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Screening for attention-deficit/hyperactivity disorder in borderline personality disorder

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	DISORDER 1	
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2	Screening for attention-deficit/hyperactivity disorder in borderline personality disorder	
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DISORDER 2 22 **ABSTRACT** 23 **Background**: A valid screening instrument is needed to detect attention-deficit/hyperactivity 24 disorder (ADHD) in treatment-seeking borderline personality disorder (BPD) patients. 25 We aimed to test the performance of the widely-used Adult ADHD Self-Report Scale v1.1 26 screener (ASRS-v1.1). 27 Methods: 317 BPD subjects were systematically assessed for comorbid ADHD and 28 completed the ASRS-v1.1. 79 BPD patients also completed the Wender Utah Rating Scale 29 (WURS-25). **Results:** The prevalence of adult ADHD was of 32.4%. The overall positive predictive value 30 31 of the ASRS-v1.1 was of 38.5%, the negative predictive value 77.0%, the sensitivity 72.8%, and the specificity 43.9%. Combining WURS-25 and ASRS-v1.1 improved sensitivity to 32 33 81.8% and specificity to 59.6%. **Limitations:** Cross-sectional study on treatment-seeking patients. 34 Conclusions: We found a high prevalence of ADHD using structured interviews. The ASRS-35 36 v1.1 was not a sensitive screener for identifying possible ADHD cases in a BPD population, 37 with a high number of false positives. When combined with the WURS-25, it offered 38 improved screening. 39 40 **Keywords**: adult ADHD; screening; Borderline Personality Disorder; comorbidity; diagnosis;

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ASRS-v1.1

1. Introduction

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Attention-Deficit/Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder that 45 46 persists into adulthood in about two-thirds of individuals (Fayyad et al., 2007; Simon et al., 2009), with an estimated prevalence in adults ranging from 1% to 6% (Fayyad et al., 2007; 47 Kessler et al., 2006; Simon et al., 2009). Adult ADHD has been frequently reported to be 48 49 comorbid with Borderline Personality Disorder (BPD). In clinical samples of BPD patients, 50 the prevalence of adult ADHD is higher than in the general population, ranging from 16.1% to 38.1% (Asherson et al., 2014; Ferrer et al., 2010; Philipsen et al., 2008; Prada et al., 2014). 51 52 These high prevalence rates are consistent with the fact that BPD symptoms are more 53 frequent in ADHD adolescents (Burke and Stepp, 2012; Speranza et al., 2011; Stepp et al., 54 2012). Several studies showed prospectively that ADHD was a risk factor for a subsequent 55 development of BPD (Fischer et al., 2002; Miller et al., 2008; Stepp et al., 2012), with rates of 56 BPD among adults with ADHD ranging from 19% to 37%. 57 Criterion overlap, i.e. the fact that some symptoms are shared by the two disorders 58 (impulsivity, emotional and affective lability, interpersonal deficits) is not sufficient to explain ADHD and BPD comorbidity (Matthies and Philipsen, 2014). Several hypotheses 59 60 have been raised to explain this higher-than-chance association: shared genetic and 61 environmental vulnerability (Distel et al., 2011), similar neurobiological dysfunction (Lampe 62 et al., 2007), or ADHD symptoms increasing the chance to live in an invalidating environment during childhood, therefore increasing the chance to develop BPD in 63 64 adolescence and adulthood (Asherson et al., 2014; Matthies and Philipsen, 2014; Philipsen et 65 al., 2008). Regardless of the reason for the interaction between the disorders, the comorbidity 66 appears to be an important problem. The presence of adult ADHD is associated with more severe symptoms of BPD, more frequent comorbidities, a worse outcome and poor response 67

