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ADHD and Nicotine use in schizophrenia or Asperger syndrome: a controlled study

Maria Unenge Hallerbäck, Tove Lugnegård & Christopher Gillberg

Abstract

Objective: Examine ADHD prevalence, rating scales, and relationship to nicotine use in adults with schizophrenia or Asperger syndrome. **Methods:** Ninety-five individuals, 41 with schizophrenia and 54 with Asperger syndrome were included. Self-rating of adult ADHD symptoms with the Wender Reimherr Adult Attention Deficit Diagnostic Rating Scale (WRAADDS), parent rating of proband's ADHD childhood and adult life symptoms using the Swanson, Nolan And Pelham questionnaire (SNAP), and report of clinical ADHD diagnosis, were included as ADHD measures. Nicotine use data was compared with data from a population sample. **Results:** Ten percent of the schizophrenia group and 30% of the Asperger syndrome group had a clinical ADHD diagnosis. Nicotine dependency in the whole sample was closely linked to ADHD. **Conclusion:** The prevalence of comorbid ADHD was high in both schizophrenia and Asperger syndrome. The WRAADDS self-rating scale for ADHD can be one useful tool for assessing comorbid ADHD in these patient groups.

Introduction

Schizophrenia, Asperger syndrome and attention-deficit/hyperactivity disorder (ADHD)

It has become generally accepted that ADHD is not just a disorder of childhood. Furthermore, ADHD may well co-exist with other psychiatric disorders. Retrospective studies on individuals with schizophrenia/schizophreniform psychosis (SP), as well as studies on populations with a genetically high-risk for schizophrenia, have shown that attention-deficit/hyperactivity disorder (ADHD) symptoms are more common in these groups than in the general population (Keshavan, Sujata, Mehra, Montrose, & Sweeney, 2003; Niemi, Suvisaari, Tuulio-Henriksson, & Lonnqvist, 2003; Peralta et al.2007). The neurodevelopmental theory of SP postulates that, although the characteristic symptoms in SP commonly appear in late adolescence or early adulthood, a substantial proportion of individuals with the disorder have had a wide range of behavioural or developmental abnormalities long before the “onset” of psychosis (Rapoport, Addington, Frangou, & Psych, 2005; Owen, O'Donovan, Thapar, & Craddock, 2011).

There have been several publications on co-existing ADHD in children with Autism Spectrum Disorders (ASD) (Leyfer et al., 2006; Sinzig, Walter, & Doepfner, 2009; Yerys et al., 2009; Sibley et al., 2011). However, studies on the same type of “comorbidity” in adults have been few and far between (Nydén et al., 2010). Asperger syndrome (AS) is considered to be one form of ASD. AS, as defined in DSM-IV-TR (American Psychiatric Association, 2000) or by Gillberg (Gillberg, 1992), involves severe sustained impairment in social interaction and development of restricted, repetitive patterns of behaviour, interests and activities. The disturbance causes clinically significant impairment. In contrast to autistic disorder, there are no clinically significant major delays or deviance in language acquisition. Whereas autistic disorder is often associated with learning disability, individuals with AS commonly have a general intelligence within the normal range.

DSM-IV and the Wender Utah adult ADHD criteria

The DSM-IV criteria for ADHD were developed for children. Many of these criteria are age-specific, for example “often runs about or climbs excessively” or “often has difficulty playing or engaging in leisure activities quietly”, descriptions that are usually not applicable to adults. Wender has suggested operational criteria that better specify characteristics more directly relevant for ADHD in adults (Wender, Wolf, & Wasserstein, 2001). The Wender Utah adult ADHD criteria include both a childhood history consistent with the DSM criteria and specific adult characteristics. The adult characteristics are composed of seven symptoms: 1. Attention deficits, 2. Motor hyperactivity, 3. Affective lability, 4. Hot temper, explosive short-lived outbursts, 5. Disorganization, inability to complete tasks, 6. Emotional overreactivity 7. Impulsivity. The first two symptoms are both required along with at least two of the remaining five symptoms. The Wender Utah criteria have been widely used in studies on ADHD in adults (Ginsberg, Hirvikoski, & Lindfors, 2010; Retz et al., 2010).

