Research / Araştırma

Psychometric Properties of the Turkish Version of the Adult ADHD Self-Report Scale (ASRS-v1.1) in a Sample of Inpatients with Alcohol Use Disorder

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ABSTRACT

Psychometric properties of the Turkish version of the Adult ADHD Self-Report Scale (ASRS-v1.1) in a sample of Inpatients with alcohol use disorder

Objective: The Adult Attention Deficit Hyperactivity Disorder (ADHD) Self-Report Scale (ASRS) allows dimensional self-rating assessment of ADHD according to DSM-IV. The Turkish version of the scale was validated in university students. The aim of the present study was to evaluate psychometric properties of the Turkish version of the ASRS in a sample of inpatients with alcohol use disorder (AUD).

Method: Participants included 190 inpatients with AUD. Participants were evaluated with the ASRS and the Adult ADD/ADHD DSM-IV Based Diagnostic Screening and Rating Scale (Adult ADHD Scale).

Results: The ASRS-18 (18 item version) was found to be a psychometrically sound adult ADHD screening measure with high convergent validity when compared with Adult ADHD Scale (r=0.738; 0.694 for inattentive-IN subscale and 0.690 for hyperactive/impulsive-HI subscale) and to have a Cronbach's α of 0.863 (0.822 for IN subscale and 0.775 for HI subscale). Two components accounted for 31.13% and 9.27% of total variance, respectively, for the ASRS-18. Subscales were highly correlated with total ASRS-18 score (n=190, r=0.887, r=0.886, respectively) and moderately correlated with each other (r=0.571). Test-retest correlation was moderate (n=120, r=0.677) for IN subscale whereas test-retest correlation was high for HI subscale (r=0.774) and for ASRS-18 (r=0.765). The ASRS-18 had sensitivity and specificity scores of 0.81 and 0.75, respectively, when using the optimal cut-off score of 30. Additionally, the ASRS-18 showed good discriminant validity as it significantly differentiated alcohol-dependent inpatients with a risk of ADHD from those without. The ASRS-6 (6 item version) showed psychometric properties similar to those of ASRS-18, although the sensitivity score (0.75) was lower than in ASRS-18, whereas the specificity score (0.79) was similar to ASRS-18, when using the optimal cut-off score of 10 for ASRS-6.

Conclusion: These findings confirm the Turkish version of the ASRS (both 18-item and 6-item versions) as a reliable and valid adult ADHD screening instrument that measures a two-dimension construct among inpatients with AUD.

Keywords: ADHD, alcohol use disorder, ASRS, factor analysis, reliability, validity

ÖZET

Yatarak tedavi gören alkol kullanım bozukluğu hastalarında Erişkin Dikkat Eksikliği Hiperaktivite Bozukluğu Kendi Bildirim Ölçeği (ASRS-v1.1) Türkçe formunun psikometrik özellikleri

Amaç: Erişkin Dikkat Eksikliği Hiperaktivite Bozukluğu (DEHA) Kendi Bildirim Ölçeği (ASRS-v1.1) DEHA'nın DSM-IV'e göre boyutsal özbildirim değerlendirmesine olanak sağlamaktadır. Bu çalışmanın amacı ASRS'nin Türkçe formunun psikometrik özelliklerinin alkol kullanım bozukluğu (AKB) olan ve yatarak tedavi gören hasta örnekleminde değerlendirilmesidir.

Yöntem: Çalışmaya AKB olan ve yatarak tedavi gören 190 hasta katıldı. Katılımcılar ASRS ve Erişkin BEB/DEHA DSM-IV Tabanlı Tanı Tarama ve Değerlendirme Ölçeği (Erişkin DEHA Ölçeği) uygulanarak değerlendirildi.

Bulgular: ASRS-18 (18 maddelik formu), Erişkin DEHA Ölçeği ile kıyaslandığında (r=0.738; dikkat eksikliği-DE alt ölçeği için 0.694 ve hiperaktivite/dürtüsellik-HD alt ölçeği için 0,690) yüksek konverjan geçerlik (r=0.79) gösteren ve Cronbach's α değeri 0.863 (DE alt ölçeği için 0.822 ve HD alt ölçeği için 0.775) olan psikometrik olarak güvenilir DEHA tarama ölçeği olarak bulunmuştur. ASRS-18 için iki bileşen yer almıştır ve toplam varyansın sırasıyla %31.13 ve %9.27'den sorumluydu. Alt ölçekler ASRS-18 puanıyla yüksek düzeyle (sırasıyla n=190, r=0.887, 0.886) birbirleriyle ise orta düzeyde köreleydi (r=0.571). Test-tekrar test korelasyonu DE alt ölçeği için orta düzeyde (n=120, r=0.677) iken, HD alt ölçeği (r=0.774) ve ASRS-18 için yüksek (r=0.765) düzeydeydi. Kesme puanı 30 ve üzeri olarak alındığında ASRS-18 duyarlılık ve özgüllük puanları sırasıyla 0.81 ve 0.75 olarak bulunmuştur. Ayrıca, ASRS DEHA olan alkol bağımlılarını olmayanlardan anlamlı düzeyde ayırt ederek iyi ayırıcı geçerlilik göstermiştir.

Sonuç: Bu bulgular ASRS'nin (hem 18 maddelik hem de 6 maddelik formunun) Türkçe formunun AKB olan ve yatarak tedavi gören hastalarda iki boyutlu yapıda ölçüm yapan geçerli ve güvenilir bir erişkin DEHA tarama ölçeği olduğunu desteklemektedir.

