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Construct validity and diagnostic accuracy of the Italian translation of the 18-Item World Health Organization Adult ADHD Self-Report Scale (ASRS-18) Italian translation in a sample of community-dwelling adolescents.

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ABSTRACT

Aim of this prospective study was to evaluate the factor structure, internal consistency, and diagnostic efficacy of the Italian translation of the Adult ADHD Self-Report Scale (ASRS-18; Kessler et al., 2005, 2007) in a sample of community-dwelling sample of adolescents. Three hundred eight Italian adolescents attending professional high schools were administered the ASRS-18; the adolescence ADHD module of the MINI interview was administered to obtain ADHD criterion diagnoses. Robust maximum likelihood confirmatory factor analysis results identified a bifactor model of the ASRS-18 items as the best-fitting model, RMSEA = 0.029, $p > 0.99$, TLI = 0.93, CFI = 0.95. Further analyses showed that 77.9% of the ASRS-18 reliable ($\omega = 0.78$) score variance was due to the total score. In our study the ASRS-18 proved to be able to effectively differentiate adolescents who received a MINI ADHD diagnosis ($n = 80$) from adolescents who did not receive a MINI ADHD diagnosis ($n = 163$), area under the curve = 0.80, 95% confidence interval = 0.74, 0.86. Our data suggest that the ASRS-18 may represent an effective self-report measure to screen for ADHD in community-dwelling adolescents, at least in its Italian translation.

1. Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is currently conceived as a childhood-onset neurodevelopmental disorder, characterized by the presence of developmentally inappropriate and impairing levels of inattention, hyperactivity, and impulsivity (American Psychiatric Association, 2013; Asherson et al., 2016). Although the latent distribution of ADHD is likely to be dimensional in nature (Coghill and Sonuga-Barke, 2012), epidemiological studies indicate that 5–6% of children meet *DSM-IV* criteria for ADHD (e.g., Willcutt et al., 2005). Meta-analysis of follow-up studies of children with ADHD found that 15% of children retained the full diagnostic criteria by the age of 25 years, with a further 50% of those meeting subthreshold criteria with persistence of ADHD symptoms causing continued impairments (Faraone et al., 2006).

In the transitional period between childhood and adulthood, adolescents with ADHD continue to display the impairments of children with ADHD (Sibley et al., 2012). Functional impairments and behavior problems associated with ADHD included low school grades, defiance of authority, poor peer relationships, and family conflict (see, for a review, Sibley et al., 2012). Moreover, adolescents with ADHD begin to experience the impairments that characterize adults suffering from this disorder, such as substance use (Molina et al., 2007), and driving problems (Thompson et al., 2007). Finally, there are impairments associated with ADHD that are specific to adolescence – delinquency (Sibley et al., 2011), school drop-out (Kent et al., 2011), and early initiation of sexual behavior (Flory et al., 2006).

The availability of short, self-report screening measures would greatly enhance the likelihood of adolescent and adult ADHD subjects to be correctly diagnosed and treated, although ADHD adolescent and adults are known to underreport their symptoms (Asherson et al., 2016). Against this background, Kessler et al. (2005, 2007) developed the Adult ADHD Self-Report Scale (ASRS-18), a short self-report measure that includes also a six-item screener (ASRS-6), which was developed selecting the six items that were most effective in discriminating ADHD adults from non-ADHD adults in several independent samples. However, recent data based on Rasch models of the Spanish version of the ASRS-18 proposed six different items for the ASRS-6 in substance use disorder subjects (Sanchez-Garcia et al., 2015). Recently, Ustun et al. (2017) proposed a revised version of the ASRS-6 that included two non-symptom items reflecting executive dysfunction. The ASRS-18 provides nine hyperactivity items and nine attention-deficit

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items that map onto *DSM-IV* (APA, 2000) ADHD criteria. The ASRS has been translated and validated in a number of different languages and cultures, ranging from Spanish language (Sanchez-Garcia et al., 2015) to Japanese language (Takeda et al., 2017). To our knowledge, the ASRS has never been validated in Italy.

