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PREDICTIVE VALUE OF CHILD BEHAVIOR CHECKLIST/6-18, YOUTH SELF-REPORT AND CONNERS 3 ADHD INDEX FOR ADHD IN SCHOOL-AGED CHILDREN

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Abstract

The best predictors of attention deficit hyperactivity disorder (ADHD) were examined using Conners 3 ADHD Index (Conners 3 AI) (teacher and parent reports), Child Behaviour Checklist for ages 6-18 (CBCL/6-18) and Youth Self Report for ages 11-18 (YSR/11-18) in a sample of 350 schoolchildren from the Epidemiological Project on Neurodevelopmental Disorders (EPINED) (*n*= 2,818). The diagnosis was made on the basis of the DSM-5 criteria and the three presentations of ADHD were categorised as non-diagnosis (*n*= 175), subclinical (*n*= 56) or clinical (*n*= 118). Discriminant analyses showed that the CBCL attention problems scale was the best predictor, correctly classifying almost 80% of cases (78.4% unadjusted model; 79.2% model adjusted for IQ and socioeconomic level). The slow cognitive time scale was the best predictor of inattention presentation (68.7% unadjusted; 71.0% adjusted) and the DSM scale of attention problems was the best predictor of hyperactive-impulsive (71.1% unadjusted; 78.0% adjusted) and the combined (68% unadjusted; 71.0% adjusted) presentation. Predictors did not differ between models for two (non-diagnostic and clinical) or three diagnostic categories (non-diagnostic, subclinical and clinical).

KEY WORDS: *ADHD, CBCL/6-18, validity, school-age children.*

Resumen

Se examinaron los mejores predictores del trastorno de déficit de atención e hiperactividad (TDAH) considerando el Índice de TDAH de Conners 3 (Conners 3 AI), el Listado de comportamientos infantiles/6-18 (CBCL/6-18) y el Autoinforme juvenil/11-18 (YSR/11-18) en 350 escolares. El diagnóstico se realizó con base en los criterios DSM-5 y se consideraron las categorías de no-diagnóstico (*n*= 175), subclínico (*n*= 56) y clínico (*n*= 118) con las tres presentaciones de TDAH. Los análisis discriminantes mostraron que la escala de problemas de atención del CBCL fue el mejor predictor, clasificando correctamente casi el 80% de los casos

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(78,4% modelo no ajustado; 79,2% modelo ajustado por el cociente intelectual y nivel socioeconómico). Para la presentación de inatención el mejor predictor fue la escala de tiempo cognitivo lento (68,7% no ajustado; 71,0% ajustado) y para las presentaciones hiperactivo-impulsivo (71,1% no ajustado; 78,0% ajustado) y combinada (68% no ajustado; 71,0% ajustado) la escala DSM de problemas de atención. Los predictores no difirieron entre los modelos para dos (no-diagnóstico y clínico) o tres categorías diagnósticas (no-diagnóstico, subclínico y clínico).
PALABRAS CLAVE: *TDAH, CBCL/6-18, validación, niños escolares*.

Introduction

Attention deficit-hyperactivity disorder (ADHD) is a heterogeneous neuropsychiatric disorder frequently diagnosed in childhood and defined as a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with child functioning (APA, 2013). The prevalence of ADHD in Spain is around 7% (Catalá-López et al., 2012), although considerable discrepancies have been found according to the methodology used (Lora & Moreno, 2010). On the other hand, other studies show significant increases in its prevalence in the last decade, which also affects ADHD diagnosis in the adult population (Getahun et al., 2013; Oehrlein, Burcu, Safer, & Zito, 2016; Visser et al., 2014).

The diagnosis of ADHD is based on the presence of inattention and/or hyperactivity and impulsivity symptoms prior to 12 years of age and present in two or more settings (DSM-5 criteria). The initial screening of ADHD is challenging because many of the ADHD symptoms represent an excess of normal child behaviours. Thus, the severity is the only criterion for differentiating between whether a behaviour is an ADHD symptom or not.

