

Alberto Fernández-Jaén<sup>1</sup>  
 Daniel Martín Fernández-Mayoralas<sup>1</sup>  
 Sonia López-Arribas<sup>2</sup>  
 Alexandra Pardos-Véglia<sup>3</sup>  
 Blanca Muñoz-Borrega<sup>3</sup>  
 Carolina García-Savaté<sup>3</sup>  
 Baldomero Prados-Parra<sup>3</sup>  
 Beatriz Calleja-Pérez<sup>4</sup>  
 Nuria Muñoz-Jareño<sup>5</sup>  
 Ana L. Fernández-Perrone<sup>1</sup>

# Social and leadership abilities in attention deficit/hyperactivity disorder: relation with cognitive-attentional capacities

<sup>1</sup>Pediatric Neurology Unit  
 Hospital Universitario Quirón. Centro CADE. Madrid

<sup>2</sup>Pediatric Psychiatry Unit  
 Hospital Gómez Ulla. Madrid. Centro CADE. Madrid

<sup>3</sup>Pediatric Psychology Unit  
 Centro CADE. Madrid

<sup>4</sup>Pediatric Primary Care  
 Centro de Salud Doctor Cirajas. Madrid

<sup>5</sup>Neuropediatric Section  
 Hospital Infanta Leonor de Vallecas. Madrid

**Objective.** We have analyzed social and leadership abilities in children with ADHD and their relationship with execution of tasks involving sustained attention and inhibitory control.

**Patients and methods.** A retrospective analysis of 170 patients with ADHD was performed. We evaluated leadership and social abilities, measured through the Behavior Assessment System for Children (BASC) and their relations with the results of different neuropsychological tests, including Wechsler scale for children (WISC-IV) and Conners' continuous performance (CPT II).

**Results.** In the differential analysis between the IQ, results of the tests and their relation to BASC scores, a statistically significant relation was observed between attentional capacity expected according to the patient's intelligence and social skills scores (according to BASC filled out by mothers and teachers) and leadership (according to all informants) sections.

**Conclusiones.** Attentional difficulties are closely related to social competence in patients with ADHD, either by a direct cause-effect relationship or a shared dysexecutive substrate of this disorder.

**Key words:** BASC, CPT-II, Social Skills, Leadership, ADHD, Attention Deficit/Hyperactivity Disorder, WISC-IV

*Actas Esp Psiquiatr* 2012;40(3):136-46

Correspondence:  
 Alberto Fernández-Jaén  
 Hospital Universitario Quirón  
 C/ Diego de Velázquez, 1  
 28223 Pozuelo de Alarcón (Madrid)  
 Tif.902151016  
 Centro CADE  
 C/ Jimena Menéndez Pidal 8-A, 28023 Aravaca (Madrid)  
 Tif. 913573203  
 E-mail: aferjaen@telefonica.net  
 Tel.: 915858603  
 Fax: 915 183 232

## Habilidades sociales y de liderazgo en el trastorno por déficit de atención/ hiperactividad: relación con las capacidades cognitivo-atencionales

**Objetivo.** Analizamos las habilidades sociales y de liderazgo en niños con TDAH y su relación con la ejecución de tareas que implican atención y autocontrol.

**Material y métodos.** Análisis retrospectivo clínico de 170 pacientes con TDAH. Se evaluaron las habilidades sociales y de liderazgo medido a través del sistema de evaluación de la conducta de niños y adolescentes (BASC) y su relación con diferentes test neuropsicológicos, incluyendo la escala de Wechsler para niños-IV (WISC-IV) y el test de ejecución continuada de *Conners* (CPT II).

**Resultados.** En el análisis diferencial entre el cociente intelectual, los resultados de los test y su relación con las puntuaciones del BASC, se observó una relación estadísticamente significativa entre la capacidad atencional esperada para la inteligencia del paciente, y la puntuación en los apartados habilidades sociales (según el BASC rellenado por madres y profesores) y de liderazgo (según todos los informadores).