Starting from these premises, we aimed at testing the factor structure, internal consistency, and diagnostic efficacy of the Italian translation of the ASRS-18. Since early diagnosis is crucial for preventing long-term negative outcomes of adult ADHD and screening instruments are particularly relevant for non-psychiatric subjects, we administered the ASRS to a sample of community-dwelling adolescents who were receiving professional education at a large institute in the North of Italy.

2. Methods

2.1. Participants

Three hundred eight community dwelling adolescents ($M = 177$, 57.5%, $F = 131$, 42.5%; mean age = 14.91, $SD = 2.70$ years) who were receiving professional education at a large institute in the North of Italy. After obtaining Institutional Review Board approval from the university and the principals of the schools, researchers recruited adolescents from classrooms (data were collected in Winter 2016–Spring 2017). Written informed parent consent and adolescent assent were obtained prior to study participation. In order to participate in the present study, participants were required to speak Italian as their first language in order to avoid cultural and lexical bias in questionnaire responses; to maximize the likelihood of including adolescents potentially meeting *DSM-IV* ADHD criteria in our sample, only adolescents who were reported by their teachers as manifesting externalizing problem behaviors (e.g., truancy, anger outbursts at school, calling teacher names, restless behavior during classroom time, reckless behavior at school, drug misuse, etc.) were allowed to participate in this study. A subsample of 243 (79.9%) adolescents agreed to be administered a diagnostic interview for assessing *DSM-IV* ADHD and CD; 21.1% of the adolescents declined to participate due primarily (98.5%) to the time commitment the study required. Notably, adolescents who were administered the MINI were not significantly different from adolescents who were not administered the MINI on gender, $\chi^2(1) = 0.03$, $p > 0.80$, $\varphi = 0.01$, and average ASRS-18 mean score, $t(306) = 0.38$, $p > 0.70$, $d = 0.00$. Fig. 1 showed the flow of participants through the study. The interview was administered by trained research fellows blind to ASRS-18 scores, as well as to adolescents' grades.

2.2. Measures

2.2.1. Adult ADHD Self-Report Scale (ASRS-18; Kessler et al., 2005)

The ASRS is made up of two parts—the first one (Part A, screening) includes six items that, according to the authors, best predict the presence or absence of ADHD; Part B is made up of the remaining 12 items. Consistent with the other existing translations of the ASRS-18, the scale has been translated into Italian using the standard WHO translation and back-translation protocol (National Comorbidity Survey, 2005).

Each question asked how often a symptom occurred over the past 6 months on a 0–4 scale with responses of never = 0, rarely = 1, sometimes = 2, often = 3, and very often = 4. The ASRS-18 items are summed to yield a total score but may also be grouped into two subscales: Inattentive (INA) and Hyperactive/Impulsive (H/I), each one comprised of nine items. Thus, the scale permits a global ADHD diagnosis (the higher the ASRS-18 total score, the higher the intensity of ADHD symptoms), as well as the assessment of INA and H/I symptomatology.

2.2.2. MINI International Neuropsychiatric Interview, Plus, Version 5.00 (MINI; Sheehan et al., 1997)

The MINI was designed as a brief structured interview for the major Axis I psychiatric disorders in *DSM-IV* and ICD-10. This interview was chosen because it includes an ADHD Module specifically designed for assessing adolescent ADHD and because the inter-rater reliability of the Italian version of the MINI was previously established (Rossi et al., 2004). Consistent with previous studies (Kumar et al., 2011), our adolescents were administered only the adolescent ADHD Module from the MINI to obtain *DSM-IV* categorical diagnoses of ADHD. The MINI adolescent ADHD Module yields 9 questions (rated yes/no) for *DSM-IV* ADHD inattention symptoms and 9 questions (rated yes/no) for *DSM-IV*ADHD hyperactive/impulsive symptoms. We could assess the inter-rater reliability of MINI adolescent ADHD dimensional scores (i.e., number of symptoms) on 34 adolescent participants; one-way, random effect ANOVA intraclass r value was 1.00.