Structured diagnosis interviews are the most reliable and valid diagnosis instruments. However, using this type of instrument is often cumbersome, and therefore rating scales, which have been proven to be valid for ADHD screening, are now commonly used. Furthermore, these instruments can be completed by parents and teachers, which is important given that the Subcommittee on Attention-Deficit/Hyperactivity Disorder, Steering Committee on Quality Improvement and Management (2011) recommends having information about the presence of symptoms from different sources, such as parents and teachers and even from the children themselves. However, which informant (parents, teachers or the children themselves) is most reliable in reporting the child's behaviour remains unclear. Previous cross-sectional studies in different cultures have found conflicting results about the agreement of information from the various informants: parents - teachers - children (Cosi, Canals, Hernández-Martinez, & Vigil-Colet, 2010; Gresham et al., 2018; Petot, Rescorla, & Petot, 2011; Rescorla et al., 2017; Wang et al., 2014). Furthermore, while Wang et al. (2014) found that some factors like being a boy, being older and having high levels of family conflict increases the parent - child discrepancies, Petot et al. (2011) did not find variations, according to problem type, identity of the parental informant, gender or age of the adolescent, in informant agreement. For ADHD, Canals, Morales-Hidalgo, Jané, & Domènech (2018) found that parents reported more symptoms

than teachers, but Rabiner et al. (2010) found that teachers showed instability in clinically elevated ratings of inattentive symptoms.

Of the rating tools, some of the most used are the Conners' scales (Conners, 2008), the ASEBA measures (Achenbach & Rescorla, 2001) and the ADHD Rating Scale-IV (ADHD-RS-IV) (DuPaul, Power, Anastopoulous, & Reid, 1998). The ADHD Rating Scale-IV (DuPaul et al., 1998) is a checklist of 18-items developed to assess ADHD symptomatology according to DSM-IV criteria in children aged 5 to 18 and frequently usedfor screening in primary care and school environment (Lora & Moreno, 2010). Conners' scales are commonly used in the assessment of ADHD symptoms, and there are several versions according to the number of items and for different informants. Therefore, *Conners 3 ADHD Index* (Conners 3 AI) is a brief tool used for assessing the ADHD symptoms in school aged children (6-18 years old) and is derived from the *Conners Rating Scale* (Conners, 2008). Previous research has determined that these rating scales presented a sensitivity of 78-92% and a specificity of 84-94% for ADHD in discriminant analyses (Conners, Sitarenios, Parker, & Epstein, 1998a, 1998b). However, no data about the predictive value of the Conners 3 AI have been published (Snyder et al., 2008). The ASEBA measures are used to identify a wide range of psychological problems during childhood and adolescence by age group and informant. There are three report forms for schoolchildren: the *Child Behavior Checklist* for school aged children (CBCL/6-18) completed by parents, *Teacher Report Form* (TRF/6-18) completed by teachers, and *Youth Self-Report* (YSR/11-18) completed by adolescents (Achenbach & Rescorla, 2001). Data obtained from these instruments are relevant for both clinical practice and research because they provide a multidimensional profile of child behaviour. In fact, the results of some studies have shown the good predictive value of CBCL/6-18 and TRF/6-18 for the screening of various psychiatric problems, and specifically ADHD (Biederman, Monuteaux, Kendrick, Klein, & Faraone, 2005; Schmeck et al., 2001; Spencer et al., 2018). Furthermore, both Spencer et al., (2018) and Schmeck et al., (2001) found that the attention problems subscale has the highest predictive value. However, Jarret, van Meter, Youngstrom, Hilton, & Ollendick, (2018) found that ASEBA measures (CBCL/6-18 and TRF/6-18) are useful and effective tools for predicting ADHD combined presentation diagnosis but not for the inattentive presentation. Likewise, Levelink, Feron, Dompeling, & van Zeben-van de Aa, (2018) found that both CBLC/6/-18 and TRF/6-18 were good predictors for specialized mental health care, although some additional sociodemographic characteristics need to be considered.

Given that ADHD is a highly prevalent disorder, we believe it is important to propose a reliable and effective protocol for ADHD screening in the various professional fields (clinical, educational and research). The propose of the present study is to analyse the best predictors of ADHD diagnosis considering the data from several informants obtained with the Conners' and the specific ADHD ASEBA measures and determine whether the use of more than one these instruments increases the prediction power of ADHD diagnosis in comparison with the use of a single scale. Finally, we will also examine whether the accuracy of these instruments, regardless of the child intelligence quotient (IQ) and family

socioeconomic status (SES), varies between the specific groups of ADHD symptoms.

Methods

Participants

The sample of this study was drawn from the Neurodevelopmental Disorders Epidemiological Research Project (EPINED), which recruits a representative sample of the community school population of children from Nursery Education (3-5 years of age) and Primary Education (10-11 years of age) in the province of Tarragona (Spain). Participants come from ordinary schools that are randomly selected to include a representative sample from urban and rural areas (of the 213 possible schools, 66 were selected). All the schoolchildren attending the second course of Nursery Education (*n*= 2.755) and the fifth course of Primary Education (*n*= 2.818) in the selected schools were invited to participate in the study. The first phase of the project consisted of screening for ASD, SCD and ADHD and, in the second phase, the diagnostic procedure of ASD, SCD and ADHD were carried out.

