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PII: S0165-1781(17)31701-8
DOI: 10.1016/j.psychres.2018.06.017
Reference: PSY 11492

To appear in: *Psychiatry Research*

Received date: 17 September 2017
Revised date: 25 May 2018
Accepted date: 7 June 2018

Please cite this article as: Suzan W.N. Vogel , Margreet ten Have , Denise Bijlenga , Ron de Graaf , Aartjan T.F. Beekman , J.J. Sandra Kooij , Distribution of ADHD symptoms, and associated comorbidity, exposure to risk factors and disability: results from a general population study, *Psychiatry Research* (2018), doi: 10.1016/j.psychres.2018.06.017

Highlights

- An increased number of ADHD symptoms was associated with higher comorbidity.
- An increased number of ADHD symptoms was associated with higher exposure to risk factors.
- An increased number of ADHD symptoms was associated with higher disability.
- ADHD seems a dimensional trait in the adult general population.

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Distribution of ADHD symptoms, and associated comorbidity, exposure to risk factors and disability: results from a general population study

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Abstract

The aim of this study was to examine whether ADHD is a dimensional trait in the adult general population. We studied whether an increased number of ADHD symptoms was associated with higher comorbidity, exposure to risk factors (childhood abuse and parental psychopathology), and disability. We ascertained whether even low numbers of ADHD symptoms were associated with an increased burden of disease. Data were used from the second wave of the Netherlands Mental Health Survey and Incidence Study-2 (NEMESIS-2, *N*=5,303). NEMESIS-2 is a nationally representative face-to-face survey on mental health of the Dutch general population. ADHD symptoms, mental comorbidity, and disability were assessed using the Adult ADHD Self-Report Scale Screener, the Composite International Diagnostic Interview version 3.0, and the Medical Outcomes Study Short Form Health Survey, respectively. Dose-response relationships were found between the number of ADHD symptoms and Axis I and II mental disorders; exposure to risk factors; and mental and physical disability. Our study supports the notion that ADHD is a dimensional trait in the adult general population. Even low numbers of symptoms were associated with an increased burden of disease, and therefore these should be identified and treated.

Keywords: ADHD symptoms; population survey; comorbidity; risk factors; disability.

1. Introduction

Many psychiatric disorders exist on a continuum of dimensional traits. These include panic disorder (Batelaan et al., 2007), psychotic disorder (van Os et al., 2009), and borderline personality disorder (Ten Have et al., 2016). Some somatic disorders like diabetes (Weyer et al., 2001), blood pressure (Faraone et al., 2009), and Alzheimer's dementia (Morris et al., 2001), can have been described in a similar way. The dimensional model is best understood using an iceberg metaphor: at the tip of the iceberg are the known cases with a full-blown disorder, representing one end of the dimension. The largest part of the iceberg is below the waterline, which depicts persons who have low numbers of symptoms or are asymptomatic, representing the other end of the dimension (Lund and Jensen, 1989).

Attention-Deficit/Hyperactivity Disorder (ADHD) is also considered a dimensional trait. This is supported by genetic, taxometric, and neuroimaging studies (Mohamed et al., 2015). The cross-national prevalence range of a diagnosis of ADHD in adults (i.e., the tip of the iceberg) is 2.8-3.4% (Fayyad et al., 2007; Fayyad et al., 2017). In contrast to the tip of the iceberg that has received increasing attention in epidemiological research in the last decade; the part under the waterline has been studied less. However, some epidemiological studies have investigated the relationship between low numbers of ADHD symptoms and comorbidity (Das et al., 2012; Estevez et al., 2014), disability (Das et al., 2012; Estevez et al., 2014), lifestyle habits (Weissenberger et al., 2018), violence (Gonzalez et al., 2013), suicidality (Stickley et al., 2016), loneliness (Stickley et al., 2017), satisfaction with life (Oerbeck et al., 2015), emotional empathy (Groen et al., 2017), screen time (Montagni et al., 2016) or dental anxiety (Carlsson et al., 2013), amongst others. In general, these studies found that those with low numbers of ADHD symptoms occupy an intermediate position between those with no ADHD symptoms and those with full threshold ADHD. For example, the study by Das and collegues (2012) found that a higher number of ADHD symptoms was associated with increased comorbidity and disability. However, it remains unclear whether low numbers of ADHD symptoms are associated with the same risk factors (e.g., parental psychopathology and childhood abuse) as full-blown ADHD (Lindblad et al., 2011; Sugaya et al., 2012). It is also unknown whether

low numbers of symptoms are linked to mental and physical disability, after adjusting for co-existing psychiatric disorders. Studying the whole iceberg and not just the tip is necessary in order to gain insight into the impact of ADHD as a trait in the general population.

Using data from the Netherlands Mental Health Survey and Incidence Study–2 (NEMESIS-2), an epidemiological study among adults from the general Dutch population, we tested whether the distribution of ADHD symptoms correlates (i) with rising levels of co-occurring DSM-IV axis I and axis II disorders, (ii) with increasing risk factors of childhood abuse and parental psychopathology and (iii) with increasing levels of both mental and physical disability, after adjustment for sociodemographic characteristics and psychiatric comorbidity.