2.3. Data analysis

Cronbach α values and Haberman's (2008) H reliability estimates were computed; to the degree that α coefficients are larger than H coefficients, subscale scores provide a relatively better indicator of subscale true score standing, and, thus, can be reported (Reise et al., 2013). Robust maximum likelihood confirmatory factor analysis (MLR CFA) was used to assess the factor structure of the ASRS. The following models were tested: a) a unidimensional model, with a single latent

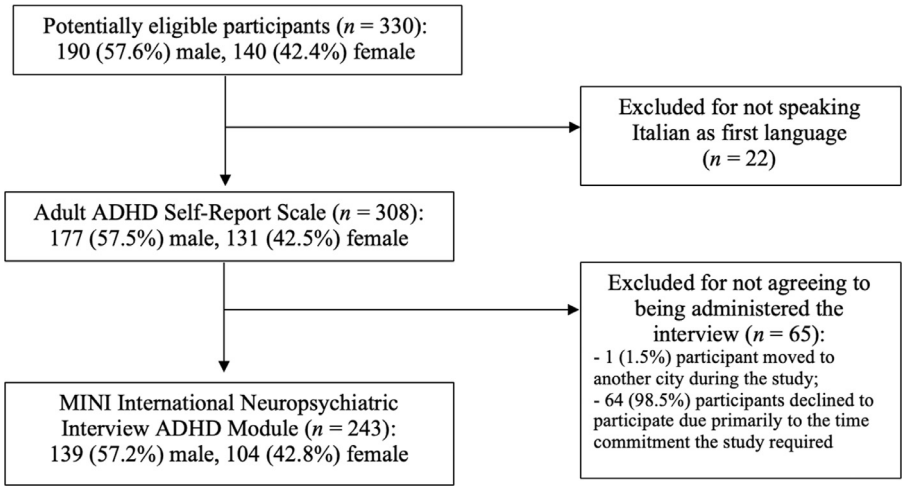

Fig. 1. Flow chart of participant recruitment and exclusion.

factor underlying all the ASRS items; b) a two-factor model based on the a priori item allocation rule to an ASRS INA factor (items 1, 2, 3, 4, 7, 8, 9, 10, and 11) and to a H/I factor (items 5, 6, 12, 13, 14, 15 16, 17, and 18); c) a CFA bi-factor model, with all ASRS items loading on the general factor, and two specific factors corresponding to the INA factor and the H/I factor, respectively. Following Hu and Bentler's (1999) suggestions and cut-off scores, we used several measures to identify model fit.

The reliability of the factors was assessed by computing omega-hierarchical (ω_H) and omega-specific (ω_S) coefficients (Reise et al., 2013). The ω coefficient is an estimate of the percentage of variance in observed total scores due to all sources of common variance (Reise et al., 2013). The ω_H coefficient is an estimator of the percentage of test score variance accounted for by variation on the general factor (Reise et al., 2013). The ω_S coefficient estimates the reliability of a subscale (e.g., ASRS-18 INA or H/I subscales) after controlling for the general factor (Reise et al., 2013).

Mann–Whitney tests and *t*-tests were computed in order to compare the median/mean scores of the ASRS items and total scores, respectively, between ADHD adolescents and non-ADHD adolescents. Forward logistic regression analysis was used to evaluate if the ASRS items may be sufficient to summarize the information that is necessary to effectively discriminate ADHD adolescents from non-ADHD adolescents, and to identity the ASRS items that best discriminated ADHD adolescents from non-ADHD adolescents.