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68	to treatment (Philipsen et al., 2008; Storebø and Simonsen, 2014). Observational studies
69	nevertheless suggest that treating BPD patients medically for comorbid adult ADHD
70	improved their response to psychotherapy (Prada et al., 2015).
71	The identification and treatment of ADHD in treatment-seeking BPD patients may therefore
72	improve the overall outcome. The detection of ADHD in BPD subjects relies mainly on a
73	clinical evaluation aiming at distinguishing symptoms pertaining to one or the other disorder.
74	It is a difficult task for several reasons. ADHD may not have been diagnosed during
75	childhood, or patients may not remember having been diagnosed. Furthermore, several
76	features of BPD overlap with those of ADHD, including emotional instability and
77	dysregulation (affective lability, hot temper, and stress intolerance) (Skirrow and Asherson,
78	2013), low self-esteem (Harpin et al., 2016), interpersonal deficits (Perroud et al., 2017),
79	impulsivity (Prada et al., 2014), inner restlessness (Jung et al., 2016), and risk-taking behavior
80	(Fossati et al., 2001). The complexities of symptom overlap and comorbidity create a
81	particular problem for general adult mental health services, to which patients with BPD are
82	often referred, but where experience of the diagnosis and clinical management of ADHD is
83	often lacking. Furthermore, the diagnosis of adult ADHD is rather time-consuming and even
84	if the prevalence of ADHD is high, screening can be cost-effective in terms of identifying
85	patients who are likely to have ADHD in order to better allocate resources. It is therefore
86	useful to have a reliable screening tool for ADHD in BPD patients. Several instruments are
87	available for the screening of adult ADHD (Belendiuk et al., 2007). Some of them are in the
88	public domain and show potential for providing a cost-effective approach for confirming
89	current symptoms of ADHD in BPD patients. However, the usefulness of these tools has not
90	yet been tested.

92	The 6-item version of the World Health Organization Adult ADHD Self-Report Scale v1.1
93	(ASRS-v1.1) symptom checklist is a short, freely-accessible and largely-used screening tool.
94	This version was developed for optimal consistency with the clinical classification. In the
95	seminal study of ASRS-v1.1, a population survey found that the tool had a sensitivity of
96	68.7%, a specificity of 99.5% and a positive predictive value (PPV) of 89.3% (Kessler et al.,
97	2005) (see Table 1 for description of psychometrics). Furthermore, the ASRS-v1.1 has
98	demonstrated high internal consistency (Adler et al., 2006) and good test-retest reliability
99	(Matza et al., 2011). In a subsequent primary care study with a slightly larger sample
100	(N=200), Hines et al. (2012) reported high sensitivity (100%) and moderate positive
101	predictive power (52%), suggesting that the ASRS-v1.1 would rarely miss ADHD in an adult
102	with ADHD. This result has been replicated in psychiatric populations, and particularly in
103	comorbid populations, and the screening tool is thought to have high sensitivity, but may lack
104	specificity. In a large study involving patients seeking treatment for substance use disorder,
105	van de Glind et al. (2013) found that the overall PPV of the ASRS-v1.1 was 26%, and its
106	negative predictive value (NPV) was 97%. The sensitivity was good and its specificity was
107	moderate for identifying possible ADHD cases in this population (van de Glind et al., 2013).
108	In another study with cocaine use disorder patients, the NPV was also found to be good
109	(92%), suggesting that ASRS-v1.1 is a useful screener for these patients (Dakwar et al.,
110	2012).
111	
112	As ADHD comorbidity in BPD patients is now recognized as an important issue, and since
113	ASRS-v1.1 is a widely used and recommended screening tool for ADHD, we suspect that the
114	ASRS-v1.1 is also extensively used in patients with BPD. However, the psychometric
115	properties and relevance of this instrument have not been adequately tested among treatment-
116	seeking BPD patients. Moreover, doubts remain as to how ASRS-v1.1 can identify correctly-

diagnosed ADHD patients with BPD. BPD and/or bipolar disorder type II patients scored
highly at the ASRS-v1.1 (Edebol et al., 2012), in the range between ADHD patients and
control subjects, and ASRS has been shown to have a low specificity in bipolar disorder
patients (Perroud et al., 2014).
The purpose of this study was to assess the clinical relevance of the ASRS-v1.1 in detecting
comorbid ADHD among a population of outpatients seeking treatment for BPD; ADHD was
assessed by means of a clinical interview that included a semi-structured interview for ADHD
during childhood and adulthood. ADHD is typically considered as a neurodevelopmental
disorder with symptoms present during childhood, even if this statement was recently
challenged by prospective epidemiological studies (Agnew-Blais et al., 2016; Caye et al.,
2016; Moffitt et al., 2015). We wondered whether the specificity of the ASRS-v1.1 could be
improved by using a self-report questionnaire assessing ADHD symptoms during childhood,
namely the Wender Utah Rating Scale (WURS-25) which was used in a subset of patients
(Ginsberg et al., 2010; Rao and Place, 2011).

