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Staffan Söderström, Richard Pettersson & Kent W. Nilsson

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Quantitative and subjective behavioural aspects in the assessment of attention-deficit hyperactivity disorder (ADHD) in adults

STAFFAN SÖDERSTRÖM, RICHARD PETTERSSON, KENT W. NILSSON

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Background: Self-rating scales and cognitive tests are instruments used in the assessment of attention-deficit hyperactivity disorder (ADHD). However, few studies have examined the differential validity of these kinds of instruments in psychiatric samples. *Aims:* To examine the discriminative validity of two self-report scales (ADHD Self-Report Scale [ASRS v.1.1], Current Symptom Scale [CSS]) and a continuous performance test with measures of motor activity (QBTest Plus). *Methods:* The interrelation between the instruments, and their abilities to differentiate between patients with an ADHD diagnosis and non-ADHD patients referred for psychiatric assessment were examined in a naturalistic sample of 61 adult patients. *Results:* The area under the receiver operating characteristic curve (AUC) for the dichotomized versions of the test variables in all tests ranged from 0.61 to 0.71. The ASRS and CSS exhibited sensitivity of 90.2% and 85.4%, and specificity of 35.0% and 40.0%, respectively. Variables from the QBTest Plus showed the opposite result for the variables QBImpulsivity and QBInattention, with sensitivity of 58.5% and 36.3% and specificity of 80.0% and 100.0%. Sensitivity and specificity of QBActivity were 68.3% and 65.0%, respectively. A stepwise discriminant function analysis showed that two variables from the QBTest Plus—QBInattention and QBActivity—accounted for 22.8% of the between-group variability, with the strongest predictor being QBInattention. The function yielded an overall correct classification of 72.1%. The classification correctly identified 87.8% of patients diagnosed with ADHD and 40.0% of non-ADHD patients. *Conclusion:* The discriminant validity of self-rating scales and the more objective measure of ADHD symptoms are poor and should be integrated generally with other sources of data.

• *ADHD, Adult, QBTest Plus, ASRS, Current Symptoms Scale—Self-Report Form (CSS).*

Staffan Söderström, Neuropsykologisk mottagning, Eriksborg, ing. 32, 721 89, Västerås, Sweden, E-mail: staffan.soderstrom@ltv.se; Accepted 27 December 2012.

The incidence and prevalence of attention-deficit hyperactivity disorder (ADHD) are increasing in parallel with an increased general awareness in society about its basic symptoms (1). Many instruments used in the assessment and diagnosis of ADHD are based on self-assessment. Several studies indicate that self-ratings can be associated with several potential shortcomings, as ADHD patients under-report symptoms, are vulnerable to bias, often have memory problems and can, for different reasons, engage in simulation of symptoms (2–7).

A supplement to subjective self-report scales, which can assist in the assessment of ADHD, are the more objective measures of symptoms of hyperactivity, impulsivity and inattention, such as computerized continuous performance tests (CPTs).

Meta-analysis indicates that neuropsychological tests of sustained and focused attention, such as CPTs, and verbal learning show the largest differences between adults with ADHD and normal controls, with effect sizes in the moderate range (0.40–0.60) (8–10). The findings are less consistent between patients with ADHD and those with other psychiatric disorders; several studies that have examined Conner's CPT (CPT II) indicate that differences in performance between patients with ADHD and those with other psychiatric disorders are either small or non-existent (11–13).

The QBTest Plus, a computer-based test that combines CPT with the measurement of motor activity, is one of the few objective quantitative measures that cover all three core areas (hyperactivity, impulsivity and inattention) in

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ADHD. In 2010, Lis et al. (14) showed that adults with ADHD exhibited a higher degree of motor activity during the QBTest Plus and made more mistakes in the form of omissions (failure to respond to stimuli) than controls.

Edebol and colleagues (15) investigated the differential validity of QBTest Plus in a naturalistic sample of 19 adult psychiatric patients referred for ADHD assessment. They found that the test could detect a majority of the patients diagnosed with ADHD with a sensitivity of 83% but the specificity was only slightly better than chance (57%). In a later study, Edebol (16) further examined the sensitivity and specificity of the QBTest Plus in a larger sample of 55 patients with ADHD and 202 healthy controls. Analysis of a categorical variable, "Prediction of ADHD", constructed from QBTest Plus raw scores, yielded 86% sensitivity and 83% specificity (16).