2. Methods

2.1 Participants

Data were used from the first and second wave of NEMESIS-2, a longitudinal cohort study on the prevalence, incidence, course, and consequences of psychiatric disorders in the Dutch general population, aged 18-64 years at baseline. NEMESIS-2 is based on a multistage, stratified, random sampling of households, with one respondent randomly selected from each household. Insufficient fluency in Dutch was an exclusion criterion. The response rate of the first wave (November 2007-July 2009) was 65.1%. This sample was nationally representative, although younger participants were somewhat underrepresented. All first wave respondents were approached for follow-up, 3 years after the first wave from November 2010 to June 2012. Of this group, 80.4% (*N*=5,303) was reassessed. Psychopathology at baseline was not related to loss to follow-up in the second wave, after adjustment for demographics (de Graaf et al., 2013). Associations between psychopathology and attrition were adjusted for demographics, since psychopathology varies strongly with sociodemographic characteristics (de Graaf et al., 2013). Measures in this study were determined at the second wave, except for comorbid Axis I disorders (occurrence was determined between the first and second waves). The research proposal was approved by the Medical Ethics Review Committee for Institutions on Mental Health Care (METIGG), and all respondents gave written informed consent. 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. Sampling methods have been reported more extensively elsewhere (de Graaf et al., 2010).

2.2 Measures

2.2.1 Adult ADHD symptoms

Adult ADHD symptoms were measured using the Adult ADHD Self-Report Scale (ASRS) Screener version 1.1 (Kessler et al., 2005). The ASRS screener consists of six items: four items indicating inattention symptoms and two items indicating hyperactivity symptoms. The frequency of a given

symptom over the past 6 months was rated on a five-point response scale ranging from 0 (never) to 4 (very often). The scores on the six items were converted into binary values according to the official scoring system. The ASRS screener has been shown to have moderate sensitivity (68.7%), excellent specificity (99.5%), and excellent total classification accuracy (97.9%) for ADHD (Kessler et al., 2005). The ASRS screener has been shown to outperform the full version of the ASRS (with 18 items measuring the frequency of all 18 DSM-IV ADHD symptoms) in terms of psychometric properties and classification accuracy . For the present study, we defined four categories of ADHD symptoms: 0, 1-2, 3, and ≥ 4 symptoms. Using the ASRS v 1.1 classification, individuals with 4 or more positively scored items were considered to have symptoms highly consistent with ADHD in adults (Adler et al., 2003). Furthermore, individuals were divided into four strata with the following score ranges: 0–9 (stratum I), 10–13 (stratum II), 14–17 (stratum III) and 18–24 (stratum IV), based on Kessler et al. (2007).

2.2.2 Comorbidity of Axis I and II disorders

The 3-year presence of any Axis I comorbid mood disorder (major depression, dysthymia, bipolar disorder), anxiety disorder (panic disorder with or without agoraphobia), agoraphobia (without panic disorder), social phobia, specific phobia, generalized anxiety disorder), and/or substance use disorder (alcohol or drug abuse and dependence) was established using the Composite International Diagnostic Interview (CIDI) version 3.0 (Kessler and Ustun, 2004). The CIDI is a fully structured interview based on the Diagnostic and Statistical Manual of Mental Disorders 4th edition criteria (DSM–IV; (APA, 1994)), which has shown to be a reliable and valid instrument (Haro et al., 2006).

Indications for two Axis II disorders, antisocial personality disorder (ASPD) and borderline personality disorder (BPD) were measured using questions from the International Personality Disorder Examination (IPDE) (Loranger et al., 1994). These questions are part of CIDI 3.0 (Huang et al., 2009; Lenzenweger et al., 2007). This measure generates lifetime estimates and uses a true-false response format, with scores being assigned on the basis of the total sum of ‘true’ responses. People with ≥ 3 out of 7 ASPD symptoms were viewed as suffering from ASPD, as they fulfil the required

number of DSM-IV criteria for an ASPD diagnosis (APA, 2000). For BPD, a cut-off of ≥ 5 out of 9 symptoms was used, which is congruent with the DSM-IV criteria for a BPD diagnosis. In a clinical reappraisal interview, performed in a subsample of the National Comorbidity Survey Replication (NCS-R) in the United States, it was found that such interview questions allow for a valid assessment of ASPD and BPD diagnoses (Lenzenweger et al., 2007).

2.2.3 Risk factors for ADHD symptoms

We assessed two risk factors. The first was childhood abuse (i.e. whether one had experienced emotional neglect, psychological abuse, or physical abuse on two or more occasions, or sexual abuse on one or more occasion before the age of 16). These questions, based on self-report, were used before in the studies NEMESIS-1 and NESDA (the Netherlands Study of Depression and Anxiety; see e.g., (Janssen et al., 2004; van Harmelen et al., 2010)). The second risk factor was the lifetime mental health problems of subjects' parents. Participants were asked if at least one of their biological parents has ever been treated by a psychiatrist, hospitalized isn a mental institution, or ever exhibited one or more of the following: severe depression, delusions or hallucinations, severe anxiety or phobias, alcohol abuse, drug abuse, regular problems with the police, and/or suicidal behavior.

