared. Obesity was defined as BMI  $\geq 30$  based on the standard WHO definition.

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