Anahtar kelimeler: DEHA, alkol kullanım bozukluğu, ASRS, faktör analizi, güvenirlik, geçerlik

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INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is a childhood-onset disorder that persists into adolescence and adulthood in more than half of the cases (1). The estimated prevalence of ADHD in the general adult population is between 1.2% and 7.3% (2,3). Studies in adults with ADHD find lifetime rates of alcohol use disorders (AUD) ranging between 21.0% and 53.0% (4,5), whereas previous studies found the prevalence of high risk of ADHD to be ranging between 21.0% and 23.1%, according to screening test (6-8). In an international multi-center study using the Adult ADHD Self-Report Scale (ASRS) (9,10), adult ADHD prevalence was found to be lower among treatment-seeking patients with AUD than among patients with drug use disorder (11). Nevertheless, a history of ADHD in childhood increases the risk of developing AUD by a factor of 1.74 (12), 1.35 (13), or 1.51 (14). Recent meta-analyses on this matter suggest a significant effect of childhood ADHD on the prevalence of AUD in young adulthood (12,13), but not on alcohol use (12). Nevertheless, ADHD was positively associated with early initiation of alcohol use, the risky use of alcohol, and the presence of AUD (15).

Patients with ADHD have a higher risk of developing drug dependencies, which tend more toward chronification, in comparison with a group of patients without ADHD (16-18). Due to their symptoms, individuals with ADHD may experience more difficulties adapting to new situations and coping with the many challenges this life period poses. Under these circumstances, they may be more vulnerable to using licit and illicit substances and to developing substance use disorder (SUD) (19). When considering the subdimensions of ADHD, after adjusting for the overlap between symptom domains, both hyperactivity/impulsivity (HI) and inattentiveness (IN) uniquely associated with alcohol, nicotine, and polysubstance dependence in an adult population-based sample (20). In another study among a group of young adults, HI symptoms were found to be associated with alcohol and nicotine use, whereas IN symptoms were only associated with alcohol use (21). In an adolescent population

diagnosed with ADHD and SUD, the combined subtype (HI+IN) presented with more severe SUDs and higher rates of conduct disorder (22). Although both HI and IN were consistently associated with substance use and SUD, the relatively stronger association of HI symptoms with substance use and SUD is consistent with the extant literature noting impulsivity as a precursor of substance use and SUD (23).

Comorbid ADHD and SUD are associated with a more severe course of substance use and with social and psychiatric impairment (24). Individuals with SUD and ADHD had significantly higher self-rated impairments across several domains of daily life, as well as higher rates of substance abuse and alcohol consumption, suicide attempts, and depression (25). Patients with AUD and ADHD comorbidity relapse to AUD on average 2.7 months earlier than patients without ADHD (26,27). The risk-taking behavior that is common among people with SUD is further increased among those with comorbid ADHD symptoms, particularly with respect to dangerous driving practices (28). Significant associations were found between ADHD symptom severity and self-reported histories of self-harm behavior, suicidal ideation, and suicide attempts, which are mediated by psychosocial variables including AUD comorbidity (29).

While semi-structured interviews are the gold standard for psychiatric diagnoses, they are time consuming and expensive and are not feasible for screening large populations (30). Among several self-assessment instruments that have been suggested to overcome this limitation, Turkish versions of the Wender-Utah Rating Scale (WURS), (31,32) the Adult ADHD Scale (Adult ADD/ADHD DSM-IV Based Diagnostic Screening and Rating Scale) developed by Atila Turgay in Canada in 1995 (33,34), and the Adult ADHD Self Report Scale (ASRS) (9,35) are available.

In conjunction with the World Health Organization (WHO), Kessler et al. (9) developed a self-report scale for the screening of ADHD in adults (ASRS-v1.1) (10), proposing a short, 18-item scale (9 items for IN and 9 items for HI) that relates directly to the DSM-IV-TR diagnostic criteria. These 18 statements describe

aspects of ADHD to be rated on a 5-point Likert scale from "0-never" to "4-very often". Stepwise logistic regression results showed that 6 of the 18 items predict ADHD better than the whole scale (9). Part A of the scale is a 6-item list, and the second part (Part B) includes the remaining 12 items. Thus only the six first questions are used for screening and the remaining 12 to provide additional clinical information. The ASRS-6 (Part A) comprises four items taken from the original subscale of the ASRS-18 measuring inattention and two items from the original subscale measuring hyperactivity (9). The scoring algorithm is the total score obtained adding up the points (0-4) of the first six items. The scale was translated to many languages such as Chinese (36), Spanish (37) and Swedish (38).

The Adult ADHD Self-Report Scale (ASRS), which provides information about symptoms in adulthood only, has been more studied in addicted populations and generally reports good psychometric properties (11,37,39). Only one study analyzed patients with AUD separately, and it found better sensitivity than in other illicit drugs-dependent patients (11). Although sensitivity was lower for ASRS-v1.1 (60.9%) than WURS (87.5%) in a population with SUDs, ASRS-v1.1, being the simplest and shortest instrument to administer, may have advantages when a large number of patients needs to be screened (40). Accordingly, ASRS rather than WURS was used in international epidemiological studies (35).

Since ADHD is an underdiagnosed and undertreated debilitating condition in adults with AUD, addiction psychiatrists should familiarize themselves with the symptoms of ADHD in adults with AUD in order to diagnose and manage ADHD and addiction in these patients appropriately (41). Unfortunately, screening for adult ADHD is not a routine practice in drug and alcohol treatment services (42). However, given the generally high prevalence of adult ADHD, all treatment-seeking SUD patients should be screened and, after a confirmed diagnosis, treated for ADHD, given that the literature indicates poor prognoses of SUD in treatment-seeking SUD patients with ADHD (11).

A study of the Turkish version of the scale was conducted in university students (35); psychometric properties of the scale were not previously studied in AUD, which is more prevalent than illicit drug dependence in Turkey. In addition, the prevalence of undiagnosed ADHD in AUD inpatients is estimated to be high, and it is related with the severity of AUD and other negative variables such as psychiatric comorbidity (25). Unfortunately, this implies greater therapeutic needs and negatively affects the quality of life and interpersonal relationships of these patients (8). Thus, as a study population for the evaluation of psychometric properties of ASRS, patients with AUD have priority.