Nicotine dependency among individuals with psychiatric disorders

Nicotine dependency is more common among patients with psychiatric disorders than in the general population (Aubin, Rollema, Svensson, & Winterer, in press, epub 2011). Among the mentally ill, smoking prevalence is highest in patients with SP. Heavy smoking and high nicotine dependency are more frequent in smokers with SP as compared with the general population (de Leon & Diaz, 2005). Patients with SP live substantially shorter lives than the general population and the primary cause of death is tobacco-related medical illness, such as cardiovascular disease, chronic obstructive pulmonary disease and lung cancer (Brown, Inskip, & Barraclough, 2000; George & Ziedonis, 2009; Hennekens, Hennekens, Hollar, & Casey, 2005). Childhood ADHD is strongly associated with early initiation of cigarette smoking (Milberger, Biederman, Faraone, Chen, & Jones, 1997; Gehricke, Hong, Whalen, Steinhoff, & Wigal, 2009; Charach, Yeung, Climans, & Lillie, 2011). Patients with autism spectrum disorders (including those with AS), as well as those with obsessive-compulsive disorder, have, on the

contrary, been reported to have a low prevalence of smoking (Bejerot & Humble, 1999; Bejerot & Nylander, 2003).

Substance abuse and psychiatric disorders

It is well known that substance abuse (i.e. abuse of alcohol, cannabis, amphetamine and similar) often is associated with psychiatric illness. Prospective studies have shown that mental disorders are a risk factor for developing substance abuse (Swendsen et al., 2010). Cannabis use is both a risk factor for developing schizophrenia but also frequently used as self-medication to reduce symptoms, although the long-term effects are intensified symptoms instead.

Aim

The aim of the present study was to explore the prevalence of and usefulness of a variety of rating scales for “comorbid” ADHD in adult patients with either SP or AS, and, whether or not nicotine use and substance abuse in SP or AS might be related to the presence of ADHD.

Method

Participants

A total of 95 individuals born 1972-1987 with clinical diagnoses of either SP (n=41) or AS (n=54) were included in the study. Demographic characteristics for the two study groups are presented in Table 1. All participants provided informed consent. The study was approved by the Medical Ethical Review Board at Uppsala.

Table 1. *SP and AS study group characteristics*

	SP group n = 41	AS group n = 54	p
Age in years	28.9 (SD 4.6)	27.0 (SD 3.9)	ns
High school graduation	63.4% (26)	55.5% (30)	ns
Regular employment	7.3% (3)	3.6% (2)	ns
Social security assistance/sickness benefits	87.8% (36)	75.9% (41)	ns
Substance abuse ever	31.7% (13)	11.1% (6)	p=.013
Current psychopharmacological treatment	87.8% (36)	43.6% (24)	p<.001

SP group.

The participants were recruited from the only adult psychiatric clinic in the county of Värmland, Sweden and from an outpatient clinic for patients with psychosis in the city of Gothenburg. In Värmland all adult psychiatric services were in the public domain at the time of the study and organized at the county level into one clinic. The staff at the different psychiatric out-patient departments around the county was informed about the study and asked to screen their service for patients with schizophrenic psychosis. They were asked to inform the patient about the study, to give a standard (oral and written) full description of the study. Patients who did not have a current contact were sent a participation inquiry. Individuals with current severe psychotic symptoms requiring hospitalisation were approached when symptoms were considered less florid. Patients accepting to participate were included only after written informed consent had been received from each individual. In order to increase the number of participants, we approached an outpatient clinic for patients with psychosis in the city of Gothenburg, from which we unfortunately only managed to recruit one man and three women.