The total final sample for the present study was 350 children from Primary Education, of whom 177 were at risk of ADHD and 173 were controls. Of the total sample, 35.7% (*n*= 125) were girls, the mean age was 10.97 (*SD*= 0.459) and 85.1% (*n*= 298) were autochthonous. In terms of family SES, about half were middle SES (54.3%; *n*= 190), 18.0% (*n*= 63) were high SES and 14.9 (*n*= 52) were low SES. In terms of diagnosis, 50.0% (*n*= 175) were classified as non-diagnosis, 16% (*n*= 56) as subclinical and 33.7% (*n*= 118) as clinical. No significant differences were found in terms of age, gender, ethnicity or SES between participating and non-participating families or between first- and second-phase samples.

Instruments

a) *Conners 3 ADHD Index* (Conners 3 AI; Conners, 2008). The Conners 3 AI is a 10-item scale which assesses the presence of ADHD symptoms in children between 6 and 18 years of age. This scale has a cut-off point for elevated scores or subclinical range (65-69 Tscore) and for very elevated scores or clinical range (≥70 T score). The reliability in the Spanish population was α= .92 for the parents' form and α= .97 for the teachers' form (Morales-Hidalgo, Hernández-Martínez, Vera, Voltas, & Canals, 2017).
b) *Child Behavior Checklist* (CBCL/6-18; Achenbach & Rescorla, 2001). The CBCL/6-18 is a 113 item questionnaire reported by parents of children aged 6-18 years old which provides eight syndrome scales (anxious depressed, withdrawn depressed, somatic complaints, social problems, thought problems, attention problems, rule-breaking behaviour and aggressive behaviours), six DSM oriented scales (including attention deficit/hyperactivity problems scale), a sluggish cognitive tempo scale and a score of total psychological problems. The reliability of the Spanish version ranged from α= .71 to α= .87 (Sardinero,

Massa, & Muñiz, 1997). The Youth Self-Report (YSR/11-18) is a self-reported questionnaire administered to children and adolescents aged 11-18 which provides the same scales with the exception of sluggish cognitive tempo (Achenbach, 1991). The reliability of the Spanish version for the ranged from α= .27 to α= .83 (Abad, Forns, Amador, & Martorell, 2000). The reliability of the YSR/11-18 in our sample ranged from α= .60 to α= .82 among the syndrome scales and for total psychological problems scale was α= .93.

c) *Kiddie Schedule for Affective Disorders and Schizophrenia for School Age Children Present and Lifetime Version* (K-SADS-PL; Kaufman et al., 1997). The K-SADS-PL is one of the most widely used diagnostic interviews in research and clinical care to collect information on psychiatric disorders in children or adolescents. We used the Spanish version which has shown good reliability and validity (de la Peña et al., 2018; Ulloa et al., 2006). In this case, it was administered to the parents to obtain ADHD diagnoses. The ADHD section of K-SADS contemplates DSM manifestations on inattention, hyperactivity-impulsivity, and temporal and interference criteria separately.
d) *Wechsler Intelligence Scale for Children* (WISC-IV; Wechsler, 2005). The WISC-IV was administered to obtain the children's IQ. WISC-IV is an intellectual aptitude assessment tool which provides information about child total IQ and several neuropsychological functions. It can be administered to children between 6 and 16 years old.
e) *Hollingshead Four Factor Index of Socioeconomic Status* (Hollingshead, 2011). Family SES was calculated considering the parental education level and employment following the Hollingshead Four Factor Index of Socioeconomic Status.

Procedure

The present study focuses on the participants in the second phase of the fifth course of Primary Education (10-11 years of age) and the data from the ADHD screening and diagnostic procedure. In the first phase, ADHD screening was carried out by Conners 3 AI reported by parents and teachers. Children who scored 65 (T score) or above on parent and teacher reports (risk sample), and children without risk of any neurodevelopmental disorder randomized by age, sex and school (control sample) were selected to participate in the second phase. In this phase, the diagnostic procedure was carried out using the Wechsler Intelligence Scales for Children (WISC-IV) and the Youth Self-Report (YSR/11-18) administered to children, and the Kiddie Schedule for Affective Disorders and Schizophrenia for School Age Children (K-SADS) and the Child Behavior Checklist (CBCL/6-18), which were administered to parents. Moreover, additional sociodemographic data were collected on ethnicity, family SES (parental education and employment), pregnancy and birth outcomes, age of parents and current residence, as were data on the psychopathological history of the child and previous pharmacological, psychological or educational intervention and the family history of psychological problems.