2.2.4 Disability

Mental disability during the past four weeks was assessed with the mental component scale (MCS) of the Medical Outcomes Study Short Form Health Survey (MOS SF-36) (Ware and Sherbourne, 1992). The MCS consists of four subscales: (1) Social functioning, involving problems in one's normal social activities as a result of somatic or emotional problems (Cronbach's $\alpha = 0.78$); (2) Role emotional functioning, addressing problems at work or in other daily activities as a result of emotional problems (Cronbach's $\alpha = 0.88$); (3) Mental health, involving questions on depression, anxiety, and psychological well-being (Cronbach's $\alpha = 0.79$); and (4) Vitality, examining energy and tiredness (Cronbach's $\alpha = 0.77$). Four other subscales form the physical component scale (PCS), which addresses physical disability: (1) Bodily pain, measuring limitations in one's daily activities due to pain (Cronbach's $\alpha = 0.84$); (2) General health perceptions, investigating one's health perceptions

(Cronbach's α = 0.76); (3) Role physical functioning, focusing on problems at work or in other daily activities as a result of physical problems (Cronbach's α = 0.90); and (4) Physical functioning, examining limitations in physical activities (Cronbach's α = 0.92). These scales vary from 0 (low functioning/ill health) to 100 (high functioning/good health).

2.2.5 Sociodemographic characteristics and medication use

The sociodemographic characteristics and potential covariates/confounders in the association between ADHD symptoms and disability were: gender, age, education level, living situation (i.e. living with a partner or not), job status (i.e. having a paid job or not), and use of ADHD medication (psychostimulants, atomoxetine, and modafinil) in the past 12 months.

2.3 Statistical analyses

All analyses were performed with STATA version 12.1, using weighted data to correct for differences in the response rates in several sociodemographic groups at both waves and differences in the probability of selection of respondents within households at baseline. Robust standard errors were calculated in order to obtain correct 95% confidence intervals and p-values (Skinner et al., 1989). First, sociodemographic characteristics of the four categories of ADHD symptom numbers were calculated using simple descriptive analyses. Second, multivariate logistic regression analyses were performed to examine to what extent the number of ADHD symptoms is associated with Axis I and II disorders and risk factors, adjusted for gender and age. Results of multivariate logistic regression analyses are usually expressed in adjusted odds ratios, but can also be expressed in adjusted average predicted probabilities by using the margins command (http://www.ats.ucla.edu/stat/stata/dae/logit.htm). We opted for this last mode, because it enables to show the probabilities of mental disorders in all ADHD symptom categories, including the reference category as was done before (Ten Have et al., 2016). Third, multivariate linear analyses were used to examine to what extent the number of ADHD symptoms is associated with disability, adjusted for sociodemographic characteristics (model 1), and additionally for psychiatric comorbidity (model 2) as confounders. In total, only 11 participants (0.2%) reported ADHD medication use. Therefore, we did

not include ADHD medication use as a covariate in the analyses. The results were expressed in adjusted averages by using the margins command. Two-tailed testing procedures were used with 0.05 alpha levels. We applied the Benjamini-Hochberg correction for multiple testing (Benjamini and Hochberg, 1995). In addition, we performed the same analyses as described above using the four strata. For this analyses, we allowed for a maximum of two missing items on the six questions, leading to a sample size of 5,298 subjects.

3. Results

3.1 Distribution of ADHD symptoms and associated sociodemographic correlates

Of the 5303 participants, 5.3% had symptoms highly consistent with ADHD in adults (threshold of ≥4 symptoms). Forty four percent reported having no ADHD symptoms, 42.5% had 1-2 symptoms, and 8.2% had 3 symptoms (Table 1). The number of ADHD symptoms was significantly related to gender (p=.016), age (p<.001), and living situation (p<.001). An additional analysis showed that there was no gender difference when comparing those subjects with ≥4 symptoms vs. those with ≤3 symptoms (p=.316). A trend was observed for job status (p=.060). Educational level was not significantly different across the number of ADHD symptom categories (p=.155). Presented results were unadjusted for multiple testing (an asterix indicated significance after adjustment for multiple testing). We also conducted analyses using the four ASRS strata (see appendix for results). One difference emerged when using the 4 ASRS strata: the ASRS strata were significantly related to job status (p=.037).

[Table 1]

3.2 Comorbidity with Axis I and II disorders

Table 2 presents results of multivariate logistic regression analyses to determine to what extent number of ADHD symptoms is associated with a variety of mental disorders. After adjustment for gender and age, subjects with higher number of ADHD symptoms were significantly more likely to have any mental Axis I disorder (0 symptoms: 10.96%, 1-2 symptoms: 25.97%, 3 symptoms: 57.18%, ≥4 symptoms: 74.76%; *p for trend* <.001). The same applied for the association between the number of ADHD symptoms and any mood (*p for trend* <.001), anxiety (*p for trend* <.001) and substance use disorder (*p for trend* <.001). Moreover, subjects with higher number of ADHD symptoms were significantly more likely to have almost all specific mood, anxiety, and substance use and personality disorders. Agoraphobia was the only disorder that was not associated with the number of ADHD symptoms (*p for trend* =.456). A near significant association was observed for drug abuse (*p for*

trend=.060). We also conducted analyses with the four ASRS strata. In general, results were similar to those observed when using the four categories of the number of ADHD symptoms. However, a few differences emerged. Regarding dysthymia and alcohol abuse, results became nonsignificant when using the 4 ASRS strata (dysthymia: *p for trend* =.147*;* alcohol abuse*: p for trend* =.099). Finally, a significant result instead of the previously observed trend was found for drug abuse (*p for trend* =.007).