The clinical diagnosis was confirmed or rejected by the Structured Clinical Interview for Diagnosis according to the DSM-IV (SCID-I) (First & Gibbon, 2004). SCID I. Originally, 46 patients with a clinical diagnosis of SP had been included in the study. For five patients a diagnosis of SP could not be confirmed by the SCID-I. The SCID-I diagnoses for the remaining 41 patients (the SP group) - 25 males and 16 females - were: Schizophrenia paranoid type - 12 males and 7 females, schizophrenia undifferentiated type - 5 males and 1 female, schizoaffective disorder - 2 males and 6 females, schizo-

phreniform disorder - 3 males, and psychotic disorder - 3 males and 2 females. (Hallerback, Lugnegard & Gillberg, 2012)

AS group.

The 54 individuals (26 males, 28 females) with a clinical diagnosis of AS were recruited from two different outpatient clinics in Värmland, providing services for people with neurodevelopmental/neuropsychiatric disorders including AS and other autism spectrum disorders. For 45/54, (83%), a diagnosis of AS or ASD was confirmed by using the Eleventh version of the Diagnostic Interview for Social and COmmunication Disorders (DISCO-11) (Wing, Leekam, Libby, Gould, & Larcombe, 2002) with a parent. In the remaining nine cases either the proband or the parents did not accept a parental interview.

Measurements

Clinical ADHD diagnosis.

All participants were asked, in connection with the SCID interview, about prior diagnostic assessments, and specifically if they had been examined for or clinically diagnosed with ADHD.

Wender Reimherr Adult Attention Deficit Diagnostic Rating Scale (WRAADDS).

The Wender Reimherr Adult Attention Deficit Diagnostic rating scale is based on the Utah criteria for adult ADHD (Rosler et al., 2006). It was originally designed as an interview. It has been used in several studies to assess ADHD symptoms over time in treatment studies (Rosler, Fischer, Ammer, Ose, & Retz, 2009 ; Retz et al 2010; Rosler et al., 2010; McRae-Clark, Brady, Hartwell, White, & Carter, 2011.; Wender et al., 2011). The psychometric properties including test-retest reliability and internal consistencies have been described in two posters. The test-retest reliability has been reported to be ex-

cellent and the internal consistencies have been reported to be acceptable (Reimherr et al., 2003; Reimherr, Marchant, Strong & Wender, 2008; Wender et al., 2011).

The WRAADDS includes 35 descriptions, and the individual is asked to rate how appropriate each description is on a five-point scale: *0-not, 1-a little bit, 2-moderately, 3-quite a bit, to 4-very much*. The scale yields a total score (range 0-140). The seven subscales are congruent with the Utah criteria for ADHD and measures: (1) Attention deficits, (2) Hyperactivity, (3) Affective lability, (4) Hot temper, (5) Disorganization, inability to complete tasks, (6) Emotional overreactivity and (7) Impulsivity. The Swedish version has been modified to serve as a self-rating scale.

Swanson, Nolan And Pelham questionnaire (SNAP).

The Swanson, Nolan And Pelham questionnaire (SNAP) (Swanson et al., 2001) for ADHD (and oppositional-defiant disorder/ODD) symptoms is based on the DSM-IV criteria. If both the participant and the parents consented, then the parents were asked to complete the SNAP. The questionnaire was given in two versions, one referring to childhood symptoms and the other to present time. We made some minor alternations and removed the words “playing”, “classroom” and “homework”, since they are generally not applicable in adults. Parents were given the questionnaire with a stamped envelope in connection with a face-to-face interview with DISCO-11 and were asked to complete it at home and return it in the mail. Parents of 32 SP patients and 45 AS patients participated in the interviews and 24 in the SP group and 39 in the AS group returned the SNAP questionnaires.

On the SNAP, each of the 18 DSM-IV criteria for ADHD is framed as a question enquiring how frequently the behaviour occurs, rated on a Likert scale: *0-never, 1-rarely, 2-often, and 3-very often*. There are two additional questions on the SNAP, one relating to attention difficulties and the other concerning hyperactivity/impulsivity. The maximum total score for ADHD on the SNAP is 60 points.

The total score was used here with a view to examining the correlation with other scales and to assess variation across groups. In addition, the SNAP results were analysed in reference to the DSM-IV definitions (6 out of the 9 DSM-IV criteria required for a diagnosis). A criterion was considered to be met if the behaviour was reported to occur often or very often (ratings of 2 or 3).