In the present study, the area under the curve (AUC; i.e., the probability that a randomly selected clinical case would score higher on the ASRS than a randomly selected non-case; Kessler et al., 2005) was used as a measure of the overall ability of the ASRS to predict the presence or absence of ADHD diagnosis. The AUC of a perfect measure is expected to be 1.0, whereas it is expected to be 0.5 for a useless instrument. AUC based on 10-fold cross-validated (CV) receiver operating characteristic (ROC) analysis (LeDell et al., 2014) was used to identify the best balance between sensitivity and specificity with respect to MINI ADHD diagnosis. For all possible cut-off scores provided by ROC analysis, cut-off scores with sensitivity close to or higher than 0.70, and specificity close to or higher than 0.70 were identified for detection purposes for the ASRS, with no differentiation between boys and girls. Cohen κ value was used to evaluate the diagnostic agreement between the ASRS and the MINI ADHD diagnoses. Cohen κ values ranging from 0.21 to 0.40 were considered suggestive of fair agreement, values ranging from 0.41 to 0.60 of moderate agreement, and values ranging from 0.61 to 0.80 of substantial agreement (Cohen, 1988). In the present study, sensitivity, specificity, positive predictive power (PPP), negative predictive power (NPP) and likelihood ratio values were computed (e.g., Grimes and Schulz, 2005).

3. Results

3.1. Descriptive statistics and reliability estimates

Descriptive statistics, Cronbach α values and Haberman's *H* reliabilities based on total score rather than subscales for ASRS-18 dimensions are summarized in Table 1. No significant difference between male and female adolescents was observed on ASRS-18 INA, $t(306) = 1.54$, $p > 0.10$, $d = 0.18$, H/I, $t(306) = 0.77$, $p > 0.40$, $d = 0.09$, and total score, $t(306) = 1.86$, $p > 0.05$, $d = 0.21$.

3.2. Factor analysis results

MLR CFA findings for the one-factor model of the ASRS-18 items were sub-optimal, $\chi^2(135) = 249.67$, $p < 0.001$, root mean square error of approximation (RMSEA) = 0.053, $p > 0.30$, Tucker-Lewis index (TLI) = 0.78, comparative fit index (CFI) = 0.80, standardized root mean square residual (SRMSR) = 0.058, sample size adjusted Bayesian information criterion (SABIC) = 15,832.01. The two-factor model of the ASRS-18 items showed marginal fit in MLR CFA, $\chi^2(134) = 206.50$, $p < 0.001$, RMSEA = 0.042, $p > 0.80$, TLI = 0.86, CFI = 0.88, SRMSR = 0.053, SABIC = 15,791.10. When we tested in MLR CFA a confirmatory bifactor model with a general ADHD factor, which all ASRS-18 items were expected to load on, and two orthogonal specific factors that were defined according to the a priori ASRS-18 item allocation rule to an INA factor and to a H/I factor, respectively, an adequate fit was observed, $\chi^2(117) = 147.72$, $p < 0.05$, RMSEA = 0.029, $p > 0.99$, TLI = 0.93, CFI = 0.95, SRMSR = 0.041, SABIC = 15,775.81.

Table 1
Adult ADHD Self-Report Scale: Descriptive statistics, Cronbach αs, and Haberman's *H*s in the full sample ($N = 308$).

			Pearson *r*s			Reliabilities	
	M	*SD*	1	2	3	α	*H*
1. Inattention	15.20	4.98	–			0.71	0.65
2. Hyperactivity/Impulsivity	14.03	4.90	0.44	–		0.62	0.63
3. Total Score	29.23	8.37	0.85	0.85	–	0.76	–

Note. All *r* coefficient *p*s < 0.001.

Standardized factor loadings for MLR CFA best-fitting (i.e., bifactor) model of the ASRS-18 items are listed in Table 2. ω, ω_H, and ω_S coefficient values based on MLR CFA bifactor model of the ASRS-18 items were 0.78, 0.61, 0.26, and 0.42 for ASRS-18 scale as a whole, ASRS-18 item general factor (i.e., ASRS-18 total score), ASRS-18 INA subscale, and ASRS-18 H/I subscale, respectively. The ratio of the ω_H coefficient value to the ω coefficient value was 0.779, indicating that 77.9% of the reliable variance in the ASRS-18 was due to the total score (Reise et al., 2013).