ADHD diagnosis was made by experienced research team members on the basis of the results obtained in the assessment and in accordance with DSM-5 criteria. Children who fully met the DSM-5 criteria for inattentive presentation (six or more manifestations of pattern of inattention for the past 6 months) or hyperactive/impulsive presentation (six or more manifestations of pattern of hyperactivity and impulsivity for the past 6 months) or combined presentation (inattention and hyperactivity-impulsivity are met for the past 6 months), symptoms were present prior to age 12 years and interfering in at least two settings (home, school, with friends) were classified as clinical ADHD. Children who presented four or five manifestations that interfered in at least one context were classified as subclinical ADHD. Finally, children who did not present enough manifestations for a diagnosis of clinical or subclinical ADHD were classified as Non-ADHD.

The study was approved by the Catalan Department of Education and the Research and Ethics Committees at the Sant Joan University Hospital (Reus, Spain). Informed consent was obtained from all the parents of the participating children. The children assented verbally to participate, and all the schools contacted also agreed to participate.

Data analyses

ANOVA and chi-square test were used to compare child characteristics and the potential predictors between the three ADHD diagnosis groups. For significant ANOVA's, multiple comparisons were carried out to examine among which diagnostic groups the differences were. Tukey's or Tamhane's T2 test was used depending on the presence or absence of homoscedasticity.

To determine the accuracy of the scales classifying children in one ADHD diagnosis group or another, an exploratory hierarchical discriminant analysis was carried out for all ADHD diagnoses (whatever the presentation was) and for each ADHD presentation separately with all possible predictors. Then, we performed two more discriminant analyses: the first one, we introduced the significant predictors found in the previous analyses and second one, we introduced only the best predictor. Finally, we also computed the same two analyses again but adjusted for child IQ and family SES. Data were analysed using SPSS 22.0 (IBM, 2013).

Results

Table 1 shows the socio-demographic and psychological data of the sample. Of the final sample (n= 350), 33.7% (118) of the children met the criteria for clinical ADHD diagnosis and 16.0% (56) for subclinical ADHD diagnosis. There were no differences in sociodemographic data between diagnosis groups.

Of the clinical ADHD diagnosed children, 41.5% (49) were inattentive, 9.3% (11) were hyperactive and 49.2% (58) were a combined presentation. Of the participating children, 36.4% (43) already had a previous ADHD diagnosis from other external clinical services.

The mean total IQ was in the middle range (100.42; *SD*= 15.62). As we can see in Table 2, children of the non-ADHD group showed significantly higher scores in the WISC total IQ compared to their peers with clinical ADHD. No differences were found between the non-ADHD and subclinical groups nor between the subclinical and clinical ADHD groups.

Table 1
Clinical and socio-demographic differences between ADHD diagnosis groups (ANOVA and chi-square analyses)

Clinical and socio-demographic characteristics	Non-ADHD (*n*= 175)	Subclinical ADHD (*n*= 56)	Clinical ADHD (*n*= 118)	*F*	*p*
	M (SD)	*M (SD)*	*M (SD)*		
Total IQ	103.31 (15.88)	98.98 (12.74)	96.81 (14.10)	7.00	.001
YSR/11-18 Attention problems scale	52.79 (5.15)	56.54 (7.94)	59.47 (9.36)	24.56	<.001
YSR/11-18 DSM ADHD problems scale	53.27 (5.12)	56.33 (6.74)	58.86 (8.28)	22.12	<.001
YSR/11-18 Total Psychological problems	45.64 (10.07)	50.33 (10.61)	54.71 (11.21)	25.20	<.001
CBCL/6-18 Attention problems scale[c]	54.90 (5.52)	63.52 (7.47)	68.29 (10.21)	95.80	<.001
CBCL/6-18 DSM ADHD problems scale	54.13 (5.26)	60.02 (6.17)	65.72 (8.20)	99.74	<.001
CBCL/6-18 DSM Sluggish cognitive tempo scale	54.33 (6.32)	59.93 (8.15)	63.32 (9.09)	42.7	<.001
CBCL/6-18 Total psychological problems scale	51.75 (9.12)	58.13 (8.20)	64.71 (8.23)	75.43	<.001
Conners' Parental ADHD Index Total score	63.44 (17.48)	81.61 (11.40)	85.26 (11.17)	109.01	<.001
Conners' Teachers ADHD Index Total score	57.06 (17.18)	73.07 (15.58)	76.64 (15.94)	54.77	<.001
Age (years)	10.94 (0.44)	10.97 (0.46)	11.05 (0.48)	1.12	.326
	% (*n*)	% (*n*)	% (*n*)	χ^2	*p*
Sex (girls)	38.9 (68)	37.5 (21)	30.5 (36)	2.12	.346
Nationality (autochthonous)	86.3 (151)	87.5 (49)	82.2 (97)	1.29	.522
High SES	21.1 (37)	10.7 (6)	16.9 (20)	2.21	.697
Middle SES	54.3 (95)	55.4 (31)	53.4 (63)		
Low SES	15.4 (27)	14.3 (8)	14.4 (17)		