3.3 Risk factors

As shown in the bottom part of Table 2, respondents with a higher number of ADHD symptoms were more likely to report childhood abuse and parental mental health problems (both *p for trend* <.001). We observed no differences in the results when conducting the analyses using the four ASRS strata.

[Table 2]

3.4 Mental and physical disability

Table 3 shows the outcomes of linear regression analyses associating the number of ADHD symptoms with mental and physical disability. A higher number of ADHD symptoms was associated with a greater likelihood of mental and physical disability on all of the eight SF-36 subscales (*p for trend* <.001), both in model 1 (adjusted for sociodemographic characteristics) and in model 2 (additionally adjusted for psychiatric comorbidity). No differences in the outcomes were observed when using the four ASRS strata.

[Table 3]

4. Discussion

This population-based study showed that an increased number of ADHD symptoms was associated with higher comorbidity, exposure to risk factors, and disability. Even low numbers of ADHD symptoms were associated with an increased burden of disease. These results confirm that ADHD is a dimensional trait in the general population.

Concerning the distribution of ADHD symptoms and the associated sociodemographics, we found that 5.3% of subjects met the threshold of 4 or more symptoms on the ASRS screener, thereby having symptoms highly consistent with ADHD in adults. We further showed that a higher number of ADHD symptoms was significantly related to female gender, younger age, and living without a partner, suggesting that these characteristics may be considered risk factors for ADHD symptoms. No clear significant association was observed between two indicators of socioeconomic status (SES) and ADHD symptoms: educational level and job status (this showed a trend, p=0.06). This trend became significant when analyzing the association with the 4 ASRS strata instead of the association with the number of ADHD symptoms.. These findings coincide with earlier epidemiological reports among adults with ADHD or among adults with low numbers of ADHD symptoms (Bitter et al., 2010; Caci et al., 2014; Estevez et al., 2014; Fayyad et al., 2007; Polanczyk et al., 2010; Simon et al., 2009), with the exception of the relationship between female gender and ADHD symptoms. However, this gender difference was not present when comparing those with probable ADHD to those without probable ADHD, suggesting that females scored especially higher on a low numbers of symptoms. Previous epidemiological research found a male preponderance in the prevalence of adult ADHD symptoms (Bitter et al., 2010; Fayyad et al., 2007) or no gender difference (Caci et al., 2014; Das et al., 2012; de Zwaan et al., 2012). However, a Brazilian general population survey showed that women reported more symptoms as compared to men, as measured with the ASRS screener (Polanczyk et al., 2010). One-explanation might be that the difference in gender predominance results from the assessment of ADHD symptoms with the ASRS screener, which mostly measures inattention symptoms (Kessler et al., 2005). The inattentive type is found to be more common in females than in males (Biederman et

al., 2004). Also the prevalence rate was not corrected for comorbid disorders, including mood and anxiety disorders, which are both more common among women than among men (Schuch et al., 2014). Moreover, a previous Dutch epidemiological study also found a slightly higher prevalence rate in women than in men, but this was only the case when a diagnostic threshold of four ADHD symptoms was applied (Kooij et al., 2005). No gender effect was observed when using a threshold of six symptoms. The authors suggested that ADHD symptoms in girls are relatively under-reported by significant others (i.e. parents and teachers), and that adult women themselves are more sensitive to their ADHD symptoms than their parents. Finally, females might be more willing than males to disclose mental health problems (Tedstone Doherty and Kartalova-O'Doherty, 2010).

With respect to mental comorbidity, risk factors, and levels of disability, we observed that respondents with higher ADHD symptom levels were more likely to report Axis I and II disorders, exposure to risk factors, and increasing mental and physical disability, and that the associations with disability were not driven by sociodemographics or psychiatric comorbidity. This conforms to the earlier epidemiological studies mentioned in the introduction, which showed that even low numbers of ADHD symptoms were associated with anxiety and depressive symptoms (Das et al., 2012), major depression, ASPD, alcohol abuse and dependence (Estevez et al., 2014), and mental disability (Das et al., 2012). We extended these previous studies by investigating adults with a wide age range. We showed that 1) low numbers of symptoms were related to a much broader range of psychiatric disorders than those investigated previously, that 2) even low numbers of symptoms were related to risk factors, and 3) low numbers of symptoms were linked to mental and physical disability, after adjusting for co-existing psychiatric diagnoses. Dysthymia and agoraphobia without panic disorder were not related to the ASRS strata or the number of ADHD symptoms, which is not in line with other epidemiological and clinical studies (Kessler et al., 2006; Moss et al., 2007). However, this may be simply due to the small number of dysthymia and agoraphobia cases in our study. Regarding alcohol abuse, the result became nonsignificant when using the 4 ASRS strata instead of the number of ADHD symptoms. Other studies also found conflicting evidence on the association between ADHD symptoms and alcohol abuse (Maxwell, 2013).