**Conclusiones.** Las dificultades atencionales están íntimamente relacionadas con la competencia social en pacientes con TDAH, bien por una relación causa-efecto directa o por un sustrato disejecutivo común en este trastorno.

**Palabras clave:** BASC, CPT-II, Habilidades Sociales, Liderazgo, TDAH, Trastorno por Déficit de Atención / Hiperactividad, WISC-IV,

## INTRODUCTION

Different studies have demonstrated that children with attention deficit hyperactivity disorder (ADHD) experience interpersonal difficulties and low social competence<sup>1,2</sup> both at home and, within the home, especially with the maternal figure,<sup>3</sup> as well as in the school setting with classmates and

teachers.<sup>1,4</sup> However, none of the symptomatic criteria of the ADHD of the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders, in its revised text (DSM-IV-TR),<sup>3</sup> on ADHD directly refer to the emotional and/or social development of the individual,<sup>1-3</sup> although the academic or social repercussion is necessary for its typification.<sup>3</sup> Although the nature of the social dysfunction may differ according to the ADHD subtype, this type of difficult many occur in any of them.<sup>5-7</sup>

This study has aimed to analyze the implication of the attentional and inhibitory difficulties of children with ADHD in their social competence. It is aimed to analyze social skills in children with ADHD and their relation to the execution of tasks that imply attention and self-control.

## MATERIAL AND METHODS

A retrospective study was made of 621 evaluations carried out between January 2007 and December 2009 in the CADE Center, which were motivated or justified by the suspicion of an ADHD. Only those cases in which the ages ranged from 6 to 12 years, in whom the clinical diagnosis of ADHD was made in accordance with the DSM-IV-TR criteria, were included.<sup>3</sup> Similarly, the criteria from the same manual for the diagnosis of comorbid disorders analyzed in this study were used.

An experienced neurologist and pediatric psychiatrist in our department made the clinical diagnoses of ADHD and of the different comorbidities using the same structured clinical interview prior to including the patients in this review. In every case, the diagnoses were retrospectively agreed on by both professionals before their inclusion and analysis.

Those cases that presented the following were excluded before their analysis:

- 1) significant motor or perspective disorders;
- 2) defined mental retardation (IQ less than 70);
- 3) diagnosis of generalized development disorder, obsessive-compulsive disorder, bipolar disorder, schizophrenia and or/psychoses;
- 4) known neurological diseases, epilepsy, drug abuse or dependence;
- 5) patients previously diagnosed or treated, psychologically or pharmacologically, due to suspected ADHD;
- 6) patients evaluated neurologically in other departments in the year prior to their evaluation.

The following parameters were collected: age, gender and ADHD subtype. Furthermore, the presence of any type of comorbidity was evaluated. For the statistical analysis in the present work, the following variables were selected: Oppositional Defiant Disorder (ODD), antisocial disorder (AD), generalized anxiety disorder (GAD) and major depressive disorder, single or recurrent episode or dysthymic disorder which we included in a single group.

As a part of the evaluation of children with ADHD in this center, a protocolized battery of cognitive tests, among them the Wechsler Intelligence Scale for Children-IV (WISC-IV),<sup>8</sup> test of perception of differences or "the face test",<sup>9</sup> test D2 of attention [10], Magallanes Scale of Visual Attention (MSVA)<sup>11</sup> and the Conners' continuous performance test (CPT II) were performed<sup>12</sup>. This battery was completed, among other measures, with a Behavior Assessment System for Children and Adolescents (BASC).<sup>13</sup>

From the WISC-IV, total intelligence quotient (IQ) was specifically recorded and within this, verbal comprehension (VC), perceptual reasoning (PR), working memory (WM) and processing speed (PS).

The perception test of differences or the Face perception test<sup>9</sup> evaluates aptitude to quickly and correctly perceive similarities and differences of partially ordered stimulating patterns (specifically faces, with variations in eyebrows, eyes, mouth or hair), for 3 minutes. In this cancellation test, the patient, after being shown the picture of a "face," must choose the exact "face" among a group of three different "faces".

