Article

The Clinical Utility of ASRS-v1.1 for Identifying ADHD in Alcoholics Using PRISM as the Reference Standard

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Abstract

Objective: The objective was to assess the clinical utility of the Adult ADHD Self-Report Scale (ASRS-v1.1) in identifying ADHD in alcoholics using the Psychiatric Research Interview for Substance and Mental Disorders (PRISM) as the diagnostic "gold standard." **Method:** We performed a secondary analysis of data from 379 treatment-seeking alcoholics who completed the ASRS-v1.1 and the ADHD module of the PRISM. Data analysis included descriptive statistics. **Results:** The prevalence of ADHD was 7.7% (95% CI = [5.4, 10.8]). The positive predictive value (PPV) of the ASRS-v1.1 was 18.1% (95% CI = [12.4, 25.7]) and the negative predictive value (NPV) was 97.6% (95% CI = [94.9, 98.9]). The ASRS-v1.1 demonstrated a sensitivity of 79.3% (95% CI = [61.6, 90.2]) and a specificity of 70.3% (95% CI = [65.3, 74.8]). **Conclusion:** The ASRS-v1.1 demonstrated acceptable sensitivity and specificity in a sample of treatment-seeking alcoholics when compared with the PRISM as the reference standard for ADHD diagnosis. *(J. of Att. Dis. 2019; 23(10) 1119-1125)*

Keywords
ADHD, ADD/ADHD, ASRS-v1.1, PRISM, alcohol

Introduction

ADHD is a neurodevelopmental disorder that begins during childhood and persists into adulthood in 29% to 66% of cases (Barbaresi et al., 2013; Ebejer et al., 2012; Faraone et al., 2006). The prevalence of ADHD among patients with substance use disorder (SUD) is 10.8% versus 3.8% in the general population (Simon, Rolland, & Karila, 2015). The presence of ADHD is associated with earlier use of addictive substances and earlier development of SUD, whereas having both ADHD and SUD is associated with an increased rate of additional psychiatric comorbidities, a longer addiction treatment course, and shorter time until relapse (Arias et al., 2008; Kousha, Shahrivar, & Alaghband-Rad, 2012; van Emmerik-van Oortmerssen et al., 2014; Wilens, 2006, 2007; Wilens, Biederman, & Mick, 1998; Wilens et al., 2005). Therefore, screening for ADHD in addiction treatment settings could identify patients at increased risk for other psychiatric comorbidities and negative outcomes. One of the most commonly used ADHD screening instruments is the Adult ADHD Self-Report Scale (ASRS-v1.1), which was developed in collaboration with the World Health Organization (Kessler et al., 2005).

As with most ADHD screeners, little is known about the clinical utility of the ASRS-v1.1 in SUD populations. Previous studies have used structured clinical interviews such as the Connors' Adult ADHD Diagnostic Interview for *DSM* (CAADID; Daigre Blanco et al., 2009; Dakwar et al., 2012; van de Glind et al., 2013), the Structured Clinical Interview for *DSM* Disorders (SCID; First, Spitzer, Gibbon, & Williams, 1996), or the Adult ADHD Clinical Diagnostic Scale (ACDS; Adler, Guida, Irons, Rotrosen, & O'Donnell, 2009) as the ADHD reference standard, or as part of the assessment process contributing to a diagnostic consensus among the clinical research team (Chiasson et al., 2012; Pedrero Perez & Puerta Garcia, 2007). To our knowledge, the ASRS-v1.1 has not been studied within an SUD population using the Psychiatric Research Interview for Substance and Mental Disorders (PRISM) as a reference standard. Yet, unlike other structured clinical interviews, the PRISM was developed specifically for identifying psychiatric comorbidity in SUD populations with parameters such as substance use timelines to assist in distinguishing between symptoms due to substance effects and those due to primary

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psychiatric disorders (Hasin et al., 2006; Hasin et al., 1996; Samet, Waxman, Hatzenbuehler, & Hasin, 2007).