2. Methods

- 2.1. Participants and procedure
- 317 French-speaking patients suffering from BPD were recruited in a specialized center for
- diagnosis and outpatient treatment of adults suffering from ADHD or BPD at the University
- 136 Hospitals of Geneva.
- Patients underwent a clinical evaluation conducted by a trained psychiatrist, to ascertain the
- diagnosis of BPD and/or ADHD according to DSM-IV criteria, and to exclude any organic
- condition and/or Axis I disorders that might better explain the disorder.

140	After providing informed consent, subjects were administered screening instruments (ASRS
141	1.1 for all subjects, and WURS-25 for a subset of 79 patients), followed by structured
142	diagnostic interviews conducted by trained psychologists. BPD diagnosis was further assessed
143	by the Screening Interview for Axis II disorders (SCID-II) (First and Gibbon, 2004) and other
144	diagnoses, particularly child and adult ADHD by the Diagnostic Interview for Genetic Studies
145	(DIGS) (Nurnberger et al., 1994). A best estimate procedure including the data from the
146	clinical evaluation and from the semi-structured interviews was used to confirm BPD and/or
147	ADHD. Patient were classified as "childhood ADHD" if the symptoms of ADHD were noted
148	during childhood, but not present in adulthood according to DSM-IV criteria, and "adult
149	ADHD" if symptoms of ADHD persisted in adulthood.
150	The study was approved by the ethics committee of University Hospitals of Geneva.
151	
152	2.2. Assessment instruments
153	Adult ADHD Self-Report Scale-Version 1.1: The 6-item ASRS-v1.1 screener (Kessler et al.,
154	2005) was designed to help screen for ADHD in adults (aged 18 and older). The scale consists
155	of 6 items, each of which can be scaled from 0 to 4 (0 = never; 1 = rarely; 2 = sometimes; 3 =
156	often; 4 = very often). The six questions of the ASRS-v1.1 are consistent with the DSM-IV
157	criteria and address the manifestation of ADHD in adults, with the first four questions relating
158	to inattention, and the two last ones relating to hyperactivity. One point is given for any
159	answer equal or greater than 2 for the first 3 items; one point is given for any answer equal or
160	greater than 3 for the next 3 items. If the score is 4 or more (on a scale of 0 to 6), then the
161	current symptom profile of the individual is considered to be highly consistent with ADHD
162	diagnosis in adults (Adler et al., 2006; Kessler et al., 2007). This screening tool has performed
163	well in studies, with a sensitivity of 68.7%, a specificity of 99.5%, and a PPV of 89.3%
164	(Kessler et al., 2005). Internal consistency (Cronbach alpha) ranges between 0.63 and 0.72

165	and has a test-retest reliability of 0.58 to 0.77. There is good consistency with the clinician's
166	diagnosis, with an area under the receiver operator curve of 0.90 (Kessler et al., 2007). The
167	ASRS-v1.1 is the part A of the 18-items ASRS Symptom Checklist (ASRS-18-items), the part
168	B consisting of 12 additional questions corresponds to the remaining DSM criteria for
169	ADHD. In the current study, patients completed ASRS-v1.1, then the part B of the 18-items
170	ASRS Symptom Checklist. The validated French version was used (Caci et al., 2009). As the
171	English version, the French version has a two-factor structure (inattention and
172	hyperactivity/impulsivity) (Caci et al., 2009) The prevalence of ADHD estimated using the
173	French ASRSv1.1 are similar to the one found when using the English version (Caci et al.,
174	2014).
175	
176	Wender Utah Rating Scale 25-items (WURS-25): A subset of 79 patients completed the
177	WURS-25. The questionnaire is a self-report instrument assessing retrospectively the
178	childhood diagnosis of ADHD, and features questions addressing attention problems,
179	hyperactivity, behavioral problems at school, impulsivity, over-excitability, and temper
180	outbursts. The 25-item version is a subset of the original 61-item version. Each item is rated 0
181	(not at all) to 4 (very much). ADHD was assessed using a conservative cut-off (≥ 46) that
182	indicates probable ADHD. This cut-off correctly identified 86% of the adults with ADHD,
183	99% of the "normal" patients, and 81% of the subjects with depression (Ward et al., 1993).
184	We used the validated French version (Caci et al., 2010). Compared to the English version,
185	the French version showed a similar factor structure (Caci et al., 2010), a good internal
186	consistency (Baylé et al., 2003), and similar screening properties (Romo et al., 2010).
187	
188	Diagnostic Interview for Genetic Studies (DIGS): After completing the screening instruments,
189	patients were interviewed using the French version of the DIGS (Nurnberger et al., 1994;