METHODS

The study was conducted at Bakirkoy Training and Research Hospital for Psychiatry, Neurology and Neurosurgery, Alcohol and Drug Research, Treatment and Training Center in Istanbul between September 2014 and April 2015. This is a specialized center for substance use disorders with 84 inpatient beds (36 beds for AUD), accepting patients from all over Turkey. The study was approved by the institution's Ethics Committee. Patients' written informed consent was obtained after the study protocol had been thoroughly explained to them.

One hundred ninety consecutively admitted male alcohol-dependent inpatients were considered for participation in the study. All participants met the DSM-5 diagnostic criteria for AUD.

Interviews with the study group were conducted after a detoxification period, 3 to 4 weeks after the last day of alcohol use. As the acute effects of substance intoxication or withdrawal may resemble some symptoms of ADHD (e.g. impulsivity, attention difficulties, restlessness), participants were asked to reflect upon their usual behavior, rather than behavior attributed to their alcohol use, when responding. In order to maximize the probability of capturing behavior patterns that were present before the onset of substance use, participants screening positive on the ASRS were asked the age at which the respective symptoms had begun. In accordance with DSM-5 criteria, only those reporting a symptom onset prior to age 12 were categorized as screening positive for ADHD.

Instruments for Data Collection

The Adult ADHD Self-Report Scale (ASRS):
The ASRS is a widely used and validated instrument. Its 6-item screening version has been shown to outperform the full 18-item version in sensitivity (68.7% vs. 56.3%) and specificity (99.5% vs. 98.3%) in the American general population (9,10). The ASRS-6 has also been reported to possess satisfactory psychometric properties in patients with addiction disorders (11,39,40,42-44). Specifically, in samples of patients with AUD, psychometric characteristics have been analyzed by three studies, in which satisfactory properties have been found (8,11,43). Nevertheless, the result of the test does not replace clinical diagnosis, and the clinician must take false positives into consideration by evaluating ASRS positives with gold standard scales.

The Adult ADD/ADHD DSM-IV Based Diagnostic Screening and Rating Scale (Adult ADHD Scale):
The Adult ADHD Scale was developed by Turgay (33) in Canada in 1995, translated to Turkish by Turgay himself and validated in a Turkish population (34). The scale is a 5-point Likert-type rating scale consisting of three parts; Part 1, Attention Deficit section (AD): A total of 9 items created for Attention Deficit (AD) based on the DSM-IV symptoms. Part 2, Hyperactivity/impulsivity section (HI): In this section, a total of 9 items were created for Hyperactivity/impulsivity based on the DSM-IV symptoms. Part 3, features and problems with ADHD (problems) section: The section contains a total of 30 items developed by clinical experience and observations. In the present study, only Part 1 (Cronbach's alpha 0.80) and Part 2 (Cronbach's alpha 0.80) were used.

Data Analysis

The following strategies were used to investigate the psychometric properties of the ASRS: (a) The factorial structure was examined using a principal component analysis (PCA); (b) convergent validity was evaluated by calculating the Pearson product–moment correlation between the ASRS and Adult ADHD Scale; (c) internal consistency reliability was assessed using Cronbach's alpha; (d) predictive validity, sensitivity, specificity, and optimal cut-off scores were estimated by constructing a Receiver Operating Characteristic (ROC) curve; and (e) discriminant validity was evaluated using Students' t test of the ASRS score.

RESULTS

Factorial Structure

To explore the factorial structure of the ASRS-v1.1 (both ASRS-18 and ASRS-6 versions), a principal component analysis (PCA) was performed using all participants (n=190). Criteria for retaining extracted components on the PCA were: (1) visual inspection of the scree plot to note breaks in size of eigenvalues between the components; (2) eigenvalues greater than one; and (3) percentage of variance accounted for by components retained.

To explore construct validity of the scale, first exploratory factor analysis (EFA), then confirmatory factor analysis (CFA) was conducted. Prior to any further analysis, the adequacy of sample size was verified using the Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measurement of sampling adequacy. Bartlett's test of sphericity was significant (χ^2=990.560, df=153, p<0.001) for the ASRS, and the KMO measure of sampling adequacy was acceptable (0.868).

Although a visual inspection of the scree plot revealed two components accounting for the majority of variance before components started to level off, four components on the ASRS reached the criterion of an eigenvalue greater than one (5.804, 1.668, 1.246 and 1.049) and the variance accounted for by these components was 31.13%, 9.27%, 6.92%, and 5.83%, respectively. While item 13, originally in the HI component, is included in the IN component, items 7 and 8, originally in the IN component, were included in the HI component. In addition, original HI items 10, 11, and 12 computed third component and item 14 computed fourth component.

Table 1: Item-Component Loadings for the 18-item ASRS and Item-Subscale/Item-Total Correlations for Total Sample (n=191)

Items	Component	Inattentive	ASRS	Items	Component	Hyperactive/ Impulsive	ASRS
2	0.740	0.707	0.614	11	0.692	0.700	0.610
1	0.722	0.663	0.569	12	0.656	0.733	0.656
4	0.696	0.676	0.541	14	0.581	0.522	0.583
5	0.682	0.676	0.541	17	0.570	0.607	0.531
6	0.657	0.645	0.568	16	0.566	0.594	0.527
9	0.551	0.675	0.613	15	0.557	0.525	0.423
3	0.548	0.635	0.602	18	0.510	0.554	0.537
8	0.460	0.561	0.511	10	0.474	0.569	0.519
7	0.419	0.566	0.514	13	0.424	0.603	0.612
Mean±S.D.	12.09±6.18			Mean±SD	13.66±6.14		
Eigenvalue	5.604			Eigenvalue	1.668		
% of Variance	31.134			% of Variance	9.269		
Cronbach's α	0.822			Cronbach's α	0.775		

Since the original scale had two factors, we forced for two components on the ASRS in the factor analysis. Eigenvalues were 5.804 and 1.668 for forced two components on the ASRS, and the variance accounted for by these components was 31.13% and 9.27%, respectively. In factor analysis, item 13 was placed in the first factor (IN) instead of the second factor (HI), although component loadings were similar (0.445 vs 0.424) for the two factors. In factor analysis of retest (n=121), item 13 was placed in the second factor as it was in the original scale. Thus item 13 was considered to be in the second factor.