Note: Total IQ= Total Intelligence Quotient; YSR/11-18= Youth Self Report for ages 11 to 18; CBCL/6-18= Child Behavior Checklist for ages 6 to 18; Conners' 3 AI= Conners' 3 ADHD Index; SES= socioeconomic status.

There were significant differences in child psychological outcomes between the non-ADHD and clinical ADHD groups in all scales, and between the non-ADHD

and subclinical ADHD groups. Differences between subclinical and clinical ADHD groups were found in total psychological problems, attention problems and ADHD problem scales (see Table 2). The results of these analyses showed that these measurements were suitable for posterior discriminant analyses. Nevertheless, the fact that most of the measures were not able to differentiate between subclinical and clinical ADHD groups seems to indicate that discriminant analysis will be better at classifying individuals into two ADHD diagnosis groups than into three.

Table 2

Multiple comparisons between ADHD diagnosis groups (Tukey or Tamhane's test depending on homoscedasticity)

Variables	Comparisons between ADHD diagnosis groups	Differences between means	*p*
Total IQ	Non-ADHD vs. Subclinical	4.324	.141
	Non-ADHD vs. Clinical	6.494	.001
	Subclinical vs. Clinical	2.170	.640
YSR/11-18 Attention problems scale	Non-ADHD vs. Subclinical	-3.746	.005
	Non-ADHD vs. Clinical	-6.678	< .001
	Subclinical vs. Clinical	-2.931	.111
YSR/11-18 DSM ADHD problems scale	Non-ADHD vs. Subclinical	-3.066	.009
	Non-ADHD vs. Clinical	-5.597	< .001
	Subclinical vs. Clinical	-2.532	.110
YSR/11-18 Total psychological problems scale	Non-ADHD vs. Subclinical	-4.694	.013
	Non-ADHD vs. Clinical	-9.072	< .001
	Subclinical vs. Clinical	-4.378	.034
CBCL/6-18 Total psychological problems scale	Non-ADHD vs. Subclinical	-6.381	< .001
	Non-ADHD vs. Clinical	-12.959	< .001
	Subclinical vs. Clinical	-6.578	< .001
CBCL/6-18 Attention problems scale	Non-ADHD vs. Subclinical	-8.620	< .001
	Non-ADHD vs. Clinical	-13.394	< .001
	Subclinical vs. Clinical	-4.774	.003
CBCL/6-18 ADHD problems scale	Non-ADHD vs. Subclinical	-5.887	< .001
	Non-ADHD vs. Clinical	-11.589	< .001
	Subclinical vs. Clinical	-5.702	< .001
CBCL/6-18 DSM Sluggish cognitive tempo scale	Non-ADHD vs. Subclinical	-5.597	< .001
	Non-ADHD vs. Clinical	-8.995	< .001
	Subclinical vs. Clinical	-3.398	.051
Conners' 3 AI Parents Total score	Non-ADHD vs. Subclinical	-18.171	< .001
	Non-ADHD vs. Clinical	-21.825	< .001
	Subclinical vs. Clinical	-3.654	.150
Conners' 3 AI Teachers Total score	Non-ADHD vs. Subclinical	-16.017	< .001
	Non-ADHD vs. Clinical	-19.584	< .001
	Subclinical vs. Clinical	-3.567	.390

Note: Total IQ= Total Intelligence Quotient; YSR/11-18= Youth Self Report for ages 11 to 18; CBCL/6-18= Child Behavior Checklist for ages 6 to 18; Conners' 3 AI= Conners' 3 ADHD Index.

The discriminant analysis (Table 3) for all ADHD presentation showed that the best predictors were the attention problems and DSM ADHD problems CBCL/6-18 scales and the Conners' total score (parental and teacher report). This model classifies correctly 66.1% of the cases (64.3% when it was adjusted for child total IQ and family SES level). The CBCL attention problems scale was the best predictor, as it correctly classified 66.8% by itself. In the case of inattentive ADHD presentation, the sluggish cognitive tempo scale was the best predictor (63.3%) and this value slightly increases when all the scales included in the model are considered (67.9% unadjusted; 68.5% adjusted). For the hyperactive and combined ADHD presentations, only the DSM ADHD problems scale was a predictor for ADHD (66.3%/51.4% and 66.9%/64.3% for the adjusted/unadjusted model, respectively).