Overall, our finding that increasing ADHD symptom levels were associated with higher comorbidity, exposure to risk factors, and disability, suggests that even low numbers of ADHD symptoms may be a cause of burden and/or a result of a suboptimal health status. On the one hand, if low numbers of ADHD symptoms are associated with increased disease burden, then treatment and/or indicated prevention should be targeted at individuals with low numbers of-symptoms. On the other hand, treatment of those with few ADHD symptoms could lead to medicalization and enormous public health costs (Batelaan et al., 2007). However, previously, indicated prevention studies among persons with symptoms of mental disorders have shown to be cost-effective, since these individuals require lower cost interventions than those with full-blown mental disorders (Batelaan et al., 2010). For instance, cognitive behavioral therapy was provided to persons with symptoms of panic disorder, in group sessions (Meulenbeek et al., 2009). Vice versa, low numbers of ADHD symptoms may result from a suboptimal health state. In this case, treatment and/or indicated prevention aimed at individuals with a suboptimal health state might decrease ADHD symptoms. To date, there are no studies that have focused on the progression of subthreshold ADHD symptoms to full-blown ADHD. Therefore, further studies are required to determine the developmental trajectory of low numbers of ADHD symptoms. This would identify a target group with a high incidence rate of ADHD, in order to develop appropriate preventive and treatment measures that are cost-effective and clinically effective.

Our study included a large sample size and validated instruments were used to measure ADHD symptoms, comorbid mental disorders, and disability. However, some limitations of the study need consideration. First, we identified ADHD symptoms using the ASRS self-report screener rather than a clinician's ratings. Also, the ASRS screener does not assess all the diagnostic criteria of ADHD, such as the childhood onset of ADHD symptoms or the impairment due to ADHD symptoms (APA, 2013). Therefore, the questions may be capturing something else going on in the lives of many respondents, since most respondents who scored ≥ 4 symptoms belonged to the youngest age group. For instance, the respondents may have trouble coping with the competing demands of study, paid employment, and social life. However, in general, there is an age-dependent decline of the prevalence of adult ADHD (Simon et al., 2009) and, moreover, the ASRS screener showed good concordance with

clinician diagnoses (Kessler et al., 2005). Nevertheless, further studies on the dimensionality of ADHD should use clinical diagnoses. Second, although the sample was representative of the Dutch population on most parameters, people with an insufficient mastery of Dutch, those with no fixed address and institutionalized people were underrepresented. Hence, our findings cannot be generalized to these groups. Third, the response rate of the first wave of the NEMESIS-2 study (65.1%) was somewhat low, and another 20% was lost in the second wave (de Graaf et al., 2010). Nevertheless, the sample was nationally representative and psychopathology at baseline was not related to loss to follow-up in the second wave (de Graaf et al., 2013). Fourth, we only assessed symptoms of ASPD and BPD, rather than comprehensively assessing these personality disorders according to all DSM-IV criteria. Fifth, ADHD symptoms such as restlessness and concentration problems may mimic symptoms of depression and anxiety, making it hard to distinguish these disorders from each other (Lundervold et al., 2016). Moreover, studies among psychiatric patients have shown that the ASRS screener has a low specificity (Pettersson et al., 2015; Van de Glind et al., 2013; Weibel et al., 2018). Hence, many non-ADHD psychiatric patients may also have obtained a high score. Nevertheless, a study by Milberger et al. (1995) showed that ADHD is not an artifact of symptoms shared with other psychiatric disorders, and that the comorbid conditions themselves are not an artifact of overlapping ADHD symptoms.

In summary, an increased number of ADHD symptoms was associated with higher comorbidity, exposure to risk factors, and disability, supporting the notion that ADHD is a dimensional trait in the general population. Further studies are needed to determine the developmental trajectory of low numbers of ADHD symptoms in order to develop appropriate preventive and treatment measures.

Acknowledgment

Financial support has been received from the Ministry of Health, Welfare and Sport, with supplement support from the Netherlands Organization for Health Research and Development (ZonMw) and the Genetic Risk and Outcome of Psychosis (GROUP) investigators. The funding sources had no further role in study design; in the collection, analysis and interpretation of data; in the writing of the report; or in the decision to submit the paper for publication. We would like to thank Dora Wynchank for checking the English language.

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Table 1 Sociodemographic characteristics of categories of number of Attention-Deficit/Hyperactivity Disorder (ADHD) symptoms in the general population (*N*=5,303), in weighted column percentages.

	Total	0 ADHD symptoms	1-2 ADHD symptoms	3 ADHD symptoms	≥ 4 ADHD symptoms	*p*
n (%)	5,303 (100)	2,408 (44.0)	2,201 (42.5)	427 (8.2)	267 (5.3)	
Female gender	49.5	48.2	48.6	58.8	54.0	0.016*
Age at interview						<0.001*
21-37	32.0	26.1	34.8	40.1	47.0	
38-47	24.5	24.4	24.1	27.5	23.5	
48-57	23.3	24.0	23.9	19.9	18.3	
58-67	20.2	25.5	17.3	12.5	11.2	
Education						0.155
Lower secondary	29.5	29.3	28.9	34.2	28.8	
Higher secondary	41.7	44.0	40.5	36.2	40.2	
Higher professional/ university	28.8	26.7	30.6	29.5	31.0	
Living without partner	29.9	27.5	29.3	37.8	43.7	<0.001*
No paid job	24.8	26.7	22.3	26.1	28.0	0.060

* significant after Benjamini-Hochberg correction for multiple testing.

Table 2 Clinical characteristics of categories of number of Attention-Deficit/Hyperactivity Disorder (ADHD) symptoms in the general population (*N*=5,303), in weighted average predicted probabilities adjusted for gender and age (%).