Preisig et al., 1999). The DIGS is a well-established structured clinical interview, used to
make a wide range of DSM-IV diagnoses. As it does not contain a specific adult ADHD
module, but only a child ADHD module that includes a question on duration of symptoms,
adult ADHD diagnosis was established on a sufficient number of currently-present DSM
ADHD symptoms, the presence of the disorder in childhood (before the age of 7), and the
persistence of childhood symptoms in the present, following DSM-IV recommendations. All
patients were clinically assessed, and diagnosis was based on a best estimate procedure that
took into account information from the DIGS, the clinical evaluation and, when available,
medical records and relatives.
Structured Clinical Interview for DSM-IV personality disorders (SCID): The SCID is a
structured clinical interview ascertaining DSM-IV criteria (First and Gibbon, 2004). It was
used to ascertain the BPD diagnosis. Patients had to satisfy at least five of the nine criteria for
SCID-II BPD to be considered.
2.3. Statistical analysis
Statistical analyses were carried out by Stata 14.1. Diagnoses (ADHD or not) obtained by the
mean of the best estimate procedure were used as the external criterion for the calculation of
the sensitivity, specificity, positive likelihood ratio (LR+), negative likelihood ratio (LR-),
PPV, and NPV of the ASRS-v1.1 (for definitions of these terms, see Table 1). Comparisons
between BPD patients with and without adult ADHD were established with a chi square test.
Internal consistency for ASRS-v1.1 and ASRS-18 items in the BPD sample was checked

213 < Insert Table 1 about here >

using Cronbach's alpha.

DISORDER 10 214 3. Results 215 3.1. Demographic and clinical characteristics 216 The mean age of the participants was 31.8 years (SD=9.77) and 92.4% were female. Table 2 summarizes comorbid mental disorders. Out of these 317 participants, childhood ADHD was 217 218 diagnosed in 38.5% of them, and adult ADHD in 32.4%, representing adult persistence in 219 84.4% of cases (Table 2). 220 BPD + ADHD patients were more frequently diagnosed with a substance use disorder (except 221 alcohol) than BPD patients without ADHD (54.4 vs. 31.8%). No differences were found between the two groups for other diagnoses (Table 3). 222 223 224 < Insert Table 2 about here > 225 < Insert Table 3 about here > 226 227 3.2. Validity of screening instruments 228 In our BPD sample, the internal consistency (Cronbach alpha) for the ASRS-v1.1 was 0.74, 229 which is considered as acceptable. For the ASRS-18-items, the internal consistency was good 230 (alpha=0.89). 231 ASRS-v1.1 (six items): 61.5 % of patients had four or more positive responses in the six first 232 questions of the ASRS. Table 2 summarizes the validity characteristics (with confidence 233 intervals) of the ASRS screener, and combinations of the ASRS-v1.1/WURS-25 screening 234 instruments. 235 The sensitivity of the ASRS-v1.1 was quite low (72.8%), with a NPV of 77.0%, suggesting

that the screener instrument is unable to detect an important number of cases. Using a less

stringent cut-off to improve sensitivity, with the requirement of three positive responses, we