Table 3
Classification for each ADHD presentation according to three diagnosis groups using stepwise discriminant analysis and considering only the best predictor

ADHD presentation	Unadjusted analises				Adjusted analises			
	Non-ADHD	Subclinical ADHD	Clinical ADHD	overall (%)	Non-ADHD	Subclinical ADHD	Clinical ADHD	overall (%)
All ADHD diagnoses[a]								
Non-ADHD	73.7 (123)	21.0 (35)	5.4 (9)	66.1	74.7 (112)	19.3 (29)	6.0 (9)	64.3
Subclinical ADHD	11.3 (6)	58.5 (31)	30.2 (16)		14.0 (6)	48.8 (21)	37.2 (16)	
Clinical ADHD	8.2 (9)	33.6 (37)	58.2 (64)		9.7 (9)	35.5 (33)	54.8 (51)	
Using only the best predictor: CBCL Attention problems subscale								
Non-ADHD	82.0 (137)	10.8 (18)	7.2 (12)	66.8	79.3 (119)	13.3 (20)	7.3 (11)	66.0
Subclinical ADHD	29.6 (16)	33.3 (18)	37.0 (20)		25.6 (11)	41.9 (18)	32.6 (14)	
Clinical ADHD	23.0 (26)	16.8 (19)	60.2 (68)		23.2 (22)	21.1 (20)	55.8 (53)	
Inattentive ADHD[b]								
Non-ADHD	73.7 (182)	14.6 (36)	11.7 (29)	67.9	74.2 (158)	13.6 (29)	12.2 (26)	68.5
Subclinical ADHD	22.2 (8)	41.7 (15)	36.1 (13)		27.6 (8)	34.5 (10)	37.9 (11)	
Clinical ADHD	14.9 (7)	27.7 (13)	57.4 (27)		15.9 (7)	20.5 (9)	63.6 (28)	
Using only the best predictor: CBCL Sluggish cognitive tempo subscale								
Non-ADHD	69.0 (171)	14.9 (37)	16.1 (40)	63.3	68.5 (146)	16.4 (35)	15.0 (32)	63.3
Subclinical ADHD	43.2 (16)	21.6 (8)	35.1 (13)		41.4 (12)	17.2 (5)	41.4 (12)	
Clinical ADHD	23.4 (11)	10.6 (5)	66.0 (31)		20.5 (9)	11.4 (5)	68.2 (30)	

Hyperactive ADHD[c]								
Non- ADHD	67.0 (211)	10.5 (33)	22.5 (71)	66.3	57.3 (122)	14.1 (30)	28.6 (61)	51.4
Subclinical ADHD	50.0 (3)	16.7 (1)	33.3 (2)		41.4 (12)	27.6 (8)	31.0 (9)	
Clinical ADHD	27.3 (3)	0.0 (0)	72.7 (8)		36.4 (16)	25.0 (11)	38.6 (17)	
Combined ADHD[d]								
Non-ADHD	66.8 (179)	18.7 (50)	14.6 (39)	66.9	63.7 (151)	22.4 (53)	13.9 (33)	64.3
Subclinical ADHD	36.4 (4)	36.4 (4)	27.3 (3)		37.5 (3)	50.0 (4)	12.5 (1)	
Clinical ADHD	13.2 (7)	13.2 (7)	73.6 (39)		2.4 (1)	26.8 (11)	70.7 (29)	

Notes: Adjusted model for the covariates: Total IQ and family socioeconomic status. Subscales entered in each model (sorted by order of entry): [a]CBCL Attention problems subscale; Conners' Teacher Total score; Conners' Parental Total score and CBCL DSM ADHD problems subscale; [b]CBCL Sluggish cognitive tempo subscale; Conners' Teacher Total score; CBCL DSM ADHD problems subscale; CBCL Attention problems subscale and Conners' Parental Total score; [c]CBCL DSM ADHD problems subscale; [d]CBCL DSM ADHD problems subscale.

For discriminating children without ADHD symptomatology from children with ADHD we grouped the clinical and subclinical groups to carry out new analyses. Table 4 shows that for all ADHD presentations, the overall percentage was 81.9% (83.0% adjusted) and the best predictor was the CBCL attention problems scale (78.4%/79.2%). Considering the inattentive presentation, the overall percentage of hits of the model was 75.5% (77.3% adjusted) and the best predictor was the sluggish cognitive tempo scale (68.7%/71.0%). Regarding the hyperactive presentation, the entire model classified 72.7% of the children (76.2% adjusted) and the best predictor was the CBCL DSM ADHD problems scale (66.9%/ 69.6%). For the combined presentation, 79.2% (77.6% adjusted) was correctly classified by the DSM ADHD and CBCL attention problems scales, and the best predictor (DSM ADHD scale) classified 77.1% (78% adjusted).