	Total		0 ADHD symptoms[a] *n*=2,408	1-2 ADHD symptoms *n*=2,201	3 ADHD symptoms *n*=427	≥ 4 ADHD symptoms *n*=267	*p* for trend
	n	%	% [95% CI]	% [95% CI]	% [95% CI]	% [95% CI]	
3-year Axis I disorders							
Any mental disorder	808	17.39	10.96 [9.59,12.33]	25.97 [22.10,29.84]	57.18 [48.11,66.26]	74.76 [62.99,86.53]	<0.001*
Any mood disorder	409	8.41	4.47 [3.33,5.60]	7.85 [6.43,9.28]	15.17 [11.08,19.26]	32.32 [25.48,39.17]	<0.001*
Major depression	365	7.53	4.11 [3.02,5.19]	7.26 [5.91,8.61]	13.23 [9.26,17.20]	27.09 [20.14,34.04]	<0.001*
Dysthymia	22	0.65	0.13 [-0.03,0.28]	0.92 [0.26,1.58]	1.17 [-0.64,2.99]	1.04 [0.02,2.07]	0.003*
Bipolar disorder	39	0.81	0.31 [-0.01,0.63]	0.50 [0.15,0.84]	1.80 [0.11,3.48]	4.87 [2.36,7.38]	<0.001*
Any anxiety disorder	379	7.90	5.09 [3.75,6.42]	7.38 [5.64,9.13]	15.06[10.56,19.56]	21.41 [15.23,27.58]	<0.001*
Panic disorder	82	1.94	0.96 [0.30,1.62]	2.33 [1.17,3.48]	2.73 [1.32,4.14]	4.44 [1.90,6.98]	<0.001*
Agoraphobia	16	0.33	0.31 [-0.12,0.73]	0.33 [0.04,0.61]	0.05 [-0.05,0.15]	1.11 [0.07,2.15]	0.456
Social phobia	107	2.51	1.55 [0.65,2.46]	1.99 [1.21,2.78]	5.26 [2.41,8.11]	8.98 [4.54,13.42]	<0.001*
Specific phobia	165	3.54	2.80 [1.69,3.90]	3.53 [2.37,4.68]	6.29 [3.10,9.48]	4.47 [2.43,6.51]	0.015*
GAD	87	1.59	0.45 [0.10,0.81]	1.49 [0.90,2.08]	3.53 [1.16,5.90]	7.65 [3.98,11.33]	<0.001*
Any substance use disorder	224	5.67	3.59 [2.28,4.90]	6.06 [4.66,7.47]	8.71 [5.18,12.24]	12.04 [7.35,16.72]	<0.001*
Alcohol abuse	136	3.58	2.77 [1.55,3.98]	4.08 [2.88,5.29]	3.29 [1.40,5.17]	5.27 [2.19,8.35]	0.044*
Alcohol dependence	46	0.92	0.45 [0.22,0.67]	0.76 [0.38,1.14]	2.50 [0.06,4.94]	3.30 [-0.14,6.75]	<0.001*
Drug abuse	31	0.86	0.55 [-0.03,1.13]	0.92 [0.28,1.56]	0.40 [-0.20,1.00]	3.46 [-0.05,6.96]	0.060
Drug dependence	22	0.56	0.01 [-0.01,0.03]	0.44 [0.13,0.75]	2.93 [0.45,5.40]	1.50 [0.19,2.81]	<0.001*
Lifetime Axis II disorders							
Antisocial personality disorder	138	3.35	1.54 [0.62,2.46]	3.39 [2.25,4.53]	8.01 [4.60,11.42]	10.21 [4.89,15.53]	<0.001*
Borderline personality disorder	58	1.14	0.14 [-0.02,0.29]	0.73 [0.37,1.09]	2.08 [0.82,3.34]	11.51 [7.05,15.97]	<0.001*
Risk factors							
Childhood abuse	1,509	27.29	21.49 [19.39,23.59]	28.75 [26.33,31.17]	41.14 [34.84,47.44]	43.64 [37.41,49.86]	<0.001*
Lifetime mental health problems of parents	1,647	31.42	25.62 [23.07,28.17]	33.57 [30.66,36.48]	43.02 [36.86,49.18]	43.50 [35.50,51.49]	<0.001*

a. These numbers can be interpreted as, for example, the probability of having any mental disorder is 10.96% among those with 0 ADHD symptoms..* significant after Benjamini-Hochberg correction for multiple testing.

Table 3 Current disability of categories of number of Attention-Deficit/Hyperactivity Disorder (ADHD) symptoms in the general population (*N*=5,303), in weighted adjusted averages (Mean).