There are also 10 items on the SNAP relating to ODD, but these were not analysed here.

Nicotine use.

For comparison with the SP and AS groups use of nicotine, a general population cohort (Life and Health 2008) of young Swedish people was included. The individuals in this cohort were 18-34 years at the time of a postal survey questionnaire in which health, habits of living and living conditions in the general population were examined. This was the third time socioeconomic conditions, lifestyle factors (including smoking and snuffing habits) and self-rated health was examined in this population in this manner (Arne et al., 2009; Molarius et al., 2007). The area investigated covered 55 municipalities in five counties in central Sweden with approximately one million inhabitants. The sampling was random after stratification for gender, age group, county and municipality. The questionnaire was sent to 68 522 individuals. Data collection was completed after two postal reminders. The response rate was 52.9%. The questionnaire included the following questions about tobacco use: "*Do you smoke cigarettes?*" with the options: "*No, I have never smoked regularly*"; "*No, I have quit smoking*"; "*Yes, I sometimes smoke*" and "*Yes, I smoke daily*". Questions about snuff were framed in the same way.

Participants in the AS and SP groups completed the Fagerström Tolerance questionnaire (Fagerstrom & Schneider, 1989; Pomerleau, Majchrzak, & Pomerleau, 1989), which includes general questions about cigarette and snuff use: "*Do you smoke?*" and "*Do you use snuff?*" with the options: "*Yes*"; "*No*"; "*I have done so previously but not at present*".

The proportion in the population study answering “*Yes, daily*” on the questions “*Do you smoke cigarettes?*” is compared to the proportions in the AS and SP groups answering “*Yes*” on the comparable questions “*Do you smoke?*”. Snuff use is analysed likewise.

Daily use of nicotine is assessed by creating a variable “*Nicotine use, current*”. For the population study the response alternative “*Yes, daily*” on either or both questions “*Do you smoke cigarettes?*” and “*Do you use snuff*” is transformed to “*Yes*” on the new variable “*Nicotine use, current*”. For the AS and SP study group the answer “*Yes*” on either of the questions “*Do you smoke?*” and “*Do you use snuff?*” is transformed to “*Yes*” on the variable “*Nicotine use, current*”.

Substance abuse.

All participants in the AS and SP group were asked about current and previous substance use and abuse in the SCID-I interview. Abuse of alcohol, cannabis, amphetamine or other drugs is analysed in relation to diagnoses (SP, AS and ADHD) and in relation to nicotine dependency.

Results

Clinical ADHD diagnoses

A total of 20 of the 95 patients had a clinical ADHD diagnosis made by psychiatrists. All the clinical diagnoses (SP, AS and ADHD) had been assigned either by a psychiatrist or by a psychiatric team (psychiatrist, psychologist and other professionals) at a centre for neurodevelopmental diagnostic assessments.

Two men and two women in the SP group (4/41, 10%) had an ADHD diagnosis, and all of these had been given their ADHD diagnosis in adult age.

Eight men and eight women in the AS group (16/54, 30%) had an ADHD diagnosis (significantly more than in the SP-group, $p < .02$). Three of these had been given a clinical diagnosis of ADHD when they were children, two of whom had had their ADHD diagnoses assigned prior to the AS diagnosis. Another 13 had been clinically diagnosed with ADHD when they were 20 years or older, after the diagnosis of AS had been made.

Rating scales and clinical ADHD diagnosis

WRAADDS.

WRAADDS scores were available for 93 individuals (missing data from one man in the SP group and one man in the AS group), including all of the 20 individuals with clinical ADHD diagnoses. The WRAADDS total score differed significantly between the groups with and without clinical ADHD diagnoses, see table 2. There were significant differences on five of the seven symptom scales (attention deficits; hyperactivity; disorganization, inability to complete tasks; emotional over-reactivity, and impulsivity). There was no difference on any of the WRAADDS scales when comparing the SP group with the AS group.