There is little published data concerning the discriminative validity of self-rating scales that target the symptoms of ADHD in clinical populations. The articles we found indicate that patients with other psychiatric conditions, such as mood and/or anxiety disorders, score higher than the normative mean on self-rating scales (13, 17, 18).

There is a considerable variety of scales and tests designed to measure ADHD, but as shown above, there is still limited and inconsistent knowledge concerning the discriminative validity of several of the established and commonly used instruments used for assessing ADHD.

Aims

The aim with this study was to investigate the interrelation between, and the discriminative validity of, two kinds of instruments commonly used in the assessment of ADHD: 1) two self-report screening scales—the ADHD Self-Report Scale (ASRS v.1.1) and the Current Symptoms Scale—Self-Report Form (CSS); and 2) the QBTest Plus, a computer-based test that combines a CPT with the measurement of motor activity.

Material and methods

Participants

Data from the self-report scales and the computerized QBTest Plus were collected at the Neuropsychological Clinic, Västerås, Sweden, from a naturalistic sample of 61 clinic-referred patients undergoing assessment of ADHD between 1 September 2009 and 1 March 2011. Of the total sample, 41 (67.2%) patients met the criteria for an ADHD diagnosis. Twenty (32.8%) patients who did not meet the criteria for an ADHD diagnosis comprised the "Non-ADHD" group. A large proportion (63.9%) of the referred patients had previously had contact with psychiatric services and had one or more psychiatric diagnoses. In Table 1, which shows sample characteristics, diagnoses are categorized as *Mood disorders* (depression, bipolar disorder), *Anxiety disorders* (panic disorder, social phobia, generalized anxiety, obsessive–compulsive disorder), *Axis II cluster B diagnosis* (antisocial personality disorder and borderline personality disorder) and *Substance-dependence disorders* (alcohol dependence, drug dependence).

Because of the small sample size, different subtypes of ADHD were collapsed into one diagnostic group. The different subtypes were distributed as follows: 29 (70.7%) patients with ADHD Combined Type, 11 (26.8%) patients with ADHD Predominantly Inattentive Type and one (2.4%) patient with ADHD Predominantly Hyperactive Type.

None of the referred patients were treated with medications (stimulants or non-stimulants) targeting ADHD at the time of the assessment.

After being provided with access to information about the study and data collection, the participants signed a document in which they agreed to the collected data being stored in a database and used for statistical processing. The study was approved by the Regional Ethical Review Board in Uppsala, Sweden.

Table 1. Sample characteristics.

	ADHD	Non-ADHD	t or χ^2	P
n	41 (67.2)	20 (32.8)	–	–
Age (years)	32.46 (8.99)	30.00 (9.76)	0.977	0.332
Male	18 (43.9)	8 (40.0)	0.084	0.772
Axis I and/or Axis II (cluster B) diagnoses	23 (56.1)	16 (80.0)	3.331	0.068
Distribution of Axis I and Axis II (cluster B) diagnoses				
Mood disorders	16 (39.0)	9 (45.0)	0.198	0.656
Anxiety disorders	13 (31.7)	12 (60.0)	4.449	0.035*
Axis II (cluster B) disorders	2 (4.9)	1 (5.0)	0.0004	0.984
Substance-dependence disorders	3 (7.3)	1 (5.0)	0.118	0.731

ADHD, attention-deficit hyperactivity disorder.

Values in the table represent the number of patients (per cent) except for age which represents mean (standard deviation).

*$P < 0.05$.

–indicates clear and obvious differences between groups.

Diagnoses

The diagnostic process to determine whether each patient met the criteria for ADHD was carried out in accordance with preset procedures described in a policy document concerning neuropsychiatric assessment within the county of Västmanland. The basic assessment consisted of self-rating scale(s) concerning current symptoms, a clinical interview with a significant other, intelligence testing, cognitive screening and a general psychiatric assessment (Axis I and II). If this basic investigation failed to reach a diagnostic conclusion, further assessment was initiated. This included a more in-depth investigation that included hereditary aspects and early childhood symptoms, specific testing of the three major aspects of ADHD (attention, impulsivity and hyperactivity) and other cognitive functions related to ADHD (executive functions, learning and memory, processing speed and dyslexia/dyscalculia), an extended personality assessment and a structured observation by an occupational therapist.