The D2 test,<sup>10</sup> developed in Germany by Brickenkamp, is an assessment tool of visual stimulus processing speed in stimulus cancellation task, with a duration of four minutes. It offers a measure of the subject's concentration capacity and of the inhibitory control processes since it can establish a calculation of the commission and omission errors. The test consists in crossing out the letters "d" with a double line around it with a grid full of distracting elements (letters "d" with more than or less lines and other letters similar in form, as for example, the "p"). The variables D2-Tot and D2-Con are analyzed. The first refers to the total effectiveness in the test, expressed as a measure of the amount of work performed before eliminating the number of errors made. The second indicates the concentration index, shown as a measure of the quality of attention, that is, it provides an index of the balance between speed and accuracy in the action of the subject.

The purpose of the MSVA<sup>11</sup> is to make a quantitative and qualitative assessment of the capacity of focusing, maintaining, coding and stabilizing attention to visual stimuli during a certain period of time (6 minutes in children under 12 years and 12 minutes in those older) while a simple motor task is performed. The patient should identify the figure of a man described within a grid full of distracting stimuli in form of human figures in other postures or rotations. Said test measures two variables: sustained visual attention (MSVA-SA) - capacity to focalize and code visual stimuli during this time and quality of attention (MSVA-QA)- efficacy in focalizing and coding of visual stimulus.

The CPT-II test<sup>12</sup> is a computerized test of continuous performance that evaluates selective attention and sustained attention. It also evaluates inhibitory control and vigilance

state. The patient should watch a computer screen on which visual stimuli (letter) appear rapidly for 14 minutes. The standard protocol for the CPT is initiated with a practical and short exercise, before administration of the complete text, to assure that the individual has understood the task before its performance. After this practical exercise, the evaluation is made in a protocolized way, with the adult supervisor present during the test performance. The individuals who perform the test should press the space bar every time a letter appears on the screen, except when the "X" letter appears. The data analyzed in the CPT are the number or percentage of correct responses, the number of target stimuli lost or omission errors (CPT-Om), the number of responses after a non-target stimulus or incorrect stimuli or errors by commission (CPT-Com) and the reaction time (CPT-Hit) or latency of responses in milliseconds.

The BASC<sup>13</sup> is an assessment system of the behavior of children and adolescents based on a structured history of development and descriptive questionnaires that are filled out by the patient, parents and teachers. It measures different features of the behavior and personality. This tool has been recently validated for the Spanish population.<sup>13</sup> It evaluates clinical (aggressiveness, withdrawal, hyperactivity, inattentive and others) and adaptive (adaptability, social skills and leadership) dimensions. In this tool, social skills are defined by the expertise needed to interact satisfactorily with peers and adults in the settings of the home, school and community. This is evaluated with questions such as: "does the child help other children?", "does the child congratulate others when something goes well for them?," "Does the child make suggestions without offending the others?," etc. Leadership would be included in the skill associated to achieving academic, social or community goals, specifically including the capacity to work well in group. The questions to sound out this skill are "does the child participate in social clubs or organizations?"; "Is the child generally considered the leader?"; "Does the child make decisions easily?"; "Does the child make good proposals for problem solving?," among others. Given the age, the BASC level II was used (corresponding to 6 to 12 year old children). This was made up of 134 questions in the version for the parents and 99 questions in the version for the tutors. Each item was scored from "A to D" (corresponding numerically to "0 to 3") where "A" corresponded to "it never occurs," and "D" to "it almost always occurs." Higher global scores on the hyperactivity scale or attention problems are related to greater symptomatic intensity in these sections. Global scores on the social skills scale or leadership are related to lower adaptive capacity of the child in these aspects.

The results of these variables (initially provided in typified or percentile scale scores) were subsequently analyzed according to the standardized data by age and gender and transformed into Z values (according to the standard test data) for their subsequent analysis.

After gathering the results, these were analyzed statistically using the SPSS v17.0 for Windows program (SPSS, Chicago). Given the size and distribution of the population studied, the relation between qualitative variables (for example, gender, ADHD subtype or presence of comorbidity) with the changes observed in the Z scores of the behavioral and attentional tests was evaluated by factorial analysis of the variance, with the Bonferroni *post-hoc* test when necessary. As correlation measurement, the Pearson coefficient was used. A regression study was only conducted following this, if necessary.