	Total	0 ADHD symptoms		1-2 ADHD symptoms		3 ADHD symptoms		≥ 4 ADH
	Mean	Model 1 Mean [95% CI]	Model 2 Mean [95% CI]	Model 1 Mean [95% CI]	Model 2 Mean [95% CI]	Model 1 Mean [95% CI]	Model 2 Mean [95% CI]	Model 1 Mean [95% CI]
Mental component scale (SF-36)[a]								
Social functioning	89.7	93.36 [92.42,94.31]	92.69 [91.74,93.65]	89.44 [88.51,90.37]	89.35 [88.42,90.28]	81.89 [78.93,84.86]	83.15 [80.25,86.04]	72.61 [68.26,76.96]
Role emotional functioning	92.2	97.05 [96.27,97.82]	96.05 [95.21,96.90]	92.39 [91.03,93.75]	92.26 [90.91,93.61]	80.51 [75.76,85.25]	82.35 [77.71,86.99]	68.54 [62.60,74.49]
Mental Health	80.1	83.86 [83.28,84.44]	83.27 [82.67,83.87]	79.61 [78.95,80.27]	79.51 [78.87,80.16]	71.18 [69.17,73.20]	72.31 [70.46,74.17]	66.53 [64.05,69.00]
Vitality	68.4	73.05 [72.28,73.83]	72.62 [71.82,73.42]	67.27 [66.42,68.12]	67.19 [66.34,68.04]	58.95 [56.60,61.31]	59.76 [57.47,62.05]	52.33 [49.48,55.18]
Physical component scale (SF-36)[a]								
Bodily pain	84.4	87.85 [86.67,89.04]	87.41 [86.20,88.61]	83.10 [81.84,84.36]	83.03 [81.78,84.28]	80.20 [76.51,83.89]	81.02 [77.32,84.73]	72.34 [67.65,77.02]
General health perceptions	70.4	73.69 [72.60,74.78]	73.07 [72.01,74.13]	69.74 [68.68,70.81]	69.66 [68.61,70.72]	62.97 [60.27,65.67]	64.22 [61.52,66.91]	59.48 [56.81,62.16]
Role physical functioning	84.5	89.25 [87.63,90.87]	88.57 [86.92,90.21]	84.20 [82.43,85.97]	84.09 [82.31,85.87]	74.33 [69.12,79.54]	75.58 [70.38,80.78]	63.40 [57.79,69.01]
Physical functioning	91.5	93.36 [92.42,94.31]	93.05 [92.05,94.04]	91.07 [90.15,92.00]	91.02 [90.08,91.96]	89.24 [87.27,91.21]	89.79 [87.88,91.70]	82.81 [79.74,85.88]

Note: SF-36: Medical Outcomes Study Short Form Health Survey-36. * significant after Benjamini-Hochberg correction for multiple testing.
Model 1: adjusted for sociodemographic characteristics (gender, age, education level, living situation, paid job status).
Model 2: adjusted for sociodemographic characteristics (model 1), mental disorders (any mood, any anxiety, any substance use disorder, anti-social personality disorder and borderline personality disorder).
a: These scales vary from 0 (low functioning/ill health) to 100 (high functioning/good health).

Table 1 Sociodemographic characteristics of Adult ADHD Self-Report Scale (ASRS) strata in the general population (*N*=5,298), in weighted column percentages.

		ASRS strata				
	Total	I	II	III	IV	*P*
n (%)	5,298 (100)	4,586 (86.6)	564 (10.7)	125 (2.4)	23 (0.4)	
Female gender	49.6	48.6	54.8	52.4	80.4	0.027*
Age at interview						<0.001*
21-37	32.0	29.5	48.1	46.1	36.0	
38-47	24.5	24.6	24.5	24.9	8.8	
48-57	23.3	24.2	17.7	17.3	35.2	
58-67	20.1	21.8	9.7	11.7	20.0	
Education						0.853
Lower secondary	29.5	29.6	28.2	30.5	27.1	
Higher secondary	41.7	41.8	39.9	42.7	50.1	
Higher professional/ university	28.9	28.5	32.0	26.8	22.8	
Living without partner	29.9	28.1	38.6	44.9	62.5	<0.001*
No paid job	24.8	24.6	23.1	32.3	52.3	0.037*

* significant after Benjamini-Hochberg correction for multiple testing.

Table 2 Clinical characteristics of Adult ADHD Self-Report Scale (ASRS) strata in the general population (*N*=5,298), in weighted average predicted probabilities adjusted for gender and age (%).