Table 4

Classification table for each ADHD presentation according to two diagnosis groups using stepwise discriminant analysis and considering only the best predictor

ADHD presentation and diagnosis group	Unadjusted analises			Adjusted analises		
	Non-ADHD	ADHD	Overall (%)	Non-ADHD	ADHD	Overall (%)
All ADHD diagnosis[a]						
Non- ADHD	77.8 (130)	22.2 (37)	81.9	80.0 (120)	20.0 (30)	83.0
ADHD diagnosis	13.9 (23)	86.1 (142)		13.8 (19)	86.2 (119)	
Using only the best predictor: CBCL Attention problems subscale						
Non- ADHD	82.0 (137)	18.0 (30)	78.4	84.0 (126)	16.0 (24)	79.2
ADHD diagnosis	25.1 (42)	74.9 (125)		26.1 (36)	73.9 (102)	
Inattentive ADHD[b]						
Non- ADHD	78.1 (193)	21.8 (54)	75.5	79.3 (169)	20.7 (44)	77.3
ADHD diagnosis	32.5 (27)	71.1 (59)		28.8 (21)	71.2 (52)	

ADHD presentation and diagnosis group	Unadjusted analises			Adjusted analises		
	Non-ADHD	ADHD	Overall (%)	Non-ADHD	ADHD	Overall (%)
Using only the best predictor: CBCL Sluggish cognitive tempo subscale						
Non- ADHD	69.0 (171)	31.0 (77)	68.7	71.4 (152)	28.6 (61)	71.0
ADHD diagnosis	32.1 (27)	67.9 (57)		30.1 (22)	69.9 (51)	
Hyperactive ADHD[c]						
Non- ADHD	72.5 (227)	27.5 (86)	72.7	76.1 (207)	23.9 (65)	76.2
ADHD diagnosis	23.5 (4)	76.5 (13)		21.4 (3)	78.6 (11)	
Using only the best predictor: CBCL DSM ADHD problems subscale						
Non- ADHD	67.0 (211)	33.0 (104)	66.9	69.9 (109)	30.1 (82)	69.6
ADHD diagnosis	35.3 (6)	64.7 (11)		35.7 (5)	64.3 (9)	
Combined ADHD[d]						
Non- ADHD	81.7 (219)	18.3 (49)	79.2	80.2 (190)	19.8 (47)	77.6
ADHD diagnosis	31.3 (20)	68.8 (44)		34.7 (17)	65.3 (32)	
Using only the best predictor: CBCL DSM ADHD problems subscale						
Non-ADHD	79.9 (214)	20.1 (54)	77.1	79.3 (14)	20.7 (49)	78.0
ADHD diagnosis	34.4 (22)	65.6 (42)		28.6 (14)	71.4(35)	

Notes: Adjusted model for the covariates: Total IQ and family socioeconomic status. Subscales entered in each model (sorted by order of entry): [a]CBCL Attention problems subscale; Conners' Teacher Total score and Conners' Parental Total score; [b]CBCL Sluggish cognitive tempo subscale; Conners' Teacher Total score; CBCL DSM ADHD problems subscale; CBCL Attention problems subscale and Conners' Parental Total score; [c]CBCL DSM ADHD problems subscale; CBCL Sluggish cognitive tempo subscale and Conners' Parental Total score; [d]CBCL DSM ADHD problems subscale and CBCL Attention problems subscale.

Discussion

The Conners' and ASEBA measures are screening tools that are widely used for identifying psychological problems in young populations. Both instruments have demonstrated that they have good psychometric properties in many multicultural contexts (Achenbach & Rescorla, 2007), including the Spanish population (Albores-Gallo et al., 2007; Morales-Hidalgo et al., 2017). The propose of the present study was to determine which administered scales and informants were most accurate for detecting ADHD problems, and whether the combined use of these scales would improve their accuracy. Furthermore, we also wanted to study whether the parent (CBCL/6-18) and youth self-report (YSR711-18) of the ASEBA measures, which provide broad information on psychological problems, could be a valid instrument in our context for ADHD screening as well as other specific instruments. Thus, data about ADHD and possible comorbidities could be collected. We consider adjusting the analyses according to the child total IQ and family SES relevant, because it has been established that the family SES level is a strong risk factor for ADHD prevalence(Rowland et al., 2018) and that children with a low IQ may be considered by teachers or parents as inattentive or may also have hyperactive symptoms.