Table 2. *Results on the WRAADDS for those with and without a clinical ADHD diagnosis (in addition to SP or AS)*

	Clinical ADHD diagnosis		No ADHD diagnosis		Mann Whitney U-test
	n=20		n=73		
	mean	SD	mean	SD	
Total score	78.1	19.6	54.8	25.0	$p < .001$
Attention deficit	9.0	3.2	6.0	3.8	$p = .002$
Hyperactivity	13.1	4.5	7.2	4.5	$p < .001$
Disorganization	17.8	4.9	11.8	6.6	$p < .001$
Emotional over reactivity	8.4	3.2	6.7	3.4	$p = .043$
Impulsivity	12.3	5.5	8.0	5.3	$p = .003$
Affective lability	8.7	3.7	7.3	4.3	ns
Hot temper	8.9	4.4	7.7	4.0	ns

To further explore the effectiveness of the WRAADDS total score as a measure of ADHD symptoms/diagnosis, the sensitivity versus 1-specificity for WRAADDS total score and clinical ADHD diagnosis was plotted on a Receiver Operating Characteristic (ROC) curve (Area under the curve (AUC) = 0.77, $p < .001$) (Figure 1).

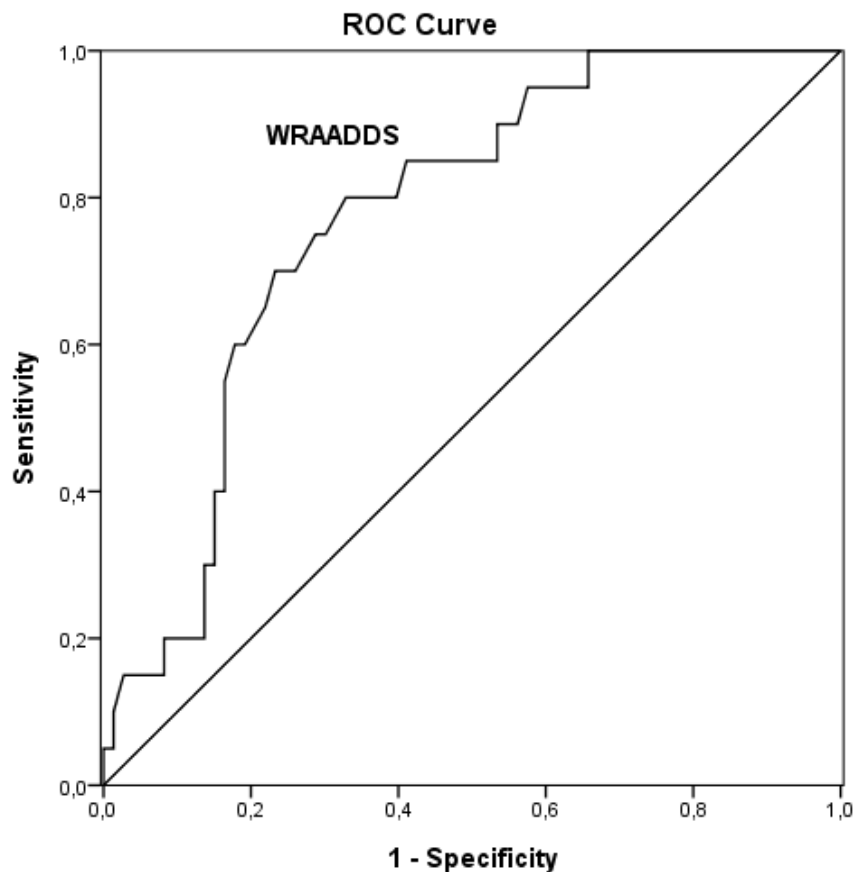


Figure 1. ROC curve for clinical ADHD diagnosis and WRAADDS (AUC=0.77, $p < .001$)

The WRAADDS total score was normally distributed according to the Kolmogorov-Smirnov test of normality. The same was true when looking separately at the subgroups with and without a clinical ADHD diagnosis (medians of 80 and 54 respectively).

SNAP.