	ASRS strata				
	I[a]	II	III	IV	*p* for trend
	% [95% CI]	% [95% CI]	% [95% CI]	% [95% CI]	
3-year Axis I disorders					
Any mental disorder	14.00 [12.56,15.44]	30.98 [25.98,35.97]	47.94 [37.37,58.51]	79.07 [57.79,100.34]	<0.001*
Any mood disorder	6.32 [5.42,7.20]	14.22 [11.03,17.41]	34.03 [23.71,44.36]	68.13 [46.96,89.29]	<0.001*
Major depression	5.82 [4.93,6.71]	12.39 [9.32,15.46]	28.59 [17.81,39.38]	51.73 [25.98,77.47]	<0.001*
Dysthymia	0.54 [0.14,0.94]	1.03 [-0.35,2.40]	0.16 [-0.16,0.48]	9.34 [-4.05,22.72]	0.147
Bipolar disorder	0.42 [0.16,0.67]	1.71 [0.34,3.07]	5.06 [1.54,8.58]	14.31 [2.12,26.49]	<0.001*
Any anxiety disorder	6.16 [5.04,7.28]	15.19 [11.19,19.18]	22.21[14.33,30.08]	36.83 [9.32,64.33]	<0.001*
Panic disorder	1.60 [0.90,2.30]	2.78 [1.01,4.55]	4.05 [0.49,7.62]	18.60 [1.11,36.09]	<0.001*
Agoraphobia	0.31 [0.05,0.55]	0.18 [-0.05,0.41]	1.04 [-0.36,2.44]	5.62 [-3.42,14.68]	0.051
Social phobia	1.82 [1.16,2.48]	4.43 [1.95,6.90]	10.97 [4.55,17.39]	17.73 [-1.44,36.90]	<0.001*
Specific phobia	3.22 [2.41,4.03]	4.63 [2.29,6.97]	7.34 [2.72,11.96]	4.75 [-2.01,11.52]	0.013*
GAD	0.99 [0.66,1.31]	4.38 [2.38,6.38]	6.10 [2.06,10.14]	6.38 [-1.78,14.53]	<0.001*
Any substance use disorder	4.64 [3.71,5.58]	9.75 [6.58,12.91]	12.77 [5.99,19.55]	22.89 [2.39,43.40]	<0.001*
Alcohol abuse	3.34 [2.43,4.25]	4.44 [2.70,6.18]	5.52 [0.90,10.14]	4.07 [-2.69,10.83]	0.099
Alcohol dependence	0.54 [0.32,0.78]	2.88 [1.04,4.72]	3.22 [0.13,6.31]	0	<0.001*
Drug abuse	0.73 [0.32,1.13]	0.57 [-0.04,1.18]	4.28 [-1.54,10.09]	14.34 [-3.10,31.78]	0.007*
Drug dependence	0.21 [0.05,0.36]	2.09 [0.61,3.56]	1.97 [-0.23,4.17]	5.42 [-5.60,16.43]	<0.001*
Lifetime Axis II disorders					
Antisocial personality disorder	2.52 [1.80,3.24]	7.21 [4.28,10.14]	10.01 [3.25,16.77]	18.26 [-0.67,37.19]	<0.001*
Borderline personality disorder	0.31 [0.15,0.46]	3.90 [1.88,5.91]	10.98 [5.30,16.65]	29.03 [9.45,48.60]	<0.001*
Risk factors					
Childhood abuse	24.76 [23.27,26.27]	40.41 [35.61,45.21]	51.05 [41.25,60.84]	47.28 [22.51,72.05]	<0.001*
Lifetime mental health problems of parents	29.54 [27.11,31.97]	42.19 [37.76,46.62]	40.60 [29.24,51.96]	61.02 [42.08,79.97]	<0.001*

a. These numbers can be interpreted as, for example, the probability of having any mental disorder is 14.00% among those in strata I.

* significant after Benjamini-Hochberg correction for multiple testing.

Table 3 Current disability of Adult ADHD Self-Report Scale (ASRS) strata in the general population (*N*=5,298), in weighted adjusted averages (Mean).

		ASRS strata						
	Total	I[a]		II		III		
	Mean	Model 1 Mean [95% CI]	Model 2 Mean [95% CI]	Model 1 Mean [95% CI]	Model 2 Mean [95% CI]	Model 1 Mean [95% CI]	Model 2 Mean [95% CI]	Model 1 Mean [95% CI]
Mental component scale (SF-36)[a]								
Social functioning	89.7	91.36 [90.60,92.12]	90.96 [90.18,91.73]	82.68 [80.23,85.13]	84.18 [81.68,86.68]	71.96 [65.24,78.68]	76.55 [70.44,82.67]	55.84 [40.67,71.01]
Role emotional functioning	92.2	94.64 [93.75,95.53]	94.03 [93.09,94.96]	82.02 [78.75,85.29]	84.37 [81.28,87.46]	65.78 [56.27,75.30]	72.57 [64.31,80.83]	49.85 [31.35,68.35]
Mental Health	80.1	81.75 [81.25,82.26]	81.39 [80.88,81.91]	72.14 [70.55,73.73]	73.52 [71.91,75.12]	65.83 [62.24,69.42]	69.85 [66.41,73.29]	51.33 [43.51,59.15]
Vitality	68.4	70.11 [69.48,70.74]	69.83 [69.20,70.47]	60.38 [58.24,62.52]	61.38 [59.25,63.51]	51.85 [48.01,55.69]	55.03 [51.13,58.93]	36.21 [24.51,47.91]
Physical component scale (SF-36)[a]								
Bodily pain	84.4	85.43 [84.49,86.41]	85.16 [84.20,86.13]	79.93 [76.83,83.03]	81.04 [77.94,84.14]	74.65 [69.13,80.17]	77.85 [72.59,83.12]	55.22 [34.98,75.46]
General health perceptions	70.4	71.66 [70.82,72.50]	71.29 [70.44,72.13]	63.99 [62.11,65.86]	65.40 [63.60,67.20]	60.80 [55.95,64.64]	65.03 [60.04,70.02]	50.22 [41.06,59.39]
Role physical functioning	84.5	86.31 [84.91,87.71]	85.83 [84.41,87.24]	77.06 [72.52,81.60]	78.84 [74.38,83.29]	64.91 [56.26,73.55]	70.31 [61.92,78.71]	56.71 [33.88,79.54]
Physical functioning	91.5	92.17 [91.38,92.96]	91.98 [91.16,92.79]	89.38 [87.66,91.11]	90.07 [88.42,91.71]	84.66 [81.20,88.11]	86.91 [83.65,90.17]	66.18 [46.31,86.05]

Note: SF-36: Medical Outcomes Study Short Form Health Survey-36. * significant after Benjamini-Hochberg correction for multiple testing.
Model 1: adjusted for sociodemographic characteristics (gender, age, education level, living situation, paid job status).
Model 2: adjusted for sociodemographic characteristics (model 1), mental disorders (any mood, any anxiety, any substance use disorder, anti-social personality disorder and borderline personality disorder).
a: These scales vary from 0 (low functioning/ill health) to 100 (high functioning/good health).