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DISORDER 11 238 found slightly improved sensitivity and NPV, but in both cases the specificity and PPV were 239 problematic (Table 4). 240 Combining ASRS-v1.1 and WURS-25 led to better sensitivity, NPV and higher specificity 241 and PPV than ASRS-v1.1 alone (Table 4). 242 < Insert Table 4 about here > 243 4. Discussion 244 245 We found that the ASRS-v1.1, a widely-used screening tool for adult ADHD, was not the best 246 instrument for screening ADHD in BPD patients. The tool was designed for screening in 247 general populations (Kessler et al., 2005), and we found that its properties are not well suited 248 to a population of BPD subjects. 249 250 In our unselected sample of patients with BPD, we found that comorbidity with adult ADHD 251 was present in 32.4% of patients, and childhood ADHD in 38.5%. This high prevalence of 252 ADHD in BPD patients has already been reported (Carlotta et al., 2013; Ferrer et al., 2010; Fossati et al., 2015, 2002; Philipsen et al., 2008; Prada et al., 2014). Ferrer et al. (2010) found 253 254 a prevalence of 38.1%, which is very similar to ours. We found a slightly higher prevalence 255 than Philipsen et al.(2008) (16.1%). In this latter study, ADHD diagnoses were only based on 256 self-questionnaires (ADHD-CL scale: Rösler et al., 2004), which might help explain this 257 discrepancy. To minimize the likelihood of overestimating the prevalence of adult ADHD, the 258 authors used a cut-off in the questionnaire that selected only patients with combined presentation of ADHD. In our sample, by considering only ADHD combined presentation, we 259 260 found a prevalence of 18.6%, which is very similar to the results of Philipsen et al. In fact, we

found that the distribution of ADHD presentations was similar in our sample to the one found

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in general population studies, with a majority of cases diagnosed with inattentive and
combined presentations (Faraone et al., 2006). An accurate estimation of childhood ADHD is
more difficult due to the lack of prospective population-wide studies and the frequent under-
diagnosis of ADHD during childhood. Follow-up studies suggested that children suffering
from ADHD have a significant risk of developing several forms of personality disorder
(Fischer et al., 2002; Miller et al., 2008; Stepp et al., 2012). Miller et al. (2008) investigated
the occurrence of personality disorders in a prospective study of young people diagnosed with
ADHD, compared with a control group without ADHD. They found that young patients
diagnosed with ADHD in childhood had a high risk (OR=13.2) of developing BPD in
adolescence. Based on retrospective assessments in adult patients, prevalence between 10 and
60% were suggested. In the high range, Fossati et al. (2002) found that 60% of patients with
BPD achieved WURS-25 scores deemed as suggestive of childhood ADHD. However, the
retrospective assessment with the WURS-25 questionnaire should be considered as
approximate, due to the scale's lack of specificity (Glöckner-Rist et al., 2013). In the lower
range, Speranza et al. (2011) found 11 % of ADHD in adolescent BPD patients, but it is
unclear whether adolescent BPD patients are strictly comparable to a group of adult BPD
patients. Our study therefore adds weight to the literature suggesting that adult ADHD is
particularly prevalent in BPD. Our estimation of 30% was based on a larger sample using, in
addition to a clinical interview, a semi-structured interview. We therefore believe that our
results are representative of the rate of comorbid ADHD in an adult BPD population.
The main purpose of the paper was to assess the validity of an ADHD screener. In this
perspective, it is crucial for a screening tool to have a correct NPV, in order to minimize the
risk of missing patients. We found that the NPV of ASRS-v1.1 was modest, leading to 27% of

ADHD comorbid BPD patients being missed. Furthermore, in 62% of cases, the positive

screening was a false alarm. Using a less stringent cut-off for the ASRS score (three positive items), the NPV was marginally improved, at the cost of creating more false positives.