SNAP scores were available for 63/95 (66%) of the individuals, including 15/20 (75%) with a clinical ADHD diagnosis. However, for two individuals in the AS group, parents only returned the SNAP adult version. Neither of these had clinical ADHD diagnosis.

For 4/12 (33%) in the AS group and 3/3 (100%) in the SP group with a clinical ADHD diagnosis, parent SNAP “childhood” ratings corresponded to a SNAP DSM-IV ADHD diagnosis (see Methods for definitions). However, for the remaining 8 (all in the AS group, 67% of the AS group with ADHD examined on the SNAP) parents reported scores under “ADHD cut-off” on the SNAP. Parents reported ADHD symptoms above ADHD cut-off for 10/48 (21%) of the individuals who did not have a clinical ADHD diagnosis (1 in the SP group (male) and 9 in the AS group, of whom 6 were women with the inattentive subtype).

The SNAP *childhood total* scores clearly separated the groups with and without clinical ADHD diagnoses (median 24.0 vs 10.0, mean 23.7 vs 12.8, SD 14.2 vs 12.1, $p=.008$ Mann-Whitney U). In contrast, the SNAP *adult total* scores did not differ significantly between those with and those without a clinical ADHD diagnosis ($p=.08$, Mann-Whitney U). Correspondingly, the AUC on the ROC curve was significant for the SNAP childhood (0.73, $p=0.009$) but fell just short of statistical significance for the SNAP adult (0.67, $p=0.053$) in relation to clinical ADHD diagnosis (Figure 2).

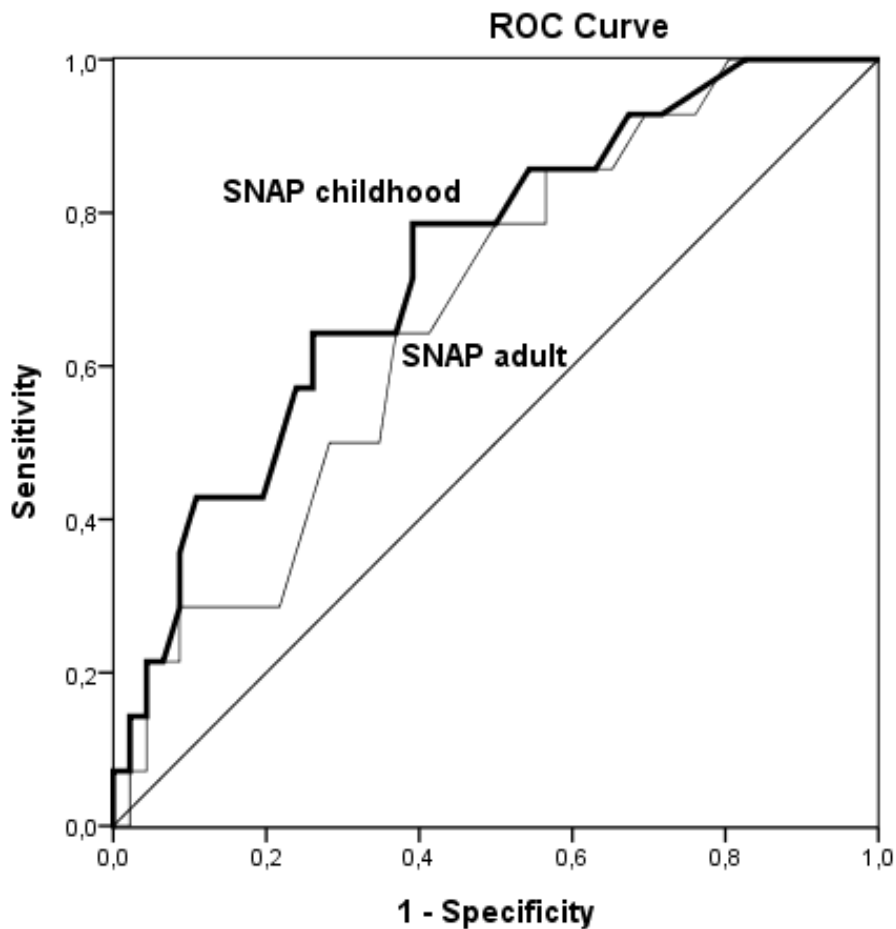


Figure 2. SNAP childhood ($AUC=.73$, $p=.009$), and SNAP adult ($AUC=.67$, $n s$)