When three diagnosis groups were considered, the model showed an acceptable percentage of hits (between 66.1% and 67.9%) predicting the belonging of individuals to the non-ADHD, the subclinical or the clinical group.

However, as we expected, when clinical and subclinical diagnosis groups were put into one group, the accuracy of the models increased (72.7% - 81.9%). These results may be due to the confounding effect of children diagnosed as subclinical. It seems, then, that these instruments are useful for detecting ADHD problems; however, distinguishing between clinical and subclinical diagnoses requires an accurate clinical assessment. The results also showed that using whole models was slightly more accurate than using only the best predictor (an improvement of between 2% and 6%).

In this regard, the best predictor for all ADHD presentations was the CBCL/6-18 attention problems scale. This result is in line with the results found by previous research, which also show that the attention problems scale is the most accurate at identifying children with ADHD (Schmeck et al., 2001; Spencer et al., 2018). The best predictor of inattentive ADHD presentation was the sluggish cognitive tempo scale. This was in contrast to the results obtained by Jarret et al., (2018) who showed that CBCL/6-18 only diagnoses the combined presentation effectively, but not for inattentive presentation. For hyperactivity and the combined presentations, the DSM ADHD problems CBCL scale was the most accurate. These results agree with those of some previous studies which found that DSM-oriented scales can provide accurate information for clinical diagnosis (Lacalle, Ezpeleta, & Doménech, 2012; Lacalle Sistere, Domenech, Granero Perez, & Ezpeleta, 2014; Nakamura, Ebesutani, Bernstein, & Chorpita, 2009). As suggested by Lacalle et al. (2012), this result could be because this scale is based on DSM criteria and supports the diagnostic specificity of the manifestations of hyperactive/impulsive symptoms. In contrast, the CBCL attention problems scale is a good measure for overall ADHD.

Although, Conners 3 AI was also a good predictor for some presentations, our results suggest that the CBLC/6-18 scales are more accurate for ADHD screening. This may be because we used the shorter forms of the Conners' scales.

Although previous research has generally shown that YSR/11-18 has a good predictive value in a variety of cultural contexts (Ivanova et al., 2007), none of the YSR scales entered as a predictor, showing that, in our sample, children are not good informants of their own ADHD problems. We suggest that it may be difficult for them to understand some items because they are too young, or because the ADHD manifestations mainly cause discomfort in their family and school. Salbach-Andrae, Lenz, & Lehmkuhl (2009) also reported that young people are not good informants about their externalizing disorders although they can be good informants about their anxiety symptoms (Cosi et al., 2010). In contrast, some previous studies found that various youth self-reported instruments were able to discriminate between diagnosis groups (Conners et al., 1997; Danielson, Youngstrom, Findling, & Calabrese, 2003).

Finally, there was little difference between the adjusted and unadjusted models, which supports that the results were not influenced by the family SES and the child total IQ. This endorses the high accuracy of the clinical test, regardless of child IQ and the family SES (Rowland et al., 2018).

One possible limitation was the small number of children in each group when we divided them into the ADHD presentation and especially into the subclinical and clinical groups. Further, it could be interesting to examine the possible

differences in relation to gender; however, this was not possible due to the low number of girls with ADHD problems in our study. Another limitation of the sample was the young age of children. Although the scale is designed to be used by children who are at least 11 years old, Ebesutani, Bernstein, Martínez, Chorpita, & Weisz, (2011) found that children between 7 and 8 years of age were able to provide valid reports on the YSR/11-18, as same as we found in our sample. The mean age of our sample was 10.97 years of age so they are a little young for the YSR/11-18. However, the children were helped to complete the questionnaire by members of the research team, thus ensuring that they understood the questions. Finally, we did not have the parental history of the ADHD children, which would be an interesting condition to control as a covariate (Rowland et al., 2018). In spite of these limitations, this is a novel study carried out with a large sample constituted by children aged 10 - 11 from urban and rural areas. Thus, our study population was representative of the population, which increases the generalizability of our findings.

In conclusion, the Conners 3 AI and CBCL/6-18 scales are appropriate for ADHD screening; however, they are not very reliable for discriminating between subclinical and clinical diagnoses. Thus, CBCL/6-18 is useful instrument for ADHD screening as well as providing data about other psychological problems. The entire models were only slightly more accurate than just the best predictor by itself, which makes it difficult to determine whether it is worth applying more than one instrument.

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