The ease of implementation makes the ASRS-v1.1 an alluring choice for an ADHD screening instrument in both research and clinical settings. Given its increasing use in studies involving SUD populations, it is important to understand its strengths and limitations when applied to this complex clinical population. Comparing the results of the ASRS-v1.1 with those obtained from validated clinical interviews can assist in determining its clinical usefulness. Therefore, we examined the clinical utility of the ASRS-v1.1 as an ADHD screening instrument in treatment-seeking patients with primary alcoholism using the ADHD module of the PRISM as the diagnostic reference standard.

Method

Study Design

This cross-sectional study is a secondary analysis of data from a longitudinal parent study on the pharmacogenetic predictors of acamprosate treatment response (Karpyak et al., 2014). The research protocol was approved by the Institutional Review Board of our institution and was conducted in compliance with all ethical standards related to human participants.

Study Sample

We analyzed data taken from a random study sample (N = 379) who had completed the ASRS-v1.1 and the PRISM at study intake, prior to receiving the first dose of acamprosate. All participants met inclusion/exclusion criteria for the parent study. For a complete list of criteria, please see the article by Karpyak and associates (Karpyak et al., 2014). Acamprosate is an antidipsotropic medication that is approved by the U.S. Food and Drug administration for the treatment of alcohol dependence. Accordingly, individuals with a primary diagnosis of alcohol dependence were eligible for enrollment consideration. Individuals with psychotic disorders or unstable psychiatric or medical illness, as determined by the principal investigator, were excluded from study participation given concerns for safety and treatment compliance. Participants were recruited from inpatient and outpatient addiction treatment at facilities associated with our institution's health system in the Midwestern United States between March 2010 and October 2012. Fourteen participants were self-referred alcoholics living in adjacent communities who were not enrolled in an addiction treatment program and who wished to receive antidipsotropic treatment.

Assessment Measures

The ASRS-v1.1 is a six-item, self-administered, ADHD screening instrument that was derived from the most predictive questions on the original 18-item Adult ADHD Self-Report Scale (ASRS). Patients are asked to rate symptoms associated with ADHD that they have experienced within the past 6 months. A cut-off score of 4 of 6 points suggests symptoms that are highly consistent with ADHD and warrants further evaluation (Kessler et al., 2005; Kessler et al., 2007). Among the general population, the ASRS-v1.1 demonstrates 68.7% sensitivity and 99.5% specificity, as well as high internal consistency, and good test–retest reliability (Adler et al., 2006; Kessler et al., 2005; Matza, Van Brunt, Cates, & Murray, 2011).

The PRISM is a semi-structured psychiatric interview for identifying psychiatric comorbidity in patients with SUD that is based upon *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM-IV-TR*; American Psychiatric Association, 2000) criteria. In addition to its inclusion of substance use timelines, the PRISM contains specific rating guidelines for differentiating between primary psychiatric disorders and substance-induced effects. In a validation study of the Spanish version of the PRISM, the PRISM demonstrated better concordance than the Structured Clinical Interview for DSM-IV-TR Disorders (SCID) for identifying several common psychiatric comorbidities when using Longitudinal Expert All Data (LEAD) procedure as the reference standard (Torrens, Serrano, Astals, Perez-Dominguez, & Martin-Santos, 2004). The ADHD module of the PRISM demonstrated good kappa concordance (0.78) with the CAADID in a Spanish validation study of SUD patients (Ramos-Quiroga et al., 2015). The PRISM was administered by certified study coordinators who had completed additional training in conducting this interview. Participants were assessed for current psychiatric disorders as well as disorders occurring within the past year including SUDs, ADHD, mood and anxiety spectrum disorders, as well as substance-induced mood and anxiety disorders. All current SUD diagnoses were confirmed by study physicians holding board certification in addiction psychiatry.

Statistical Analysis

Descriptive statistics for demographics and clinical characteristics were reported as counts (%) for categorical variables, and as mean (*SD*) and median with interquartile range for continuous variables. Sensitivity, specificity, and positive predictive values (PPVs) and negative predictive values (NPVs) were reported including the 95% confidence interval (CI). The area under the curve (AUC) was generated using a univariate logistic regression model. SAS (version 9.3; Cary, North Carolina) was used for analysis.

Results

The summary of demographic and clinical characteristics (based on PRISM assessment) of the study participants is

Table 1. Demographic and Clinical Characteristics (n = 379).