Instruments

Adult ADHD Self-Report Scale (ASRS v.1.1)

The ASRS is a self-report symptom checklist developed by the World Health Organization (WHO) that includes 18 questions of recent DSM-IV Criterion A symptoms of adult ADHD (19). Patients are asked how often a symptom has occurred over the past 6 months on a scale ranging from 0 to 4 (never, rarely, sometimes, often and very often).

In the initial study, which described the development and validation of the scale, a dichotomous six-question short-form screener (ASRS Screener) that distinguished between sum scores of 0–3 and 4–6 outperformed the 18-question version in terms of sensitivity and specificity (19).

A later cross-validation study showed that a dichotomized 0–24 scoring approach (0–13 vs. 14–24) outperformed the 0–6 scoring, area under the receiver operating characteristic curve (AUC) = 0.79 vs. AUC = 0.64, sensitivity 64.9% vs. 39.1% and specificity 94.0% vs. 88.3% (20). The authors suggest that the high AUC for the 0–6 scoring approach in the first study, which was 0.84, was due to over-fitting and recommend using the dichotomized version of the 0–24 scoring approach for clinical purposes. For the ASRS Screener, we used the dichotomized 0–24 scoring approach (0–13 vs. 14–26), as it has shown to be the most robust (20).

Current Symptoms Scale—Self-Report Form (CSS)

The CSS is a self-report rating scale based on the 18 items from the DSM-IV criteria for ADHD diagnosis. Each item is estimated on a scale from 0 to 3 (not at all or rarely, sometimes, often, very often) (21). The scale can be scored in three different ways: 1) by counting the number of items, for each sub-scale, that has been answered with 2 (often) or 3 (very often), with a score of six or more, indicating ADHD; 2) by comparing the scores from scoring method 1 to norms (≥ 1.5 *s*, indicating ADHD); and 3) by summing all scores in the scale across all items and comparing the total score against norms (≥ 1.5 *s*, indicating ADHD). For the CSS, we chose to use the scoring approach in which all scores in the scale across all items are summed and then related to age norms (21).

QBTest Plus (QB: quantitative behaviour)

The QBTest Plus is a computer-based test that combines a CPT with the measurement of motor activity. The test duration is 20 min, and during this time, the participant is presented with 600 stimuli that differ in shape and colour. Participants are instructed to press a hand-held button when the stimulus is identical (both in shape and colour) to the immediately preceding stimulus, defined as a Target, and not to respond otherwise (non-Target). The response profile (i.e. reaction time, reaction time variance, omissions and commissions) from the CPT part gives the performance related to attention and impulsivity.

During the test period, the participants' motor activity is recorded by means of an infrared camera following a reflective marker attached to a headband.

The QBTest Plus gives many parameters; in this study, we used the three cardinal variables (QBActivity, QBImpulsivity and QBInattention) developed by the test constructors, through factor analysis, to facilitate test interpretation (22). The cut-off score chosen for the three cardinal variables was 1.5 standard deviation (*s*) scores (Q-score 1.5) from the age-related norms integrated in the QBTest Plus software. As have been practice in other studies, the score was considered to indicate ADHD if at least one of the three cardinal variables met or exceeded 1.5 Q-score (15, 16).

Statistics

Differences for categorical demographic variables were analysed by χ^2. Differences in age and mean scores on the ASRS, CSS and the three QBTest Plus cardinal variables were analysed with independent-sample *t*-tests. Parametric bivariate correlation analysis was carried out with Pearson's correlation.

The diagnostic utility of the ASRS Screener, CSS, QBActivity, QBImpulsivity and QBInattention was explored using stepwise discriminant analysis.