## RESULTS

Out of the 621 evaluations analyzed, 170 fulfilled the inclusion criteria indicated in the previous section. The demographic features are described in table 1.

Distribution by gender and ADHD subtype was the following:

- -girls: 22 (54%) combined subtype, 19 (46%) predominantly inattentive type
- -boys: 72 (56%) combined subtype, 55 (42%) predominantly inattentive type, 2 (2%) predominantly hyperactive-impulsive. Given the same sample size in the last subgroup, statistically significant differences could not be obtained in comparison with the rest of the subgroups so that this is not shown hereinafter in this section.

The distribution of the subtypes according to gender did not show statistically significant differences ( $p=0.68$ ).

No significant differences were observed between the mean values of the WISC-IV or the attentional tests, according to gender or comorbidity.

When the subtype of the ADHD was analyzed, patients with combined subtypes showed lower scores in all the sections of the WISC-IV compared to the predominantly inattentive subtype, this being significant in the sections Total IQ (TIQ) and VC ( $p<0.05$ ) (Figure 1).

In the attentional tests (Figure 2), children with the combined subtype showed significantly worse results in sections D2-con, CPT-om and CPT-hit, versus patients with ADHD inattentive subtype. However, patients with the ADHD inattentive subtype committed more errors in the CPT-com.

In the analysis of the "social skills" section corresponding to the BASC filled out by the mother, father, teacher, and related to gender and subtype, the following was observed:

- The scores of the mother significantly correlated with the TIQ, RP, WM and PS. No variable of the attentional

Table 1	Demographic aspects of the patients studied		
Mean age	8.4 years (SD 2.02)		
Gender	- Males: 129 (75.9%) - Females: 41 (24.1%)		
ADHD subtype (according to DSM-IV-TR criteria)	- Combined: 94 (55.3%) - Predominately inattentive: 74 (43.5%) - Predomiantely hyperactive-impulsive: 2 (1.2%)		
Cognitive capacities (WISC-IV)	- Total intelligence quotient: 103 (SD 16.7) - Verbal comprehension: 107 (SD 17.7) - Perceptive reasoning: 104 (SD 16.5) - Working memory: 94 (SD 14.4) - Processing speed: 95 (SD 15.4)		
Comorbid disorders:	Patients	%	
- Oppositional Defiant	40	23.5	
- Anxiety	18	10.5	
- Mood	30	17.6	
- Antisocial	27	15.8	

SD= standard deviation  
 ADHD= attention deficit hyperactivity disorder  
 DSM-IV-TR= fourth edition of the Diagnostic and Statistical Manual of Mental Disorders - revised text  
 WISC-IV= Wechsler Intelligence Scale for Children-IV

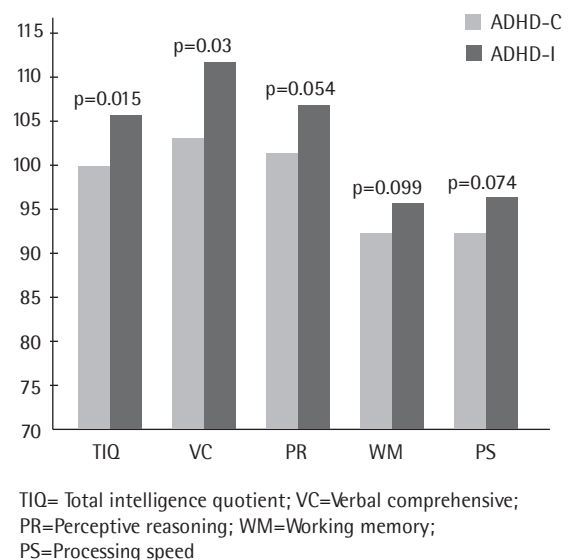
tests showed a correlate with the BASC score in social skills (Figure 3).