Variable	N (%) or $M \pm SD$ (N = 379)
Age (years)	41.9 ± 11.7
Median (interquartile range)	41.9 (31.9, 50.3)
Males	248 (65.4%)
Race	
Caucasians	361 (95.2%)
Hispanics	9 (2.4%)
African Americans	6 (1.6%)
Asians	2 (0.5%)
American Indians	1 (0.3%)
Marital status	
Single	153 (40.4%)
Married	120 (31.7%)
Divorced	89 (23.5%)
Legally separated	12 (3.1%)
Widowed	5 (1.3%)
Years of education	13.7 ± 1.9
Median (interquartile range)	14.0 (12.0, 14.0)
Currently working	219 (57.8%)
Current nicotine dependence	157 (41.4%)
Cannabis use disorder[a]	106 (28.0%)
Cocaine use disorder[a]	87 (23.0%)
Amphetamine use disorder[a]	102 (26.9%)
Opioid use disorder[a]	40 (10.6%)
Substance-induced depression/ anxiety disorder[b]	356 (93.9%)
Major depressive disorder	311 (82.1%)
Anxiety spectrum disorder	112 (29.6%)
Bipolar disorder	20 (5.3%)
Positive ASRS-v1.1	127 (33.5%)
Positive ADHD by PRISM	29 (7.7%)

Note. Except where specified, all psychiatric comorbidities occurred at or within 1 year before study intake. ASRS = Adult ADHD Self-Report Scale; *DSM-IV-TR* = *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.).

[a]Subsumes those meeting *DSM-IV-TR* criteria for drug abuse and/or dependence within 1 year before study intake.

[b]Subsumes those meeting *DSM-IV-TR* criteria for substance-induced mood and/or substance-induced anxiety disorder within 1 year before study intake.

presented in Table 1. Participants included both males (65.4%) and females, 18 to 80 years old (M = 41.9 ± 11.7 years). As expected, all study participants met criteria for alcohol dependence according to *DSM-IV-TR* criteria (American Psychiatric Association, 2000). In addition, 93.9% (n = 356) of study participants met *DSM-IV-TR* criteria as identified by the PRISM for substance-induced mood and/or anxiety disorder within the past year, and 82.1% (n = 311) met criteria for major depressive disorder within the past year. Cannabis abuse or dependence and amphetamine abuse or dependence were the most common comorbid SUDs, with the PRISM identifying 28% (n = 106) and 26.9% (n = 102) of study participants, respectively, as meeting *DSM-IV-TR* criteria within the past year.

The ASRS-v1.1 was positive (score ≥ 4) for ADHD in 127 (33.5%, 95% CI = [28.9, 38.4]) of the 379 study participants. The ADHD module of the PRISM confirmed ADHD in 29 (7.7%, 95% CI = [5.4, 10.8]) of the participants. The PPV and the NPV of the ASRS-v1.1 when using the PRISM as the ADHD reference standard were 18.1% (95% CI = [12.4, 25.7]) and 97.6% (95% CI = [94.9, 98.9]), respectively. The sensitivity of the ASRS-v1.1 was 79.3% (95% CI = [61.6, 90.2]) and the specificity was 70.3% (95% CI = [65.3, 74.8]). The area under the receiver operator curve (ROC) between the ASRS-v1.1 and the PRISM was 0.75 (95% CI = [0.67, 0.83]; see Appendix Figure A1).

Discussion

To our knowledge, the present study is the first to assess the clinical utility of the ASRS-v1.1 in identifying ADHD in an SUD population using the PRISM as the reference standard for ADHD, SUD, and other psychiatric comorbidities. The ASRS-v1.1 demonstrated an acceptable level of discrimination between study participants with and without ADHD in our study population of primary alcoholics when set against a structured interview specifically designed for identifying psychiatric comorbidities in SUD populations. The ASRS-v1.1 demonstrated a poor PPV in our study but an excellent NPV.