Results

Sample

The two groups did not differ from each other in age and gender but there was a trend to significantly more patients with the presence of an Axis I and/or Axis II (cluster B) diagnosis in the Non-ADHD group compared with the

ADHD group. In the distribution of Axis I and Axis II diagnoses there were significantly more patients with one or more anxiety disorders in the Non-ADHD group (Table 1).

Distribution and mean group differences

Mean group performances on the ASRS v.1.1 total scale score, ASRS Screener total score, CSS and the cardinal variables of QBTest Plus are summarized in Table 2. The ADHD group scored significantly higher than the Non-ADHD group on all measures. However, both groups performed well above the normative mean on almost all measures. The normative mean value for the total score of ASRS v.1.1. from the subsample of the US National Co-morbidity Survey Replication (NCS-R) is 17.19 and a score of 33 reaches the 95th percentile (23). In our sample, both groups reached a mean value over the 95th percentile. The normative mean for the CSS, presented by Barkley in 2006, for the total summary score for the age group closest to the mean age of the groups in our study is 12.0, and the plus 1.5 *s* cut-off is 23.7 (21). Both groups in our study reach a mean score exceeding the 1.5 *s* cut-off. The standardized Q-score scale used in the QBTest Plus has a mean of zero and an *s* of one. The ADHD group had a mean score exceeding 1.5 *s* on the QBActivity and QBImpulsivity variables and a mean score slightly over 1.0 *s* on the QBInattention variable compared with normative data. The Non-ADHD group did not reach the 1.5 *s* cut-off on any of the QBTest Plus variables, but performed above the normative mean on the QBActivity and QBImpulsivity variables and slightly above normative mean on the QBInattention variable (22).

Table 2. Group differences on ASRS, CSS and QBTest Plus.

	ADHD	Non-ADHD	*t* or χ^2	*P*
ASRS v.1.1	51.39 (10.60)	44.85 (12.05)	2.163	0.035*
ASRS Screener	18.10 (3.84)	15.05 (4.30)	2.799	0.007†
CSS	35.24 (9.27)	27.55 (9.38)	3.032	0.004†
QBActivity	2.63 (1.96)	1.09 (1.16)	3.226	0.002†
QBImpulsivity	1.92 (1.99)	0.83 (1.75)	2.094	0.041*
QBInattention	1.17 (0.93)	0.385 (0.59)	3.445	0.001‡

Values in the table represent mean (standard deviation, *s*) raw scores for the total scale scores of Adult attention-deficit hyperactivity disorder (ADHD) Self-Report Scale (ASRS v. 1.1), the ASRS Screener and the Current Symptoms Scale (CSS).
Values for the cardinal variables of QBTest Plus represent standardized Q-scores (*s*). QBActivity, cardinal variable Activity, QBImpulsivity, cardinal variable Impulsivity, QBInattention, cardinal variable Inattention.
*$P < 0.05$; †$P < 0.01$; ‡$P < 0.001$.

Correlation analysis

Separate correlation analyses on the two study groups showed several significant, but relatively weak, correlations between the ASRS Screener and QBTest Plus for the ADHD group but no significant correlations for the Non-ADHD group (Table 3).

Sensitivity and specificity

The diagnostic usefulness of the ASRS Screener, CSS and the three QBTest Plus cardinal variables was examined

Table 3. Summary of intercorrelations for total study sample, attention-deficit hyperactivity disorder (ADHD) group and Non-ADHD group for scores from the ASRS v1.1, ASRS Screener, CSS and the cardinal variables from the QBTest Plus.

Measure	Group	N	1	2	3	4	5	6
	Total	61	–	0.893†	0.854†	0.368†	0.248	0.375†
1. ASRS v.1.1	ADHD	41	–	0.877†	0.814†	0.400†	0.220	0.277
	Non-ADHD	20	–	0.898†	0.898†	0.023	0.133	0.410
	Total	61		–	0.787†	0.442†	0.178	0.442†
2. ASRS Screener	ADHD	41		–	0.725†	0.455†	0.141	0.374*
	Non-ADHD	20		–	0.819†	0.101	0.005	0.330
	Total	61			–	0.323*	0.205	0.372†
3. CSS	ADHD	41			–	0.284	0.050	0.219
	Non-ADHD	20			–	−0.025	0.289	0.424
	Total	61				–	0.372†	0.395†
4. QBActivity	ADHD	41				–	0.410†	0.302
	Non-ADHD	20				–	−0.103	0.165
	Total	61					–	0.105
5. QBImpulsivity	ADHD	41					–	−0.021
	Non-ADHD	20					–	0.061
	Total	61						–
6. QBInattention	ADHD	41						–
	Non-ADHD	20						–