The two factor solution of the scale then was assessed subsequently with CFA. Estimation of the model produced a good fit (χ^2/df=138.782/123=1.13; root mean square error of approximation [RMSEA]=0.026, goodness of fit index [GFI]=0.928, adjusted GFI=0.900, parsimony GFI=0.667, normed fit index [NFI]=0.865, comparative fit index [CFI]=0.982, incremental fit index [IFI]=0.983). As generally accepted, we chose as criteria χ^2/df≤5, GFI, CFI, NFI and IFI all >0.90, and RMSEA <0.05 for being perfect when evaluating the fit index (45,46). As seen in Table 1, all item-component loadings were in the "good" to "excellent" range. Thus, results from the PCA and the CFA suggest that the ASRS-18 assesses a two dimensional construct.

A visual inspection of the scree plot for ASRS-6 revealed two components accounting for the majority

Table 2: Item-Component Loadings for the 6-item ASRS and Item-Subscale/Item-Total Correlations for Total Sample (n=191)

Items	Component	Inattentive	ASRS-6
4	0.800		0.610
6	0.725		0.659
5	0.699		0.665
9	0.605		0.700
14		0.828	0.473
10		0.628	0.551
Mean±SD	12.09±6.18	13.66±6.14	13.66±6.14
Eigenvalue	2.318	1.085	2.318
% of Variance	38.64	18.08	38.64
Cronbach's α	0.705	0.298	0.654

of variance before components started to level off, and two components on the ASRS-6 reached the criterion of an eigenvalue greater than one (2.318 and 1.085); the variance accounted for by these components was 38.64% and 18.08 respectively (Table 2).

Convergent Validity and Internal Consistency Reliability

Test-retest correlation for ASRS-18 was high (n=120, r=0.765, p<0.001), whereas test-retest correlation for the IN subscale was moderate (n=121, r=0.677, p<0.001), but high for the HI subscale (n=121, r=0.774, p<0.001).

The Pearson product–moment correlation between the ASRS-18 and Adult ADHD Scale scores (n=190)

Table 3: Correlations between the scales

	ASRS-18 IN	ASRS-18 HI	ASRS-18 total	ASRS-6 total
ASRS-18 IN (n=190)		0.571	0.887	0.860
ASRS-18 HI			0.886	0.707
ASRS-18 total				0.884
Adult ADHD Scale-IN	0.694	0.478	0.661	0.590
Adult ADHD Scale -HI	0.408	0.690	0.619	0.488
Adult ADHD Scale total	0.625	0.683	0.738	0.619
Retest ASRS-1 (n=120)	0.677	0.501	0.663	0.572
Retest ASRS-2	0.460	0.774	0.696	0.566
Retest ASRS-18 total	0.635	0.722	0.765	0.639
Retest ASRS-6 total	0.858	0.756	0.905	0.636

p<0.001, IN: Inattentive HI: Hyperactive/Impulsive

Table 4: ADHD status according to the cut-off point 30 for ASRS

	ADHD according to Adult ADHD Scale					
	Absent		Present			
	n	%	n	%		p
ADHD						
Absent (n=123, 64.7%)	116	75.3	7	19.4	χ^2=67.39	<0.001
Present (n=67, 35.3%)	38	24.7	29	80.6		
Mean±SD	21.32±7.73		36.18±10.27		t=-9.80	<0.001

was moderate (r=0.737, p<0.001). Detailed correlations between these scales are shown on Table 3.

Internal consistency for the ASRS-18 (coefficient α=0.863) and its subscales (for IN α=0.822 and for HI α=0.775) examined by Cronbach's alpha, was also high (Table 1).

Test-retest correlation for ASRS-6 was moderate (n=120, r=0.636, p<0.001), as was the Pearson product–moment correlation between the ASRS-6 and Adult ADHD Scale scores (n=190) (r=0.619, p<0.001). Detailed correlations between these scales are shown in Table 3. Internal consistency for the ASRS-6 (coefficient α=0.654), examined by Cronbach's alpha, was also moderate (Table 2).

Predictive Validity, Sensitivity, Specificity, and Optimal Cut-Off Scores

The ASRS-18 and ASRS-6's predictive validity, sensitivity, and specificity were examined using a ROC curve that included all participants (n=190). Participants were dichotomously classified according to the Adult ADHD Scale as "group at risk of ADHD" or "group not at risk of ADHD". The graph of sensitivity and 1-specificity (false positivity) values, to the extent that the curve approaches the left corner or the area under the curve approaches a value of 1.0, indicates that the test can discriminate between the two groups.

Results for the ASRS-18 revealed that the area under the curve (AUC) (0.869, Std. Error=0.031) was in the "excellent" range and that a score of 30 was the most critical value for identifying a participant as having a risk of ADHD. This cut-off score corresponds to sensitivity=0.81, specificity=0.75, Kappa=0.41, positive predictive value (PPV)=0.43, and negative predictive value (NPV)=0.94.