The sensitivity and specificity of the ASRS-v1.1 in our study fell within the range of values derived from previous studies assessing the utility of the ASRS-v1.1 in SUD populations. A comparison of study results is shown in Table 2. Previous studies used structured clinical interviews including the CAADID, SCID-I, and ACDS as either the reference standard for ADHD or as part of the assessment process contributing to a diagnostic consensus among the treatment team. Taken together, our findings support that the ASRS-v1.1 maintains acceptable sensitivity and specificity for identifying ADHD when set against several validated psychiatric interviews, including the PRISM. Our finding that the AUC was 0.75 lends further support that the ASRS-v1.1 was "fair" (0.7-0.8) at discriminating between those with ADHD and those without ADHD in our study population. Moreover, the ASRS-v1.1 maintained acceptable sensitivity and specificity in our population of primary alcoholics when compared with previous studies whose study populations consisted of a mixed composition of primary addiction, suggesting that it can be applied with consistency to SUD populations with a broad range of primary addictions. An exception was found in Dakwar and colleagues' (2012) study of primary cocaine addicts where the ASRS-v1.1 performed with poor sensitivity (60.9%) though higher specificity (85.5%). The combined findings suggest that the ASRS-v1.1 may miss too many patients with ADHD

Table 2. Characteristics of Previous Studies Assessing the Utility of the ASRS-v1.1 in SUD Populations.

Study	Adler, Guida, Irons, Rotrosen, and O'Donnell (2009)	Chiasson et al. (2012)	Daigre Blanco et al. (2009)	Dakwar et al. (2012)	Pedrero Perez and Puerta Garcia (2007)	van de Glind et al. (2013)
Number of participants taking ASRS-v1.1	1,064	183	80	102	280	1,138
ADHD prevalence (%)	7.5[a]	6.0	20	25	8.2	13
Primary addiction	Alcohol/drug	Alcohol/drug	Alcohol/drug	Cocaine	Alcohol/drug	Alcohol/drug
Reference standard for ADHD	ACDS	Consensus of clinical research team	CAADID	CAADID	Consensus of clinical research team[d]	CAADID
Reference standards for non-ADHD *DSM-IV-TR* diagnoses	NP	NP	SCID-I, II	SCID-I	Consensus of clinical research team[d]	MINI-Plus, SCID-II
Study setting	Residential (NYC, USA)	Inpatient and outpatient (Canada)	Outpatient (Spain)	Outpatient (NYC, USA)	Outpatient (Spain)	Inpatient and outpatient (multinational)
PPV (%)	57.6[b]	25.6	41.2	58.3	33.3	28.3[c]
NPV (%)	NA	100	95.7	86.8	97.8	97.5[c]
Sensitivity (%)	NA	100	87.5	60.9	78.3	86.8[c]
Specificity (%)	NA	81.4	68.6	85.5	86.0	70.2[c]

Note. All values are based upon a positive ADHD screen indicating a score of ≥4 on the ASRS-v1.1 or Part A on the ASRS-v1.1 Symptom Checklist. Alcohol/drug includes populations consisting of both primary alcoholics and primary drug addicts. ASRS-v1.1 = Adult ADHD Self-Report Scale; SUD = substance use disorder; ACDS = Adult ADHD Clinical Diagnostic Scale; CAADID = Connors' Adult ADHD Diagnostic Interview for *DSM*; SCID-I, II = Structured Clinical Interview for *DSM-IV-TR* Disorders[Axis]I, II; MINI-Plus = Mini International Neuropsychiatric Interview; NP = not performed (assessment was not performed or not explicitly mentioned within the published article); *DSM-IV-TR* = *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.); PPV = positive predictive value; NPV = negative predictive value; NA = not available (value not explicitly available within the published article and/or not enough information was available for calculation of value).

[a]Imputed prevalence.

[b]PPV was calculated based upon imputed prevalence based upon known rate of ADHD in the screened positive cohort and a calculated rate of ADHD in the screened negative sample based on prior studies of the ASRS-v1.1.

[c]Values based in the Stage 2 assessment.

[d]Consensus based upon *DSM-IV-TR* criteria for Axis I and II disorders as derived from various assessments, clinical interviews, and collateral information.

(too many false negatives) when used for ADHD screening in populations with primary cocaine addiction.