ASRS v.1.1, ADHD Self-Report Scale; CSS, Current Symptoms Scale; QBTest Plus, a continuous performance test with measures of motor activity.
*$P < 0.05$; †$P < 0.01$.

through calculations of sensitivity and specificity. Figures 1–5 show graphical representations for various cut-off levels for each instrument. Table 4 specifies the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and AUC for each instrument at the cut-off levels that indicate an ADHD diagnosis (see *Instruments*).

As shown in Table 4, the self-rating scales ASRS Screener and CSS exhibited high sensitivity values but very low specificity values. Analyses of the three variables from the QBTest Plus show the opposite result for the QBImpulsivity and QBInattention variables with high specificity values and low sensitivity values. Values for sensitivity and specificity of QBActivity were even, but low. The AUC for the dichotomized versions of the tests was in the range of 0.61–0.71 for all tests.

Figures 1–5 show a pattern that distinguishes the self-rating scales results from the QBTest Plus results. The optimal intersection between sensitivity and specificity (when sensitivity and specificity are equal) is higher than the cut-off score for the ASRS Screener and CSS. An almost opposite pattern holds true for the cardinal variables of QBTest Plus, where the optimal intersection is lower than the cut-off for the QBImpulsivity and QBInattention variables. The intersection for QBActivity lies approximately at the cut-off. The optimal intersection for sensitivity and specificity is within the range of 0.60–0.72 for all variables.

Discriminant analysis

To explore further the diagnostic utility of the instruments, a stepwise discriminant function analysis was conducted with ASRS Screener, CSS and the three cardinal variables from QBTest Plus entered into the analysis. Only two variables from the QBTest Plus, QBInattention and QBActivity, added

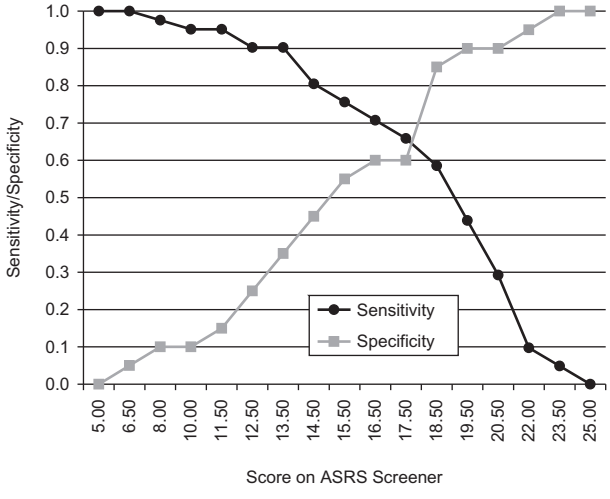

Fig. 1. Sensitivity and specificity of the attention-deficit hyperactivity disorder (ADHD) Self-Report Scale (ASRS) Screener. Cut-off score for ASRS Screening according to norms 0–13 (Non-ADHD) and 14–24 (ADHD).

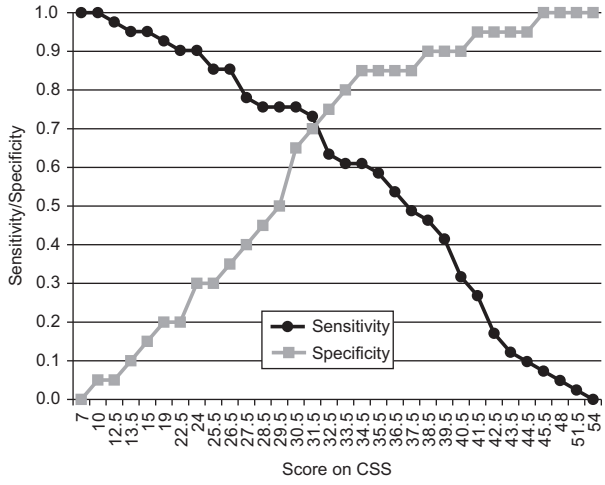

Fig. 2. Sensitivity and specificity of the Current Symptom Scale (CSS). Cut-off score for CSS according to age norms (age 30–49 years): <23.7 (Non-ADHD) and ≥ 23.7 (ADHD).