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These performances in BPD patients contrast with other clinical situations, in which ADHD is frequently associated. In general psychiatric populations, such as those suffering from comorbid substance use disorder, ASRS-v1.1 showed acceptable screening properties (Daigre Blanco et al., 2009; Dakwar et al., 2012; Rao and Place, 2011; van de Glind et al., 2013). Conversely, in bipolar disorder, one study suggested that ASRS-v1.1 lacked specificity (Perroud et al., 2014). To explain why ASRS-v1.1 performed poorly in both bipolar disorder and BPD, it could be suggested that a striking similarity between these two disorders is emotional and mood lability, and of course, the high level of impulsivity, which is also a key feature of ADHD (Richard-Lepouriel et al., 2016). However, the six items of the ASRS screener are not related to emotional or impulsive factors, but only to inattention and motor/inner hyperactivity. It is therefore less likely that the overlap of ADHD and BPD symptoms explains poor screening properties. One other hypothesis relates to depression, which is very frequently present in BPD patients (Köhling et al., 2015), even at a subthreshold level. Depression is associated with cognitive symptoms and particularly inattention. Hence, the screening tool could misattribute symptoms of depression to ADHD, which would explain the high rate of false positives. Lastly, to explain the false negative rate, it is possible that BPD patients had difficulties in observing their own symptoms. Personality disorders are characterized by poor self-knowledge, specifically a distorted sense of self, and tend to lead to inaccurate self-perceptions (Clifton et al., 2005; Morey et al., 2011). Moreover, we can also hypothesize that patients believe that ADHD symptoms are attributable to BPD symptoms (for instance, considering that being unable to finish tasks is only a characteristic of personality). These biases would lead to a high rate of false negatives.

Therefore, questioning patients about childhood might help disentangle symptoms, since BPD symptoms emerge mostly during adolescence, whereas ADHD symptoms emerge earlier in childhood, in a neurodevelopmental perspective. In fact, we found better screening parameters when we used the WURS-25 questionnaire. In a sub-sample of our population, we found that the sensitivity and the specificity of the instruments were strengthened when ASRS-v1.1 and WURS-25 were used together. With the combination of instruments, only 18% of comorbid patients are missed, with fewer false alarms, and in most of cases a positive WURS-25 is indicative of a possible diagnosis of ADHD. In patients with substance use disorders, the WURS-25 provided better sensitivity and specificity as a screening test than the ASRS-v1.1 (Notzon et al., 2016; van de Glind et al., 2013) and would appear to be the best initial choice for the screening of comorbid ADHD in this kind of population.

Identifying ADHD cases is a challenge in BPD patients. Symptomatology can overlap with BPD diagnosis or comorbid conditions. Moreover, clinicians may not be trained to correctly identify this comorbid condition. Unfortunately, even if structured clinical instruments are helpful in the diagnosis process, they are not easily accessible and remain difficult to implement in clinical practice. A better allocation of clinical resources would be to administer a reliable screening instrument, followed by a standardized instrument for all probable cases. As we found that ASRS-v1.1 is neither sufficiently sensitive nor specific for diagnosing ADHD in BPD patients, we suggest that associating ASRS-v1.1 and WURS-25 is a valuable and cost-effective alternative. It allows screening of most cases, and leaves only half of cases to assess in greater detail.

An efficient treatment of some ADHD symptoms might decrease part of the symptomatology, allowing patients to better benefit from psychotherapy, which is the main treatment of the core symptomatology. An open trial suggested that methylphenidate is effective in BPD with ADHD comorbidity, not only on ADHD symptoms, but also on BPD severity (Golubchik et al., 2008). Another recent open trial showed that comorbid ADHD-BPD patients treated with methylphenidate were able to draw more benefits from dialectical behavioral therapy (Prada et al., 2015). In a clinical perspective, these findings should be taken into account in order to achieve the best quality of care. Understanding how methylphenidate and other drugs or psychotherapy work on this particular subgroup of patients, and more specifically on their impulsive and aggressive behaviors, requires further research.

First, the WURS-25 was not administered in our entire sample. Therefore, our conclusions for this scale cannot be as firm as the ones we draw for ASRS-v1.1. Nonetheless, the prevalence of ADHD in the sub-sample that passed the WURS-25 was the same as in the entire sample, suggesting that both groups were similar. Another limitation resides in the fact that we assessed only treatment-seeking patients in a specialized center. Our results can therefore not be generalized to the entire BPD population, especially patients in primary psychiatric care. Then, the diagnosis of childhood ADHD was retrospective. To avoid an overestimation of ADHD diagnosis in childhood, we used a very conservative cut-off score (≥46), as described previously by Fossati et al. (2002), and the prevalence of childhood ADHD remained high. Nevertheless, the accuracy of our assessment of child ADHD is questionable, as patients with persistent ADHD, being more highly aware of this type of symptoms, might remember them better or be biased to respond positively to the presence of ADHD symptoms during childhood. In the same line, recent studies have suggested that, in general population the

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adult-onset ADHD seems more frequent than the traditional neurodevelopmental
representation of the disorder (Agnew-Blais et al., 2016; Caye et al., 2016; Moffitt et al.,
2015). The adult-onset ADHD diagnosis (without symptoms during childhood) was not taken
into account in our study, due to application of DSM criteria, and because these questions
were raised after the beginning of the study. More research is requested in order to know if
adult-onset ADHD is also frequent in BPD patients. Finally, we used DSM-IV criteria for
adult ADHD, while the DSM-5 suggests the possibility of symptoms starting before the age
of 12 rather than the age of seven.