The PPV of the ASRS-v1.1 in our study was the lowest found, although consistent with the overall poor PPVs found in previous studies. It is notable that our ADHD prevalence of 7.7%, as determined by the PRISM, was among the lowest found when compared with previous studies assessing the utility of the ASRS-v1.1 in SUD patients. Adler and colleagues (2009) derived an imputed ADHD prevalence of 7.5% based upon ADHD rates found in community samples. Given that community samples would be expected to have a lower rate of comorbid SUDs, their findings are difficult to compare, as they may have underrepresented the prevalence of ADHD typically found in SUD populations. Using the consensus of a clinical research team as the ADHD reference standard, Chiasson et al. (2012) found the lowest ADHD prevalence of 6%. It may be that the PRISM's ability to discriminate among psychiatric comorbidities resembles that offered by the rigorous process performed by Chiasson's team, which included individual interviews performed by a psychiatrist as well as interviews from family members for historical symptoms of ADHD. Furthermore, the fact that our ADHD prevalence remained in the lower range despite the high rate of comorbidity in our study population may also support the PRISM as an instrument with facility to discriminate between the complex comorbidity profiles often found in SUD populations. Regardless of the prevalences determined, the ASRS-v1.1 generally yielded poor PPVs even among studies with more robust ADHD prevalence rates. Taken together, these results suggest that the ASRS-v1.1 maintains a high rate of false positives. Despite its poor PPV, the ASRS-v1.1 demonstrated a superior NPV, which is also consistent with its performance in previous studies. Thus, a patient who screens negative for ADHD on the ASRS-v1.1 has a very high probability of not having ADHD.

Our study results support the clinical utility of the ASRS-v1.1 in SUD populations when used to exclude the diagnosis of ADHD in those who screen negative. The ASRS-v1.1 may not be as useful at identifying ADHD in SUD patients given its high false positive rate. Those who screen positive on the ASRS-v1.1 should receive further assessment for ADHD as

well as other psychiatric comorbidities that can mimic and overlap with ADHD symptoms. Prompt identification and treatment of comorbidities such as mood and anxiety disorders may improve addiction treatment outcomes in SUD patients. In patients with confirmed ADHD, increased monitoring, psychoeducation, and increased aftercare may optimize addiction treatment outcomes. The role of pharmacologic treatment of ADHD in SUD patients is beyond the scope of this article, but could be considered. Therapies such as cognitive behavioral therapy for ADHD could also be incorporated into addictions treatment.

Our study must be considered in light of its limitations. Because our results specifically characterize the utility of the ASRS-v1.1 for an alcoholic patient population, the exclusion of participants with other primary addiction diagnoses may decrease the generalizability of our results. Nonetheless, our findings were consistent with those from mixed populations in previous research. In addition, our study participants were voluntarily seeking pharmacotherapy for alcoholism, and they may have represented a more highly motivated sub-population of alcoholics, which may limit the generalizability of our findings in populations composed of court mandated patients, those with more severe addictive illness, and those with less insight. An important consideration is that our participants consisted predominantly of Caucasian males. The influence of ethnicity and culture on psychiatric phenomena is becoming more evident, and it may limit the generalizability of our results in more diverse populations. Males with SUDs are historically overrepresented both within the general population as well as in addiction treatment programs and this was true in our study. The number of females with ADHD in our study was proportionate to that of males, which is also consistent with previous findings in SUD populations (van Emmerik-van Oortmerssen et al., 2014). Despite these consistencies, our study could have benefited from having a larger sample of ADHD positive men and women.

Future research should focus on the clinical utility of the ASRS-v1.1 and the PRISM in populations consisting of other primary SUDs, such as cannabis and opioid use disorders, to determine whether these instruments are better suited for use in specific addictions populations. Studies comparing outcome measures, such as adherence to ADHD medication and relapse to substance use between patients with positive ADHD status on the PRISM, and patients screening positive for ADHD on the ASRS-v1.1 but negative on the PRISM, could help elucidate the prognostic relevance of these instruments.

Conclusion

The ASRS-v1.1 demonstrated acceptable sensitivity and specificity for detecting ADHD in an alcohol-dependent treatment-seeking population when using the PRISM as the reference standard for ADHD and other psychiatric comorbidities. The ASRS-v1.1 maintains clinical utility in SUD patients when weighed against the most commonly used ADHD reference standards. Although its PPV is poor, its excellent NPV makes it a useful instrument for reasonable exclusion of ADHD in SUD populations.