3.3. Diagnostic accuracy statistics

According to MINI interview, 80 (32.9%) adolescents received a *DSM-IV* ADHD diagnosis. Adolescents who received a MINI ADHD diagnosis showed significantly lower average school grades[1] ($M = 6.74$, $SD = 0.94$) than non-ADHD adolescents ($M = 7.13$, $SD = 0.99$), $t(241) = -2.92$, $p > 0.01$, $d = -0.40$. ADHD adolescents received lower average behavior grade ($M = 7.96$, $SD = 0.89$) than non-ADHD adolescents ($M = 8.41$, $SD = 0.82$), $t(241) = -3.92$, $p < 0.001$, $d = -0.54$.

Descriptive statistics, bivariate associations (i.e., Mann–Whitney tests and *t*-tests), and logistic regression analysis results for ASRS-18 item and total scores, including the total scores based on the six-item screener and on the six best performing items in forward logistic regression, are summarized in Table 3. The 10-fold CV, ROC AUC analysis of the ASRS-18 total score was 0.80, $SE = 0.03$, 95% CI = 0.74, 0.86. When we considered the 6-item screener total score 10-fold CV, ROC AUC was 0.75, $SE = 0.04$, 95% CI = 0.68, 0.81. Finally, when we carried out 10-fold CV ROC analysis of the sum of the six ASRS-18 items that best discriminated ADHD adolescents from non-ADHD adolescents in forward LR analysis the corresponding AUC was 0.84, $SE = 0.03$, 95% CI = 0.78, 0.89.

Ten-fold CV ROC analysis results suggested an ASRS-18 total score ≥ 31, an ASRS-6 score ≥ 11, and a score ≥ 12 for the sum of the six ASRS-18 items that best discriminated ADHD adolescents from non-ADHD adolescents in LR analysis (ASRS-6-LR), yielded the best balance between sensitivity and specificity in predicting MINI ADHD diagnosis. Cohen κ value, sensitivity, specificity, PPP and NPP values for these cut-off scores are listed in Table 4. When we relied on an ASRS-18 total

[1] Schools in Italy use a 10-point scale that can be divided into failing (0 to 5) and passing (6 to 10) grades. A behavior grade lower than 8 indicates severe problem behavior at school and in the case of 6 grade, or even 7 grade in behavior, failure may occur.

Table 2
Robust maximum likelihood confirmatory bifactor model of the adult ADHD Self-Report Scale Items: Standardized factor loadings ($N = 308$).

Adult ADHD Self-Report Scale Items	*M*	*SD*	Standardized factor loadings ADHD	INA	H/I
1. Wrapping up the final details	1.48	0.82	0.28***	0.21*	–
2. Difficulty getting things in order	1.40	1.04	0.37***	0.16	–
3. Remembering appointments	1.27	1.07	0.35***	0.20	–
4. Avoid or delay getting started	1.87	0.99	0.32***	0.31***	–
5. Fidget or squirm	2.04	1.27	0.29***	–	0.36***
6. Feel overly active and compelled	1.76	1.10	0.18	–	0.66***
7. Make careless mistakes	2.20	0.97	0.38***	0.51***	–
8. Difficulty keeping your attention	2.25	1.04	0.32***	0.52***	–
9. Difficulty concentrating	0.99	0.91	0.43***	0.28**	–
10. Difficulty finding things	1.82	1.11	0.47***	0.05	–
11. Distracted by activity or noise	1.91	1.10	0.41***	0.26**	–
12. Leave seat in meetings	0.85	0.95	0.43***	–	0.15
13. Feel restless or fidgety	1.95	1.06	0.35***	–	0.37***
14. Difficulty unwinding and relaxing	1.54	1.27	0.30***	–	0.21*
15. Talking too much	1.85	1.13	0.29***	–	0.21*
16. Finishing the sentences	1.30	1.08	0.29***	–	0.21*
17. Difficulty waiting turn	1.34	1.06	0.44***	–	0.00
18. Interrupt others	1.40	0.89	0.41***	–	0.06