- There was no relation between the cognitive parameters and the BASC scores provided by the father.
- From the BASC scores provided by the teacher, a significant and linear relation was only observed with CPT-Om with a Pearson correlation index (PI) of -0.19 (p=0.02). That is, the worse the results of the CPT, the worse the social skills.

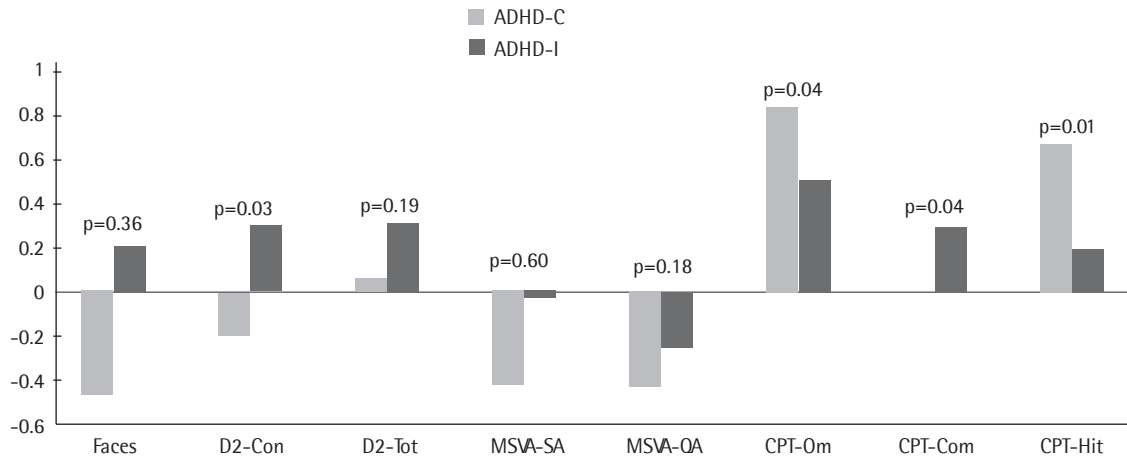
In the study of the field "leadership" itself of the BASC filled out by the mother, father and teacher, and relation to gender and subtype, the following was observed:

- The scores of the mother and father significantly correlated with all the WISC-IV scores. No variable of the attentional tests showed a correlation with the BASC score in the leadership section.
- The scores of the teacher showed a significant relation with the TIQ and VP of the WISC-IV. There were no significant relations with other parameters (Figure 4).

In the differential analysis between the TIQ and the WM or the different results of the cognitive-attentional test and

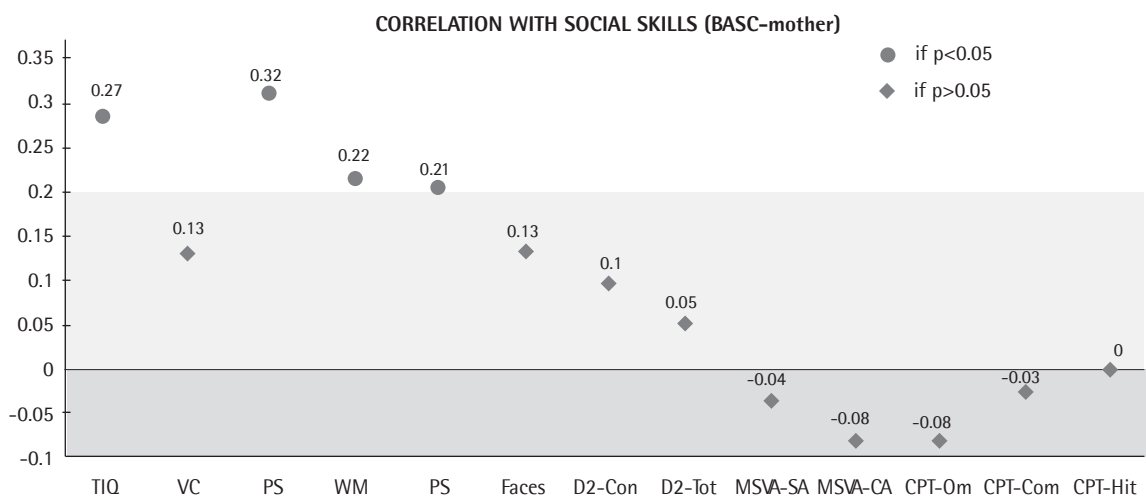


**Figure 1** Mean values of the WISC-IV (Wechsler Intelligence Scale for Children- version IV) according to ADHD subtype (ADHD-C=combined; ADHD-I=predominately inattentive)