5. Conclusion

As ADHD is frequently associated with BPD and can be treated, it is essential to diagnose it. When the ASRS-v1.1 is used to identify adult ADHD in BPD patients, clinicians should be aware that the properties of this tool are not optimal. We found a high rate of missed cases, and more false positives than correct positives. Combining it with WURS-25 appears to be a better strategy for the screening of ADHD in BPD, before using structured diagnostic interviews.

17 **DISORDER** 379 Acknowledgments 380 Special thanks to Gérald Bouillault, Jean-Jacques Kunckler, Karen Dieben, Agnès Reymond, 381 Caroline Weber, Sophie Blin, Venus Kaby for selecting participants, collecting and 382 monitoring data and for administrative, technical, and logistic support. They have no conflicts 383 of interest to declare. 384 385 **Funding/support** 386 The collection of the Geneva sample was supported by the Swiss National Foundation (Synapsy 51NF40-158776) 387 388 389 390 References 391 Adler, L.A., Spencer, T., Faraone, S.V., Kessler, R.C., Howes, M.J., Biederman, J., Secnik, 392 K., 2006. Validity of Pilot Adult ADHD Self- Report Scale (ASRS) to Rate Adult 393 ADHD Symptoms. Ann. Clin. Psychiatry 18, 145–148. 394 doi:10.3109/10401230600801077 395 Agnew-Blais, J.C., Polanczyk, G.V., Danese, A., Wertz, J., Moffitt, T.E., Arseneault, L., 396 2016. Evaluation of the Persistence, Remission, and Emergence of Attention-397 Deficit/Hyperactivity Disorder in Young Adulthood. JAMA Psychiatry 73, 713–720. 398 doi:10.1001/jamapsychiatry.2016.0465 399 Asherson, P., Young, A.H., Eich-Höchli, D., Moran, P., Porsdal, V., Deberdt, W., 2014. 400 Differential diagnosis, comorbidity, and treatment of attention-deficit/hyperactivity 401 disorder in relation to bipolar disorder or borderline personality disorder in adults. 402 Curr. Med. Res. Opin. 30, 1657–1672. doi:10.1185/03007995.2014.915800 403 Baylé, F.J., Krebs, M.O., Martin, C., Bouvard, M.P., Wender, P., 2003. [French version of 404 Wender Utah rating scale (WURS)]. Can. J. Psychiatry Rev. Can. Psychiatr. 48, 132. 405 doi:10.1177/070674370304800220 Belendiuk, K.A., Clarke, T.L., Chronis, A.M., Raggi, V.L., 2007. Assessing the concordance 406 407 of measures used to diagnose adult ADHD. J. Atten. Disord. 10, 276-287. 408 doi:10.1177/1087054706289941 409 Burke, J.D., Stepp, S.D., 2012. Adolescent disruptive behavior and borderline personality 410 disorder symptoms in young adult men. J. Abnorm. Child Psychol. 40, 35–44. doi:10.1007/s10802-011-9558-7 411 Caci, H., Bouchez, J., Baylé, F.J., 2010. An aid for diagnosing attention-deficit/hyperactivity 412

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Table 1:

Definitions of psychometrics calculated in this study

sensitivity	Probability of positive screener given disease present = true positive rate
specificity	Probability of negative screener given disease not present = true negative
	rate
PPV Positive Predictive Value	Probability that disease is present given positive screener
NPV Negative Predictive	Probability that disease is absent given negative screener
Value	
LR+ Positive Likelihood Ratio	True positive rate/false positive rate (sensitivity/(1-specificity))
LR- Negative Likelihood Ratio	False negative rate/true negative rate ((1-sensitivity)/specificity)

Table 2: Demographic information and comorbidity in the population of BPD patients (N=317).