significant predictive power to the function (Wilks' lambda = 0.772, $F(2, 59) = 8.55$, $P < 0.001$). Together, they accounted for 22.8% of the between-group variability. The strongest predictor was QBInattention, which had a discriminant loading of 0.826, followed by QBActivity (0.773). The function yielded an overall correct classification of 72.1% and the cross-validated classification showed the same result. The classification correctly identified 87.8% of the patients diagnosed with ADHD and 40.0% of the patients not diagnosed with ADHD. However, the group variance–covariance matrices were not equal (Box's mean = 10.276, $P = 0.02$); therefore, these results should be interpreted with caution.

Discussion

This study has shown that ADHD patients rated themselves higher on the self-assessment scales, ASRS Screener and CSS concerning hyperactivity/impulsivity

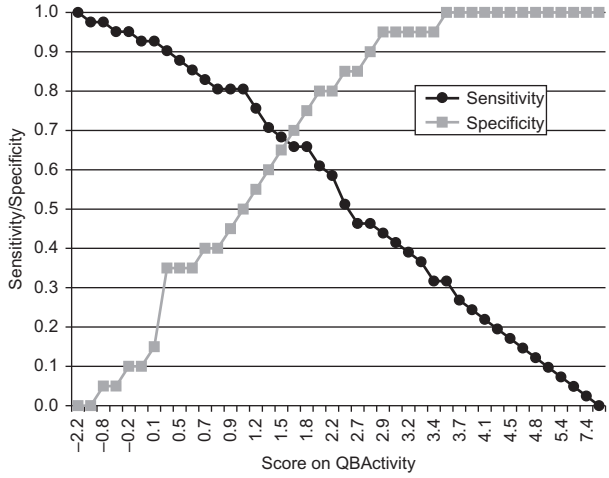

Fig. 3. Sensitivity and specificity of the QBTest cardinal variable QBActivity. Cut-off score of QBActivity according to norms: <1.5 Q-score (Non-ADHD) and ≥ 1.5 Q-score (ADHD).

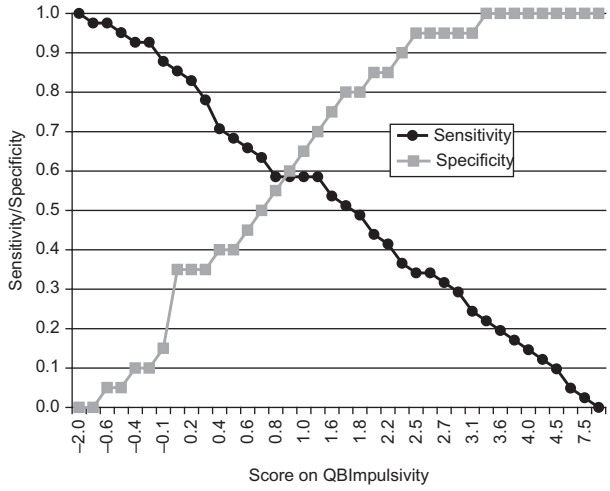

Fig. 4. Sensitivity and specificity of the QBTest cardinal variable QBImpulsivity. Cut-off score of QBImpulsivity according to norms: < 1.5 Q-score (Non-ADHD) and ≥ 1.5 Q-score (ADHD).

Table 4. Concordance of dichotomized values of ASRS Screener, CSS and cardinal variables of QBTest Plus with clinician diagnosis of attention-deficit hyperactivity disorder (ADHD).