Note.
ADHD: ADHD general factor; INA: inattentive specific factor; H/I: hyperactive/impulsive specific factor.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

score ≥31 to consider a possible ADHD diagnosis with MINI ADHD diagnosis, a significantly higher proportion of false positives (FP; 18.5%) than of false negatives (FN; 7.4%) was observed, McNemar $\chi^2(1) = 10.73$, $p < 0.01$. Similar considerations held for an ASRS-6 score ≥11 (FP = 18.1%, FN = 10.3%, McNemar $\chi^2(1) = 4.70$, $p < 0.05$), and an ASRS-6-LR score ≥12 (FP = 16.0%, FN = 8.2%, McNemar $\chi^2(1) = 5.49$, $p < 0.05$).

4. Discussion

Consistent with previous reports in adult samples (e.g., Kessler et al., 2005, 2007), the Italian translation of the ASRS-18 seemed to represent a reliable and valid self-report measure to screen for ADHD symptomatology also in a sample of community dwelling adolescents. This finding may have relevant clinical implications because could allow for early identification of adolescents needing for accurate ADHD assessment to start early treatment of long-term sequelae of childhood ADHD, or even rapid diagnosis and treatment of adult-onset ADHD (e.g., Agnew-Blais et al., 2016). It should be stressed that our adolescent sample did not aim to be representative of the Italian adolescent population; rather, inclusion criteria (i.e., presence of problem behavior) aimed at maximizing the likelihood of including ADHD adolescents. This sampling strategy may explain the large ADHD base rate (32.9%) that was observed in our adolescent sample.

Confirming and extending previous studies based on adult samples (e.g., Kessler et al., 2005, 2007; Sanchez-Garcia et al., 2015), our findings based on Haberman's (2008) approach and Reise et al. (2013) method to dimensionality assessment seemed to indicate that the correlations among the ASRS-18 items were explained by a single, common latent dimension, purportedly corresponding to ADHD symptomatology. Thus, clinicians and researchers should focus mainly (not to say exclusively) on the ASRS-18 total score to evaluate the likelihood of ADHD problems.

Although ASRS-18 Inattention subscale yielded reliable scores according to Haberman's (2008) criteria, MLR CFA results strongly supported a bifactor model of the ASRS-18 items as the best fitting model; except for ASRS-18 item 6, all ASRS-18 items showed significant and non-negligible standardized factor loadings on the ADHD general factor. According to Reise et al. (2013) approach to unidimensionality assessment, the wide majority (i.e., 77.9%) of the overall ASRS-18 reliability ($\omega = 0.78$) was concentrated in its total score, at least as it was operationalized in the ADHD general factor; moreover, both specific factors showed sub-optimal reliability estimates (i.e., ω_S values), suggesting that ASRS-18 subscale scores has very limited reliability when the effect of the general factor was controlled for (Reise et al., 2013).

Consistent with the available evidence on adult subjects (e.g., Kessler et al., 2005, 2007), in our study the ASRS-18 proved to be able to effectively differentiate adolescents who received a MINI ADHD diagnosis from adolescents who did not receive a MINI ADHD diagnosis. According to Mann–Whitney *U* tests, 83.3% of the ASRS-18 items showed significantly higher median scores among ADHD adolescents than among non-ADHD adolescents. Confirming and extending previous findings (e.g., Kessler et al., 2005, 2007; Sanchez-Garcia et al., 2015; Ustun et al., 2017), our logistic regression analysis results suggested that six ASRS-18 items may be sufficient to summarize the information that is necessary to effectively discriminate ADHD adolescents from non-ADHD adolescents, although the six items that emerged as the best predictors of ADHD in community-dwelling adolescents in our LR analyses were largely different from those that were originally included in the ASRS-6. Our results were at least partially consistent with Sanchez-Garcia et al. (2015) results indicating how in adults with substance use disorder the ASRS-6 should be modified to yield adequate diagnostic accuracy, as well as Ustun et al's (2017) results suggesting the need for a complete re-definition of the ASRS six-item screener.