	Mean	SD
age (years)	31.8	9.77
	N	%
females	293	92.4
single	197	62.3
having children (missing value for 71 patients)	98	39.8
employed		
ADHD (clinical & DIGS)		
ADHD during childhood	122	38.5
adult ADHD	103	32.4
Adult ADHD presentation		
Predominantly inattentive	55	45.1
Combined	59	48.4
Predominantly hyperactive/impulsive	8	6.6
Psychiatric comorbidity (DIGS)		
Major depressive episode *	256	80.7
Bipolar disorder *	42	13.2
Psychosis *	65	20.5
Anxiety disorder *	98	30.9
Eating disorder *	138	43.5
PTSD *	111	35.3
Alcohol use disorder **	143	45.1
Substance use disorder (except alcohol) **	124	39.1
Substance use disorder (Any) **	187	59.0
* lifetime ** current		
ASRS	N	%
Positive ADHD screening (ASRS-v1.1)	195	61.5
	Mean	SD
number of positive responses (ASRS-v1.1)	3.79	1.7
ASRS-18-items total score	42.6	12.4
WURS (N=79)	N	%
Positive screening (WURS-25≥46)	53	57.1
	Mean	SD
WURS-25 score	55.6	20.5

Table 3:

Psychiatric comorbidities in BPD patients without or with adult ADHD (* lifetime comorbidity; ** current comorbidity)

Psychiatric comorbidity	no adult	ADHD	adult	ADHD		
(DIGS)	(N=214)		(N=103)			
	%	N	%	N	X2	p
Major depressive episode *	79.9	171	82.5	85	0.31	0.58
Bipolar disorder *	13.1	28	13.6	14	0.02	0.90
Psychosis *	17.8	38	26.2	27	3.05	0.08
Anxiety disorder *	31.8	68	29.1	30	0.22	0.63
Eating disorder *	42.1	90	46.6	48	0.58	0.44
PTSD *	34.6	74	36.9	38	0.16	0.69
Alcohol use disorder **	46.3	99	53.4	55	1.42	0.23
Substance use disorder	31.8	68	54.4	56	14.90	< 0.001
(except alcohol) **						
Substance use disorder (Any) **	53.7	115	69.9	72	7.51	<0.005

Table 4:

ASRS-v1.1 characteristics comparing standard cut-off with alternative scoring algorithms (N=317), and WURS characteristics alone and associated with ASRS-v1.1 (N=79)

	Sensitivity	Specificity	LR (+)	LR (-)	PPV	NPV
	% [95% CI]	% [95% CI]	[95% CI]	[95% CI]	%	%
ASRS-v1.1 (standard: 4 positive items)	72.8 [63.2-81.1]	43.9 [37.2 -50.9]	1.30 [1.10-1.54]	.619 [.436879]	38.5 [31.6-45.7]	77.0 [68.6-84.2]
ASRS-v1.1 (modified: 3 positive items)	88.3 [80.5-93.8]	27.1 [21.3-33.6]	1.21 [1.09-1.35]	.430 [.242764]	36.8 [30.8-43.2]	82.9 [72.0-90.8]
ASRS-v1.1 score >14	67.0 [57.0-75.9]	57.0 [50.1-63.7]	1.56 [1.27-1.91]	.579 [.43781]	42.9 [35.1-50.9]	78.2 [70.9-84.4]
WURS >= 46 (N=79)	95.5 [77.2-99.9]	43.9 [30.7-57.6]	1.70 [1.33-2.18]	.104 [.0149719]	39.6 [26.5-54.0]	96.2 [80.4-99.9]
ASRS-v1.1 and WURS >=46 (N=79)	81.8 [59.7-94.8]	59.6 [45.8-72.4]	2.03 [1.4-2.94]	.305 [.122759]	43.9 [28.5-60.3]	89.5 [75.2-97.1]
ASRS-v1.1 or WURS >=46 (N=79)	100 [84.6-100]	24.6 [14.1-37.8]	1.33 [1.14-1.54]	0 []	33.8 [22.6-46.6]	100 [76.8-100]