	ASRS Screener*	CSS†	QBAct†	QBImp†	QBIna†
Sensitivity	90.2	85.4	68.3	58.5	36.6
Specificity	35.0	40.0	65.0	80.0	100.0
PPV	74.0	74.5	80.0	85.7	100.0
NPV	63.6	57.1	50.0	48.5	43.5
Total classification accuracy	72.1	70.5	67.2	65.6	57.4
AUC	0.626	0.627	0.666	0.683	0.693

CSS, Current Symptoms Scale; QBAct, QBTest Plus cardinal variable Activity; QBImp, QBTest Plus cardinal variable Impulsivity; QBIna, QBTest Plus cardinal variable Inattention; PPV, positive predictive value; NPV, negative predictive value; AUC, area under the receiver operating characteristic curve.

*Dichotomized as 0–13 (Non-ADHD) and 14–24 (ADHD).

†Dichotomized as < 1.5 standard deviation (*s*) normative mean (Non-ADHD) and ≥ 1.5 *s* normative mean (ADHD).

and inattention, and performed significantly worse on the core variables of the objective cognitive test, QBTest Plus, than a control group of psychiatric patients without ADHD, who in turn rated themselves higher and performed worse in relation to normative data.

Our results also showed a significant correlation between self-assessment and the QBTest Plus results in the ADHD group, but not in the Non-ADHD group. This may have been because of the small sample size of the Non-ADHD group, as the correlation coefficients were almost at the same low levels.

The self-report scales show high sensitivity in identifying patients with ADHD (90.2% for the ASRS Screener and 85.4% for the CSS), but they are overly inclusive, resulting in many false positives (specificity 35.0% and 40.0%, respectively). The opposite is the case for the QBTest Plus, which has a high degree of specificity for the cardinal symptoms of inattention and impulsivity (100.0% and 80.0%) but low sensitivity (36.6% and 58.5%) when the cut-off score of 1.5 *s* was applied. The sensitivity and specificity were both low for the cardinal symptom activity (68.3% and 65.0%, respectively). An explorative stepwise discriminant analysis was performed which showed a different pattern. The function showed that the cardinal symptoms of inattention and activity contributed most in separating the two groups, with the strongest predictor being inattention. It classified 87.8% of ADHD patients correctly, but identified only 40% of the Non-ADHD group as not having the diagnosis. The total correct classification was 72.1%. However, as shown above, the same classification power can be achieved with the self-rating scales alone. Thus, the message to the clinician is that very high scores on the self-assessment scales (i.e. 18 points on the ASRS Screener) and/or the inattention scale of the QBTest Plus (1.5 Q-score on QBInattention) indicate a high probability of ADHD diagnosis, but at the cost of potentially missing patients with ADHD.

One limitation of this study is the relatively small sample size, with only 20 individuals in the Non-ADHD group. At the same time, the sample is representative of patients seeking help or evaluation for symptoms of ADHD at psychiatric or ADHD specialty clinics. It also means that the comparison group (subjects not diagnosed with ADHD) to a great extent have other psychiatric problems, particularly anxiety and depression, together with symptoms typical of ADHD. This selection of patients is likely to have affected the discriminative power of the study and it is probable that a different result would have been the case if a comparison had

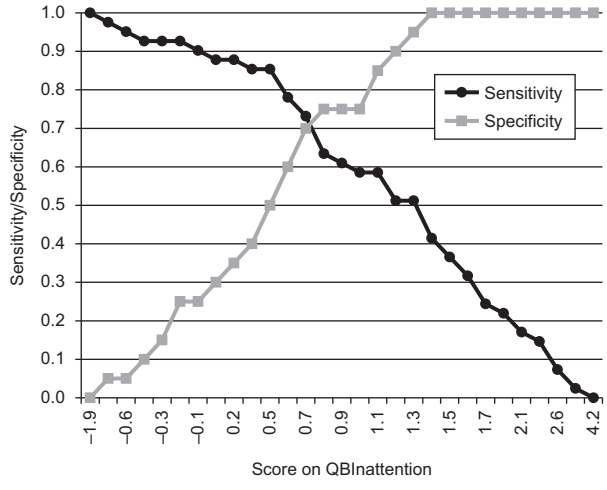

Fig. 5. Sensitivity and specificity of the QBTest cardinal variable QBInattention. Cut-off score of QBInattention according to norms: < 1.5 Q-score (Non-ADHD) and ≥ 1.5 Q-score (ADHD).

been made between patients diagnosed with ADHD (with or without comorbid conditions) and matched clinical controls with diagnose-typical symptoms, i.e. depression, without elements of ADHD-related symptoms. However, in clinical reality, patients that are assessed for ADHD in general display a complex mix of symptoms and the existence of ADHD-related symptoms often contribute to the initiation of the assessment. For professionals working in the context of making differential diagnosis—as in clinical practice—what is crucial is for the instruments to have discriminative power in a mixed group of psychiatric patients.