Table 4 shows the comparison of the group with ADHD and the group without ADHD according to a cut-off point of 30 on the ASRS-18. These results show that the cut-off score of the ASRS-18 might be able to discriminate between those with a risk of ADHD and those not at risk among inpatients with AUD.

Results for the ASRS-6 revealed that the area under the curve (AUC) (0.810, Std. Error=0.039) was in the "excellent" range and that a score of 10 was the most critical value for identifying a participant as being at

Table 5: ADHD status according to the cut-off point 10 for ASRS-6

| | ADHD according to Adult ADHD Scale | | | | | |
| | Absent | | Present | | | |
	n	%	n	%		p
ADHD						
Absent (n=131, 68.9%)	122	79.2	9	25.0	χ^2=40.06	<0.001
Present (n=59, 31.1%)	32	20.8	27	75.0		
Mean±SD	8.23±3.72		12.39±3.65		t=-6.06	<0.001

risk of ADHD. This cut-off score corresponds to sensitivity=0.75, specificity=0.79 Kappa=0.44, PPV=0.46, and NPV=0.93.

Table 5 shows the comparison of the group at risk of ADHD and the group not at risk according to a cut-off point at 10 on the ASRS-6. These results show that the cut-off score of the ASRS-6 might be able to discriminate between those at risk of ADHD and those not at risk among inpatients with AUD.

Discriminant Validity

To evaluate discriminant validity, Student's t test was conducted. Mean score of the ASRS-18 and ASRS-6 were compared according to the participants' group membership. The mean scores of the ASRS-18 (t=-9.80, p<0.001) (Table 4) and ASRS-6 (t=-6.06, p<0.001) (Table 5) were statistically higher in the group at risk of ADHD.

DISCUSSION

The ASRS-v1.1 is a self-report measure developed for DSM-IV to screen individuals both in the general public and in clinical settings who may have ADHD (9). The present study evaluated the psychometric properties of both the 18-item ASRS (ASRS-18), which was validated in Turkish university students previously (35), and the 6-item screening version of the scale (ASRS-6) among inpatients with AUD. Consistent with the original study (9) and the Turkish version of the scale (35), the results of the present study suggest strong psychometric properties of the ASRS-v1.1 in patients with AUD, including high internal consistency and convergent validity.

The Turkish version of the ASRS-18 was found to have satisfactory psychometric characteristics as an ADHD screening test. Internal consistency for the ASRS-18 (coefficient α=0.863) and its subscales (for IN α=0.822 and for HI α=0.775) examined by Cronbach's alpha was as high as it was in the study conducted in Turkish university students, which were found to be 0.88, 0.82, and 0.78, respectively (35). Also, consistent with the previous study (35) conducted in Turkey among university students in which ASRS-18 had a moderate correlation (r=0.52) with WURS, the almost high correlation (r=0.738) between the ASRS-18 and the Adult ADHD Scale in the present study indicated good convergent validity.

Consistent with the original study conducted in the general population (9) and the study conducted by Dogan et al. (35) in university students, in the present study PCA for the ASRS-18 produced a two-dimensional construct, with the first component (IN) accounting for 31.13% of the total variance (eigenvalue=5.6) and the second component (HI) accounting for 9.27% of the total variance (eigenvalue=1.7). In the study by Dogan et al. (35), the IN component accounted for 21.29% and the HI factor for 20.29% of the total variance. This difference between the two studies may be attributable to the samples being different; the previous one being young adults from the general population (35) and the present one being adults with AUD. According to self-ratings, as HI symptoms decrease in adulthood, IN symptoms increase and tend to dominate the clinical picture (47).

In the present study, the use of CFA, which had not been conducted in the previous study (35), provided further support for the two dimensional structure of the ASRS-18.

The ROC curve showed that the ASRS-18 had good predictive validity as suggested by high sensitivity, specificity, and the AUC. Our results revealed that a cut-off score of 30 for the ASRS-18 was the most critical value for identifying participants having ADHD according to the Adult ADHD Scale. The ASRS-18 also showed good discriminant validity as evidenced by its ability to significantly differentiate the alcohol dependents at risk of ADHD from those not being at risk.

A study using CFA (48) to test two different factor structures for the ASRS-6 – a single-factor model (ADHD model) and a two-factor model consisting of attention deficit disorder and hyperactivity/impulsivity (IN/HI model) – found that the ASRS-6 measures two correlated constructs, rather than one unitary construct in two different populations: university students and 157 outpatients treated for drug dependence. Our results were consistent with this study in that in factor analysis, 4 of 6 items that had originally been taken from the IN dimension of the ASRS scale were included in factor 1 (IN), whereas 2 items taken from the HI dimension were included in factor 2 (HI). Nevertheless, we conclude that ASRS-6 can be used as a unidimensional scale as suggested in the original study (9).

Accepting a cut-off point of 14 on the ASRS-6, van de Glind et al. (11) found a sensitivity of 84.95% and a specificity of 66.95%, Daigre et al. (43) found a sensitivity of 86.7% and a specificity of 66.1%, and finally, in a sample of patients with AUD, Roncero et al. (8) found a sensitivity of 83.3% and a specificity of 66.1%, PPV of 32.3%, and an NPV of 95.4%. In the present study, the cut-off score of 10 for ASRS-6 corresponded to sensitivity=0.75, specificity=0.79, PPV=0.46, and NPV=0.93. Cut-off scores may differ according to the population that is studied and the language of the scale. Consistent with our study, Ramos-Quiroga et al. (49), using the Spanish version ASRS-6 in an outpatient clinical context, found the best psychometric characteristics of the scale using a quantitative ranking between 0 and 24 points, setting 12 as cut-off point (sensitivity of 0.97, specificity 0.91, PPV 0.92 NPV 0.97, kappa index 0.88 and area under the curve 0.94).