Correlations between rating scales

The total score of the WRAADDS, SNAP childhood and SNAP adult were correlated on a pair-wise basis. The Spearman r for the correlation between SNAP childhood and adult total scores was 0.76 ($p<.001$). The correlation between WRAADDS total scores on the one hand and SNAP childhood and adult total scores on the other were 0.33 ($p= .009$) and 0.21 (n.s.) respectively.

Nicotine use

Current nicotine use was significantly more frequent in the collapsed patient group than in the general population (Table 3). Nicotine use was more common among those with a clinical ADHD diagnosis in both the AS and the SP group (Table 4).

Table 3. Nicotine use in the Swedish population and in the study group.

	Population study 18–34 year-olds n= 7551	Study group AS and SP n=95	Fisher's exact test two-tailed sign.
Nicotine use, current	20.5 %	44.2 %	p<.0001
Cigarette use	9.9 %	35.8 %	p<.0001
Snuff use	11.4 %	23.4 %	p=.0017

Table 4 Nicotine and substance abuse in relation to clinical diagnoses (schizophrenic psychosis (SP) with or without ADHD and Asperger syndrome (AS) with or without ADHD) and gender (m/f = male/female)

	Clinical diagnoses								Total m/f
	SP + ADHD		SP – ADHD		AS + ADHD		AS - ADHD		
		m/f		m/f		m/f		m/f	
Nicotine use, current	4 (100%)	2/2	22 (59%)	16/6	10 (62%)	8/2	7 (18%)	2/5	28/15
Substance abuse, ever	4 (100%)	2/2	9 (24%)	8/1	5 (31%)	4/1	1 (3%)	1/0	15/4
- alcohol	1 (25%)	1/0	5 (13%)	5/0	3 (19%)	2/1	1 (3%)	1/0	9/1
- cannabis	1 (25%)	1/0	3 (8%)	3/0	2 (12%)	1/1			5/1
- amphetamine	3 (75%)	1/2	4 (11%)	3/1	4 (25%)	3/1			7/4
- other drugs					2 (12%)	2/0			2/0

Substance abuse

There were 19 individuals who reported substance abuse, only one participant had a current substance abuse. Substance abuse was closely linked to nicotine dependency. With one exception (a man with Asperger syndrome and previous alcohol abuse) all participants with substance abuse had a current or previous nicotine dependency.

Gender effects

There were 10 men and 10 women with clinical ADHD diagnosis, two men and two women in the SP group, and 8 men and 8 women in the AS group. Looking at the WRAADDS total score subdivided by gender, there were significant differences between those with and without clinical ADHD diagnoses for both men and women (men p=.001, women p=.026, Mann-Whitney U). In contrast, SNAP child-

hood total scores in individuals with or without clinical ADHD, differed significantly for men $p=.004$ but not for women, $p=.38$. The ROC curve analysis of WRAADDS was significant for men (AUC 0.90 $p=.001$), but not women, AUC (0.73, $p=.09$ ns). The same was true for SNAP childhood (men AUC 0.83, $p=.006$ and women AUC 0.63, $p=.34$ ns.) SNAP adult was not significant for either gender.