Another limitation is that the clinicians who were part of the diagnostic process of ADHD were not blind to the test results. The results from the ASRS, CSS and QBTest Plus were part of the total information available for the assessment. A weakness in this procedure is that it is possible that any one of the instruments included in the study may have weighed more heavily in the diagnostic decision. However, the results of the study, with poor diagnostic validity of all the included measures, indicate that the diagnoses are built on an overall assessment, including data from clinical interviews with patient and significant other, cognitive screening and psychiatric assessment of Axis I and II disorders.

Our study indicates that self-assessment instruments are too non-specific, and thereby too inclusive, because many patients without ADHD, in this psychiatric sample, rate themselves highly on these scales. Other studies have found the same result using other, similar self-rating instruments (13, 18, 24). In contrast, the results from the QBTest Plus show that it is too exclusive; many patients who have ADHD are not captured by the test. Other studies that have investigated the clinical usefulness of the QBTest Plus and other CPT tests show inconsistent results. Lis and colleagues compared 20 non-medicated adults with ADHD with 20 matched healthy controls and found that activity measures from the QBTest Plus best separated the two groups, although diagnostic usefulness in terms of sensitivity and specificity was not specified (14). Edebol et al. (15, 16) received different results when validating the QBTest Plus in a psychiatric sample and healthy controls in two different studies. The results showed lower specificity in the study investigating the psychiatric sample. Other CPT studies indicate that discriminative power is substantially decreased when comparing ADHD patients with patients with other psychiatric conditions (11, 13).

ADHD is a clinical diagnosis. We assess human behaviour, but we do not directly measure brain activity. When we are faced with the task of determining whether a person fits a certain diagnosis, such as ADHD, we sum up the different components in the form of present complaints, childhood development, hereditary aspects, and cognitive assessment, which comprise the diagnosis, like an algorithm. In the process of diagnosis, we need all the data we can get. Self-assessments and neuropsychological testing are, therefore, of great value in diagnosing ADHD, which strongly emphasizes cognitive functions in its criteria.

Different subtypes of ADHD may exhibit different relationships between sub-scales of self-rating scales and objective tests, as the QBTest Plus, and clinical diagnoses of ADHD. This could influence the degree of sensitivity and specificity of the instruments, especially as the discriminant analysis in our study indicated that the activity variable was one of the variables that contributed the most in differentiating between the two groups. Future studies using larger samples should, therefore, investigate further the diagnostic usefulness of this kind of instruments to differentiate between sub-samples of ADHD in psychiatric samples.

In summary, our study indicates that, in clinical practice, self-rating scales and the more objective measures of symptoms of ADHD should not, by themselves, be considered conclusive in the diagnostic process but should be integrated generally with other sources of data. Subsequently, in keeping with the discriminant analysis, which takes into account all the different data from all the different study participants, the clinician should have several data sources, preferably from different informants; consider different time frames; compare the present patient with all her or his previous patients; and decide whether this particular patient has the diagnosis in question. Therefore, further studies could add to our diagnostic knowledge by developing a model for integrating information from multiple sources into a computerized algorithm, rather than simply comparing different scales to determine which performs best at a particular diagnosis in a specific population.

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Staffan Söderström, Neuropsychologist, Neuropsychological Clinic, Central Hospital, 721 89, Västerås, Sweden.
Richard Pettersson, Psychologist, Neuropsychological Clinic, Central Hospital, 721 89, Västerås, Sweden.
Kent W. Nilsson, Professor, Centre for clinical research, Uppsala University, County council of Västmanland, Central Hospital, 721 89, Västerås, Sweden.