In comparison with the data published in the original article on ASRS psychometric features in a general adult population (9), sensitivity was higher (75.0% vs. 68.7%) and specificity was lower (79.0% vs. 99.5%). These differences highlight the relevance of conducting a good clinical diagnosis in addicted patients, because they tend to show more false positives than does the general adult population.

While the prevalence of ADHD in adults, with a cut-off point of 14, was estimated to be 21.1% in Roncero et al.'s study (8), in the present study with a cut-off point of 10, this rate was much higher (31.1%). The main reason for this inconsistency may be that we used the Adult ADHD Scale as the gold standard, whereas Roncero et al. (8) used Conners' Adult ADHD Diagnostic Interview for DSM-IV (CAADID). In a multicenter international study, the prevalence of DSM-IV and DSM-5 adult ADHD varied for DSM-IV from 5.4% (CI 95%:2.4-8.3) for Hungary to 31.3% (CI 95%:25.2-37.5) for Norway and for DSM-5 from 7.6% (CI 95%:4.1-11.1) for Hungary to 32.6% (CI 95%:26.4-38.8) for Norway (50). Thus, like the cut-off score of ASRS, prevalence rates of ADHD may also differ according to the population that is studied and the language of the scale. Nevertheless, the cut-off scores for ASRS-18 and ASRS-6 found in the present study should be used cautiously: Since both ASRS and Adult ADHD Scale used in the present study are self-rating screening scales and a diagnostic interview for ADHD was not conducted afterwards, these cut-off scores may only indicate that an individual is at risk of ADHD rather that providing a diagnosis of ADHD. This observation can be considered as a limitation of the present study. Another limitation may be that retrospective recall of childhood ADHD symptoms is particularly challenging in populations with AUD due to impaired memory and the often complex histories with adverse psychosocial risk factors for the development of behavioral problems (25).

Nevertheless, while the questions in the ASRS are consistent with DSM-IV criteria, it has been found that psychometric properties of ASRS are similar for DSM-IV and DSM-5 criteria in addicted patients (11).

Therefore, probably the results of this study are also generalizable to DSM-5 criteria. The ASRS displays good psychometric characteristics. Since it is a brief scale that is consistent with the DSM-5 interval criterion for diagnosis, it is valuable in both general and clinical Turkish populations. In conclusion, the present study extended the evaluation of the psychometric properties of the ASRS to Turkish patients with AUD, supported the two-dimensional construct of the ASRS-18 with confirmatory analysis in Turkey and replicated the findings of a previous study conducted among the university students (35).

Contribution Categories	Name of Author
Development of study idea	C.E., G.U.
Methodological design of the study	C.E., M.B., B.E.
Data acquisition and process	G.T.U., R.A., M.B.
Data analysis and interpretation	C.E., B.E.
Literature review	C.E., G.U., M.B., G.T.U., R.A.
Manuscript writing	C.E., G.U., B.E.
Manuscript review and revisation	C.E., G.U., G.T.Ü., R.A.

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REFERENCES

1. Klein RG, Mannuzza S, Olazagasti MA, Roizen E, Hutchison JA, Lashua EC, Castellanos FX. Clinical and functional outcome of childhood attention-deficit/hyperactivity disorder 33 years later. Arch Gen Psychiatry 2012; 69:1295-1303. **[CrossRef]**

2. Fayyad J, De Graaf R, Kessler R, Alonso J, Angermeyer M, Demyttenaere K, De Girolamo G, Haro JM, Karam EG, Lara C, Lépine J-P, Ormel J, Posada-Villa J, Zaslavsky AM, Jin R. Cross-national prevalence and correlates of adult attention-deficit hyperactivity disorder. Br J Psychiatry 2007; 190:402-409. **[CrossRef]**

3. Kessler RC, Chiu WT, Demler O, Merikangas KR, Walters EE. Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. Arch Gen Psychiatry 2005; 62:617-627. **[CrossRef]**

4. Barkley RA, Murphy KR, Kwasnik D. Motor vehicle driving competencies and risks in teens and young adults with attention deficit hyperactivity disorder. Pediatrics 1996; 98:1089-1095.

5. Biederman J. Impact of comorbidity in adults with attention-deficit/hyperactivity disorder. J Clin Psychiatry 2004; 65(Suppl.3):3-7.

6. Johann M, Bobbe G, Putzhammer A, Wodarz N. Comorbidity of alcohol dependence with attention-deficit hyperactivity disorder: differences in phenotype with increased severity of the substance disorder, but not in genotype (serotonin transporter and 5-hydroxytryptamine-2c receptor). Alcohol Clin Exp Res 2003; 27:1527-1534. **[CrossRef]**

7. Ohlmeier MD, Peters K, Wildt BT, Zedler M, Ziegenbein M, Wiese B, Emrich HM, Schneider U. Comorbidity of alcohol and substance dependence with attention-deficit/hyperactivity disorder (ADHD). Alcohol Alcohol 2008; 43:300-304. **[CrossRef]**

8. Roncero C, Ortega L, Pérez-Pazos J, Lligo-a A, Abad AC, Gual A, Sorribes M, Grau-López L, Casas M, Daigre C. Psychiatric comorbidity in treatment-seeking alcohol dependence patients with and without ADHD. J Atten Disord 2015. **[CrossRef]**

9. Kessler RC, Adler L, Ames M, Demler O, Faraone S, Hiripi E, Howes MJ, Jin R, Secnik K, Spencer T, Ustun TB, Walters EE. The World Health Organization Adult ADHD Self-Report Scale (ASRS): a short screening scale for use in the general population. Psychol Med 2005; 35:245-256. **[CrossRef]**

10. Kessler RC, Adler LA, Gruber MJ, Sarawate CA, Spencer T, Van Brunt DL. Validity of the World Health Organization Adult ADHD Self-Report Scale (ASRS) Screener in a representative sample of health plan members. Int J Methods Psychiatr Res 2007; 16:52-65. **[CrossRef]**