Appendix

Inclusion Criteria of Parent Study

Given that the parent study was designed to identify pharmacogenomics predictors of acamprosate response, participants met the following criteria in addition to having a primary diagnosis of current alcohol dependence: (a) ability to provide informed consent and (b) the participant's last drink could not be less than 5 days or more than 6 months from study enrollment.

Exclusion Criteria of Parent Study

Exclusion criteria included the following: (a) a history of hypersensitivity or allergic reaction to acamprosate, (b) current treatment with acamprosate or treatment within the last 3 weeks, (c) creatine level of >1.5 mg/dL, (d) aspartate transaminase and/or alanine transaminase level(s) greater than three times the normal limit, (e) a diagnosis of primary biliary cirrhosis, (f) chronic hepatitis or drug-induced hepatic insufficiency, (g) women who are pregnant or breast feeding, (h) women planning to become pregnant within the following year, (i) any unstable active medical or psychiatric condition as determined by the investigator, (j) active suicidal ideation, and (k) current use of disulfiram.

Study Constructs and Definitions

Sensitivity. The proportion of positive results on an assessment that are correctly identified (true positive rate, TPR). True positives (TPs) are derived from a "gold standard" assessment.

Specificity. The proportion of negative results on an assessment that are correctly identified (true negative rate, TNR). True negatives (TNs) are derived from a "gold standard" assessment.

$$\text{Sensitivity} = \text{TPR} = \text{TP} / \text{P} = \text{TP} / \left(\text{TP} + \text{FN}\right)$$

$$\text{Specificity} = \text{TNR} = \text{TN} / \text{N} = \text{TN} / \left(\text{TN} + \text{FP}\right)$$

Sensitivity and specificity are characteristics of the assessment. The population does not affect the results.

Positive Predictive Value (PPV).

The probability that participants with a positive result truly do have the disease.

Negative Predictive Value (NPV).

The probability that participants with a negative result truly do not have the disease.

PPVs and NPVs are influenced by the prevalence of disease in the population that is being tested.
PPV = TP / (TP + FP)
NPV = TN / (TN + FN)
Area Under the Curve (AUC).
The accuracy of a test depends on how well the test separates the group being tested into those with and without the disease in question. Accuracy is measured by the area under the receiver operator curve where the TPR is plotted against the false positive rate (FPR) at various threshold settings (Faraggi & Reiser, 2002; Zhou & McClish, 2011).

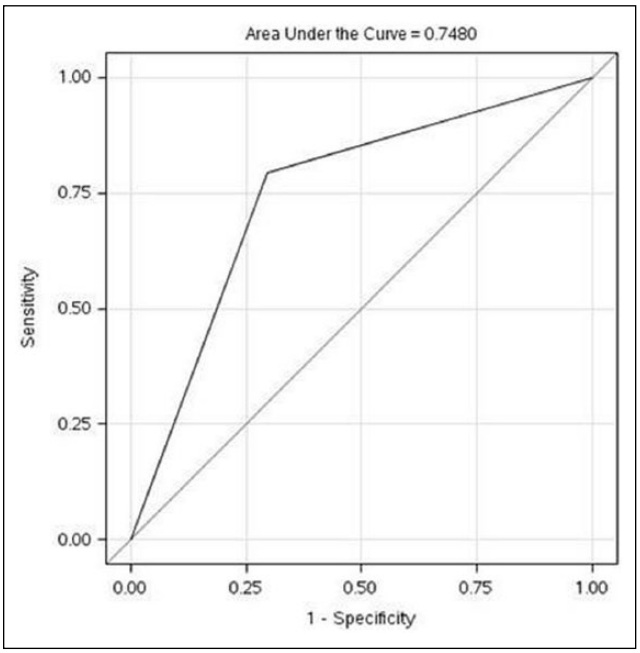

Figure A1. ROC curve for ASRS.
Note. ROC = receiver operator curve; ASRS = ADHD Self-Report Scale.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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