Consistent with previous studies (Kessler et al., 2005, 2007), our 10-fold CV ROC analysis results suggested adequate diagnostic efficacy (i.e., AUC values ≥ 0.80) for ASRS-18 and ASRS-6-LR total scores. When we relied on ROC-based cut-off scores for ASRS-18, ASRS-6, and ASRS-6-LR total scores in order to identify potential ADHD adolescents, Cohen κ values suggested at least moderate diagnostic agreement with MINI ADHD diagnosis only for ASRS-18 and ASRS-6-LR total scores; this finding, as well as the values of sensitivity, specificity, PPP, and NPP for the three total scores that were considered in our study, suggested care in using the ASRS-6 total score as an ADHD screener in community-dwelling adolescents with problem behavior. In our study, a significantly higher proportion of false positives (FP) than of false negatives (FN) was observed for the ASRS-18, ASRS-6, and ASRS-6-LR cut-off scores, respectively. In our opinion, this represents a desirable property for a fast, self-report screening measure for ADHD in adolescence, particularly considering the relatively limited FP frequency that was observed in our adolescent sample. On the other hand, FN rates ranged from 7.4% (ASRS-18 total score) to 10.3% (ASRS-6 total score), showing that a non-negligible proportion of ADHD adolescents may go undetected if clinicians would rely uncritically only on self-reports (particularly on ASRS-6 self-reports) to identify adolescents at risk for ADHD needing for in-depth ADHD assessment.

Of course, our findings should be considered in the light of several limitations. Our sample was composed of adolescents who volunteered to participate in the study, rather than of adolescents who were randomly selected from the Italian adolescent population. Moreover, only adolescents who were reported by their teachers as manifesting externalizing problem behaviors participated in this study, and this may have introduced a bias in our sampling strategy. Indeed, ADHD is often underrecognized in girls, due to a symptom profile (i.e., more inattentive and less hyperactive/impulsive than males) that is less likely to be disruptive in the class (Quinn and Madhoo, 2014). Thus, our sample was more akin to a convenience study group than to a random sample representative of the adolescents in the Italian general population. The MINI interview has been designed to yield epidemiological ADHD diagnosis, rather than clinically sound ADHD diagnoses.

Table 3
Adult ADHD Self-Report Scale in ADHD (n = 80) and non-ADHD (n = 143) adolescents: Descriptive statistics, bivariate comparisons, and logistic regression analysis results.