11. van de Glind G, van den Brink W, Koeter MWJ, Carpentier P-J, van Emmerik-van Oortmerssen K, Kaye S, Skutle A, Bu ET, Franck J, Konstenius M, Moggi F, Dom G, Verspreet S, Demetrovics Z, Kapitány-Fövény M, Fatséas M, Auriacombe M, Schillinger A, Seitz A, Johnson B, Faraone SV, Ramos-Quiroga JA, Casas M, Allsop S, Carruthers S, Barta C, Schoevers RA, Levin FR. Validity of the Adult ADHD Self-Report Scale (ASRS) as a screener for adult ADHD in treatment seeking substance use disorder patients. Drug Alcohol Depend 2013; 132:587-596. **[CrossRef]**

12. Lee SS, Humphreys KL, Flory K, Liu R, Glass K. Prospective association of childhood attention-deficit/hyperactivity disorder (ADHD) and substance use and abuse/dependence: a meta-analytic review. Clin Psychol Rev 2011; 31:328-341. **[CrossRef]**

13. Charach A, Yeung E, Climans T, Lillie E. Childhood attention-deficit/hyperactivity disorder and future substance use disorders: comparative meta-analyses. J Am Acad Child Adolesc Psychiatry 2011; 50:9-21. **[CrossRef]**

14. Wilens TE, Martelon M, Joshi G, Bateman C, Fried R, Petty C, Biederman J. Does ADHD predict substance-use disorders? A 10-year follow-up study of young adults with ADHD. J Am Acad Child Adolesc Psychiatry 2011; 50:543-553. **[CrossRef]**

15. Estévez N, Dey M, Eich-Höchli D, Foster S, Gmel G, Mohler-Kuo M. Adult attention-deficit/hyperactivity disorder and its association with substance use and substance use disorders in young men. Epidemiol Psychiatr Sci 2015; 20:1-12. **[CrossRef]**

16. Daigre C, Terán A, García-Vicent V, Roncero C. Attention deficit hyperactivity disorder and central nervous system depressants dependence. A review. Adicciones 2013; 25:171-186.

17. Biederman J, Wilens TE, Mick E, Faraone SV, Spencer T. Does attention-deficit hyperactivity disorder impact the developmental course of drug and alcohol abuse and dependence? Biol Psychiatry 1998; 44:269-273. **[CrossRef]**

18. Young JT, Carruthers S, Kaye S, Allsop S, Gilsenan J, Degenhardt L, van de Glind G, van den Brink W, Preen D. Comorbid attention deficit hyperactivity disorder and substance use disorder complexity and chronicity in treatment-seeking adults. Drug Alcohol Rev 2015; 34:683-693. **[CrossRef]**

19. Baker L, Prevatt F, Proctor B. Drug and alcohol use in college students with and without ADHD. J Atten Disord 2012; 16:255-263. **[CrossRef]**

20. Ameringer KJ, Leventhal AM. Associations between attention deficit hyperactivity disorder symptom domains and DSM-IV lifetime substance dependence. Am J Addict 2013; 22:23-32. **[CrossRef]**

21. Roberts W, Peters JR, Adams ZW, Lynam DR, Milich R. Identifying the facets of impulsivity that explain the relation between ADHD symptoms and substance use in a nonclinical sample. Addict Behav 2014; 39:1272-1277. **[CrossRef]**

22. Tamm L, Adinoff B, Nakonezny PA, Winhusen T, Riggs P. Attention-deficit/hyperactivity disorder subtypes in adolescents with comorbid substance-use disorder. Am J Drug Alcohol Abuse 2012; 38:93-100. **[CrossRef]**

23. De Alwis D, Lynskey MT, Reiersen AM, Agrawal A. Attention-deficit/hyperactivity disorder subtypes and substance use and use disorders in NESARC. Addict Behav 2014; 39:1278-1285. **[CrossRef]**

24. Moura HF, Faller S, Benzano D, Szobot C, von Diemen L, Stolf AR, Souza-Formigoni ML, Cruz MS, Brasiliano S, Pechansky F, Kessler FH. The effects of ADHD in adult substance abusers. J Addict Dis 2013; 32:252-262. **[CrossRef]**

25. Huntley Z, Maltezos S, Williams C, Morinan A, Hammon A, Ball D, Marshall EJ, Keaney F, Young S, Bolton P, Glaser K, Howe-Forbes R, Kuntsi J, Xenitidis K, Murphy D, J Asherson PJ. Rates of undiagnosed attention deficit hyperactivity disorder in London drug and alcohol detoxification units. BMC Psychiatry 2012; 12:223. **[CrossRef]**

26. Ercan ES, Coskunol H, Varan A, Toksoz K. Childhood attention deficit/hyperactivity disorder and alcohol dependence: a 1-year follow-up. Alcohol Alcohol 2003; 38:352-356. **[CrossRef]**

27. Grella CE, Hser YI, Joshi V, Rounds-Bryant J. Drug treatment outcomes for adolescents with comorbid mental and substance use disorders. J Nerv Ment Dis 2001; 189:384-392. **[CrossRef]**

28. Kaye S, Gilsenan J, Young JT, Carruthers S, Allsop S, Degenhardt L, van de Glind G, van den Brink W. Risk behaviours among substance use disorder treatment seekers with and without adult ADHD symptoms. Drug Alcohol Depend 2014; 144:70-77. **[CrossRef]**

29. Taylor MR, Boden JM, Rucklidge JJ. The relationship between ADHD symptomatology and self-harm, suicidal ideation, and suicidal behaviours in adults: a pilot study. Atten Defic Hyperact Disord 2014; 6:303-312. **[CrossRef]**

30. Zohar AH, Konfortes H. Diagnosing ADHD in Israeli adults: the psychometric properties of the adult ADHD Self Report Scale (ASRS) in Hebrew. Isr J Psychiatry Relat Sci 2010; 47:308-315.