Substance abuse was more common among men (15/51, 30%) than women (4/44, 9%)

Discussion

Clearly, ADHD is a very common clinical “comorbidity” in adults with AS. Thirty per cent of the AS group (and ten per cent of the SP group) in our study had been given a clinical diagnosis of ADHD before they were examined in the present context. This is in accordance with previously published prevalence in children (Leyfer, O., et al 2006). Only three individuals (all in the AS group) in the study (3% of the whole sample) had been given a diagnosis of ADHD during childhood; the vast majority of the clinical ADHD diagnoses (85%) had been assigned/diagnosed after age 18 years. There are at least two explanations for this finding. One is that the health services for assessing ADHD in children in the county of Värmland was limited before the mid-1990s. Accessibility for both children and adults with ADHD symptoms (and other neurodevelopmental problems) has increased markedly during the latest 10-15 years, starting from a very low level in the mid-1990s. Consequently, only a fraction of individuals with ADHD born in 1972-1987 (birth year range of our study group) would have been clinically identified as having a *diagnosis* of ADHD in childhood. The other explanation for the very low rate of childhood diagnosis of ADHD in AS is that it was common clinical practice throughout the 1980s and the 1990s, as suggested/required by the most commonly used diagnostic manuals in the field (the DSM and ICD), not to diagnose ADHD at all in individuals with AS. In the very recent past it has become more common to identify both diagnoses when they co-occur, and to treat both problem types accordingly.

A thorough clinical examination is needed when making a psychiatric diagnosis and this can never be replaced by questionnaires or focused structured observations. Nevertheless, various types of rating scales are helpful tools both in research and clinical practise, and it is essential to understand their pros and cons. For a long time, ADHD was considered to be a condition that only affected children. Our findings suggest that the criteria for ADHD as defined in the DSM-IV may be appropriate for children, but, possibly, not for adults. Parents' scoring of childhood as compared to adult symptoms on SNAP, supports that notion. The parents' rating of current DSM-IV ADHD symptoms as described on the SNAP, was not correlated with reported clinical diagnosis of ADHD. Although words such as "playing", "classroom" and "homework" have been removed, many of the symptom descriptions appear to be inappropriate for adults. Parents' *retrospective* rating of symptoms during childhood was much more useful in this context. Also, the total SNAP score appeared to be more informative for ADHD than using a SNAP algorithm of 6 out of 9 "specific diagnostic" markers. Indeed, of those with clinical ADHD diagnosis in the AS group only one third met the SNAP algorithm for ADHD. The three individuals in the SP group with clinical ADHD diagnosis and for whom SNAP scores were available, all met the SNAP algorithm.

In contrast, the patients' own self-rating of ADHD symptoms as described on the WRAADDS was clearly connected to clinical ADHD diagnosis. This is noteworthy, bearing in mind that the participants in this study have other psychiatric problems that might decrease their ability to carry out self-rating. Nevertheless, of course, the "diagnosis of ADHD" in the present study relied on the report of the patients themselves that they had been given this particular diagnosis by clinicians not participating in the study. Even so, the ADHD diagnoses reported by the participants were supported by the clinical impression of ADHD on the part of the experienced clinician doing the overall assessment. Studies relating to the interview version of the WRAADDS have been published (Marchant et al., 2011; Wender et al., 2011) but, to our knowledge, no previous publications on the self-rating version of WRAADDS has appeared in print. Our study provided some support for the WRAADDS being a useful tool when

looking for ADHD in adult patients with SP or Asperger syndrome, even though, again, it cannot be used as a diagnostic tool when used in isolation.

All the rating scales applied in our study appeared to be more valid for ADHD in men than in women. In men, the WRAADDS total score had good diagnostic performance vis-à-vis a clinical ADHD diagnosis, but the AUC was not significant for women. Nevertheless there was a significant difference in WRAADDS total score between women with a clinical diagnosis of ADHD and those without. The parent childhood SNAP total score rating corresponded relatively well with a clinical ADHD diagnosis in men, but not in women.

One major limitation of this study is the relative small number of participants. Numbers were, further reduced by the fact that all parents did not fulfil all the parent rating scales. It is very likely that the estimated rate of ADHD in our study groups is a minimum one, and it is possible that the “real” prevalence of ADHD in AS and SP is much higher than that reported here.

Nicotine use and substance abuse were frequent concomitants of SP. Nicotine was also common in AS, but only when AS was “comorbid” with ADHD. In fact, nicotine use in a patient with AS might be taken as a clinical marker of ADHD in that individual. Thus, ADHD and its strong association with nicotine use are important factors to recognise and address in clinical practice.

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