	ADHD (n = 80)		Non-ADHD (n = 163)			Logistic Regressions	
Adult ADHD Self-Report Scale Items	*M*	*SD*	*M*	*SD*	$z/t_{(241)}$	*OR*	*95% CI*
1.Wrapping up final details[S]	1.79	0.92	1.31	0.75	3.90***	1.87 (1.69)	1.19, 2.92 (1.13, 2.55)
2.Difficulty getting things[S]	1.94	1.13	1.13	0.94	5.47***	1.56(1.71)	1.09,2.23 (1.24, 2.38)
3.Remembering appointments	1.59	1.23	1.10	1.00	2.89**	1.09	0.79, 1.50
4.Avoid or delay	2.30	1.02	1.67	1.01	4.61***	1.22	0.84, 1.75
5.Fidget or squirm	2.33	1.35	1.92	1.27	2.33*	1.04	0.78, 1.37
6.Feel overly active	1.93	1.26	1.72	1.06	1.11	1.19	0.84, 1.69
7.Make careless mistakes[S]	2.71	0.98	1.96	0.88	5.61***	1.59 (1.79)	1.04, 2.44 (1.20, 2.66)
8.Difficulty keeping attention[S]	2.74	0.96	2.10	1.04	4.44***	1.55 (1.61)	1.04, 2.33 (1.12, 2.31)
9.Difficulty concentrating	1.31	1.01	0.85	0.84	3.56***	0.98	0.65, 1.49
10.Difficulty finding things	2.30	1.08	1.60	1.13	4.61***	1.39	1.00, 1.94
11.Distracted by activity	2.36	1.11	1.72	1.09	4.32***	1.19	0.85, 1.67
12.Leave seat in meetings	1.10	1.11	0.73	0.88	2.41*	1.04	0.71, 1.52
13.Feel restless or fidgety[S]	2.30	1.15	1.75	1.00	3.56***	1.26 (1.39)	0.89, 1.78 (1.02, 1.90)
14.Difficulty unwinding	1.73	1.35	1.44	1.28	1.50	0.97	0.73, 1.29
15.Talking too much	1.96	1.36	1.79	1.04	0.94	0.87	0.64, 1.20
16.Finishing the sentences	1.50	1.11	1.20	1.08	1.98*	1.22	0.87, 1.71
17.Difficulty waiting turn[S]	1.78	1.17	1.13	0.96	4.12***	1.79 (1.82)	1.25, 2.58 (1.32, 2.52)
18.Interrupt others	1.55	0.98	1.32	0.87	2.01*	0.82	0.54, 1.24
$R^2_{McFadden}$						0.31***	
Goodness-of-fit $\chi^2_{(224)}$						211.69	
$R^2_{McFadden}$ Forward LR						0.28***	
Goodness-of-fit $\chi^2_{(214)}$						241.05	
Adult ADHD Self-Report Scale Total Scores							
18-item Total Score	35.20	7.76	26.44	7.38	8.55***	1.18	1.12, 1.24
$R^2_{McFadden}$						0.21***	
Goodness-of-fit $\chi^2_{(38)}$						36.41	
6-item Total Score	11.86	3.40	8.86	2.99	7.03***	1.36	1.22, 1.50
$R^2_{McFadden}$						0.15***	
Goodness-of-fit $\chi^2_{(16)}$						15.66	
6-item Total Score (based on Forward LR)	13.25	2.92	9.38	2.88	9.80***	1.66	1.44, 1.91
$R^2_{McFadden}$						0.27***	
Goodness-of-fit $\chi^2_{(17)}$						10.38	

Note. z: Mann–Whitney U z-test; OR: odds ratio; CI: confidence interval; LR: logistic regression; S: item selected in forward LR; odds ratios based on forward LR are listed between brackets;.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

Table 4
Cut-Off Scores, Cohen κ value, Sensitivity, Specificity, Positive Predictive Power and Negative Predictive Power Values for the Adult ADHD Self-Report Scale.

	Cut-off	Cohen κ	Sensitivity	Specificity	Positive predictive power	Negative predictive power	Positive likelihood ratio	Negative likelihood ratio
ASRS-18	≥31	0.46***	0.78	0.72	0.58	0.87	2.79	0.31
ASRS-6	≥11	0.39***	0.69	0.73	0.56	0.83	2.56	0.43
ASRS-6-LR	≥12	0.48***	0.75	0.76	0.61	0.86	3.33	0.33

Note. ASRS: Adult ADHD Self-Report Scale; LR: logistic regression.

*** $p < 0.001$.

Moreover, clinical assessment of ADHD requires careful consideration of multiple sources of information and indicators. Although we tried to increase the validity of our MINI ADHD diagnoses by testing their associations with objective indicators of poor performance and discipline at school (i.e., school and behavior grades, respectively), our ADHD diagnoses were far from clinically sound ADHD assessment.

The MINI adolescence ADHD module does not allow for assessing ADHD subtypes/presentations (Sheehan et al., 1997); this prevented us to obtain a detailed picture of our ADHD adolescents. Moreover, semi-structured interviews allowing for fine-grained ADHD diagnosis in adolescence may yield different relationships with the ASRS-18 score. It should be observed that diagnostic criteria for adult ADHD were revised in the *DSM-5* Section II; regrettably, we relied on a sound epidemiological, structured interview that was explicitly designed to assess only *DSM-IV* (and ICD-10) disorders.

Finally, diagnostic agreement statistics may be influenced by the disorder base rate estimates; thus, the ASRS-18 may yield different diagnostic agreement estimates in samples that are characterized by different ADHD base rates. These considerations inherently limit the generalizability of our finding and stress the need for further studies before accepting our conclusions.

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