31. Oncu B, Olmez S, Senturk V. [Validity and reliability of the Turkish version of the Wender Utah Rating Scale for attention-deficit/hyperactivity disorder in adults]. Turk Psikiyatri Derg 2005; 16:252-259. (Turkish)

32. Ward MF, Wender PH, Reimherr FW. The Wender Utah Rating Scale: an aid in the retrospective diagnosis of childhood attention deficit hyperactivity disorder. Am J Psychiatry 1993; 150:885-890.

33. Turgay A. Adult ADD/ADHD DSM-IV Based Diagnostic Screening and Rating Scale (unpublished scale). Toronto (1995).

34. Gunay S, Savran C, Aksoy UM, Maner F, Turgay A, Yargic I. The norm study, transliteral equivalence, validity, reliability of adult hyperactivity scale in Turkish adult population. Psychiatry in Turkey 2006; 8:98-107. (Turkish)

35. Dogan S, Oncu B, Saracoglu G, Kucukgoncu S. Validity and reliability of the Turkish version of the Adult ADHD Self-Report Scale (ASRS-v1.1). Anatolian Journal of Psychiatry 2009; 10:77-87. (Turkish)

36. Yeh CB, Gau SS, Kessler RC, Wu YY. Psychometric properties of the Chinese version of the adult ADHD Self-report Scale. Int J Methods Psychiatr Res 2008; 17:45-54. **[CrossRef]**

37. Pedrero Pérez EJ, Puerta García C. [ASRS v.1.1., a tool for attention-deficit/hyperactivity disorder screening in adults treated for addictive behaviors: psychometric properties and estimated prevalence]. Adicciones 2007; 19:393-407.

38. Rodriguez A, Ginsberg Y, Fernholm A, Nyberg L. [ADHD difficult to diagnose in adults. ASRS v1.1 Self-Report Scales valuable help--now translated to Swedish]. Lakartidningen 2007; 104:1398-1400.

39. Daigre Blanco C, Ramos-Quiroga JA, Valero S, Bosch R, Roncero C, Gonzalvo B, Nogueira M. Adult ADHD Self-Report Scale (ASRS-v1.1) symptom checklist in patients with substance use disorders. Actas Esp Psiquiatr 2009; 37:299-305.

40. Dakwar E, Mahony A, Pavlicova M, Glass A, Brooks D, Mariani JJ, Grabowski J, Levin FR. The utility of attention-deficit/hyperactivity disorder screening instruments in individuals seeking treatment for substance use disorders. J Clin Psychiatry 2012; 73:e1372-1378. **[CrossRef]**

41. Ginsberg Y, Quintero J, Anand E, Casillas M, Upadhyaya HP. Underdiagnosis of attention-deficit/hyperactivity disorder in adult patients: a review of the literature. Prim Care Companion CNS Disord 2014; 16. **[CrossRef]**

42. McAweeney M, Rogers NL, Huddleston C, Moore D, Gentile JP. Symptom prevalence of ADHD in a community residential substance abuse treatment program. J Atten Disord 2010; 13:601-608. **[CrossRef]**

43. Daigre C, Roncero C, Rodríguez-Cintas L, Ortega L, Lligo-a A, Fuentes S, Pérez-Pazos J, Martínez-Luna N, Casas M. Adult ADHD screening in alcohol-dependent patients using the Wender-Utah Rating Scale and the adult ADHD Self-Report Scale. J Atten Disord 2015; 19:328-334. **[CrossRef]**

44. Hesse M. Course of self-reported symptoms of attention deficit and hyperactivity in substance abusers during early treatment. Addict Behav 2010; 35:504-506. **[CrossRef]**

45. Byrne B. Structural Equation Modeling with AMOS: Basic Concepts, Applications and Programming. Second ed., New York: Taylor and Francis, 2010.

46. Hair J, Anderson R, Tatham R, Black W. Multivariate Data Analysis. Seventh ed., New Jersey: Prentice-Hall, 2010.

47. Bramham J, Murphy DG, Xenitidis K, Asherson P, Hopkin G, Young S. Adults with attention deficit hyperactivity disorder: an investigation of age-related differences in behavioural symptoms, neuropsychological function and co-morbidity. Psychol Med 2012; 42:2225-2234. **[CrossRef]**

48. Hesse M. The ASRS-6 has two latent factors: attention deficit and hyperactivity. J Atten Disord 2013; 17:203-207. **[CrossRef]**

49. Ramos-Quiroga JA, Daigre C, Valero S, Bosch R, Gómez-Barros N, Nogueira M, Palomar G, Roncero C, Casas M. [Validation of the Spanish version of the attention deficit hyperactivity disorder adult screening scale (ASRS v. 1.1): a novel scoring strategy]. Rev Neurol 2009; 48:449-452.

50. van de Glind G, Konstenius M, Koeter MW, van Emmerik-van Oortmerssen K, Carpentier PJ, Kaye S, Degenhardt L, Skutle A, Franck J, Bu ET, Moggi F, Dom G, Verspreet S, Demetrovics Z, Kapitány-Fövény M, Fatséas M, Auriacombe M, Schillinger A, Møller M, Johnson B, Faraone S V, Ramos-Quiroga JA, Casas M, Allsop S, Carruthers S, Schoevers RA, Wallhed S, Barta C, Alleman P, Levin FR, van den Brink W. Variability in the prevalence of adult ADHD in treatment seeking substance use disorder patients: results from an international multi-center study exploring DSM-IV and DSM-5 criteria. Drug Alcohol Depend 2014; 134:158-166. **[CrossRef]**