D2 (D2 test): D2-Tot: Total effectiveness in the test and D2-Con: concentration index. MSVA (Magallanes Scale of Visual Attention): MSVA-SA=sustained attention and MSVA-OA=quality of attention. CPT (Conners Continuous-Performance Test): CPT-Om=errors by omission. CPT-Com=error by commission and CPT-Hit reaction time

**Figure 2** Mean of the Z values of the cognitive-attentional test studied according to ADHD subtype (ADHD-C=combined; ADHD-I=predominately inattentive)



WISC-IV (Wechsler Intelligence Scale for Children, version IV); TIQ= Total intelligence quotient; VC=Verbal comprehension; PR=Perceptive reasoning; WM=Working memory; PS=Processing speed. D2 (test D2): D2-Tot: total effectiveness in the test and D2-Con: concentration index. MSVA (Magallanes Scale of Visual Attention): MSVA-SA=sustained attention and MSVA-OA=quality of attention. CPT (Conners Continuous-Performance Test): CPT-Om=errors by omission, CPT-Com=error by commission and CPT-Hit

**Figure 3** Pearson correlation indexes between the cognitive and attentional variables, and mean scores in the "social skills" section according to the BASC filled out by the mother (values transformed into Z scores)

their relation to the sections "social skills" and "leadership" of the BASC itself, filled out by the parents and professors, the following could be observed:

- The fewer the standard deviations (SD) that separate the TIQ from the CPT-Om, CPT-Com and CPT-Hit (that is, the greater the attentional problem expected for the intelligence of the patient), the lower the score on the "social skills" and leadership" sections according to the BASC of the mother ( $p < 0.01$ ) (Figures 5-7).
- This same linear relationship was observed to be significant in the "leadership" section of the BASC when it was filled out by the father ( $p < 0.01$ ) (Figure 7). No relation was observed in the "social skills" section with the parameters described (Figure 6).
- When the BASC was filled out by the teacher, a significant relation was observed between the difference of TIQ and CPT-Om, with the sections of the BASC being studied ( $p < 0.05$ ). Equally, a significant relation was observed between the score on "social skill" in the distance TIQ and CPT-Hit ( $p < 0.05$ ) (Figures 6 and 7).
- When analyzing the distances in the SD separating the TIQ from the WM or the other attentional variables studied of the EMAV, D2 or Faces, no significant relations were observed.

## DISCUSSION

Neuropsychological evaluation may provide objective and transcendental help for the clinician when identifying patients with ADHD, examining alternative diagnostic tests and documenting or quantifying comorbidity<sup>14, 15</sup>. The information provided by intelligence tests, such as WISC-IV, is considered important for the differential diagnoses.<sup>15</sup> In comparative studies versus a control group, children with ADHD performed this type of test worse, generally 7 to 10 points less (0.61 standard deviations under the mean),<sup>15, 16</sup> especially at the expense of the WM in the case of WISC-IV.<sup>15</sup>

Our results show that patients with combined type ADHD have lower TIQ and VC than predominantly inattentive ADHD. Children with combined ADHD, generally males, usually have more behavioral problems<sup>17</sup> and above all, from the epistemic point of view, tend to perform the cognitive evaluations worse than the predominantly inattentive ADHD.<sup>18</sup> Different studies have documented the negative association between the grade of hyperactive-impulsive behavior and intellectual capacity.<sup>19-21</sup> However, the associations between behavioral problems (ODD and AD) and IQ are much less significant.<sup>19, 21-23</sup>

According to Cantwell and Baker,<sup>24</sup> children with combined type ADHD have a greater likelihood of having linguistic problems. This circumstance agrees with the

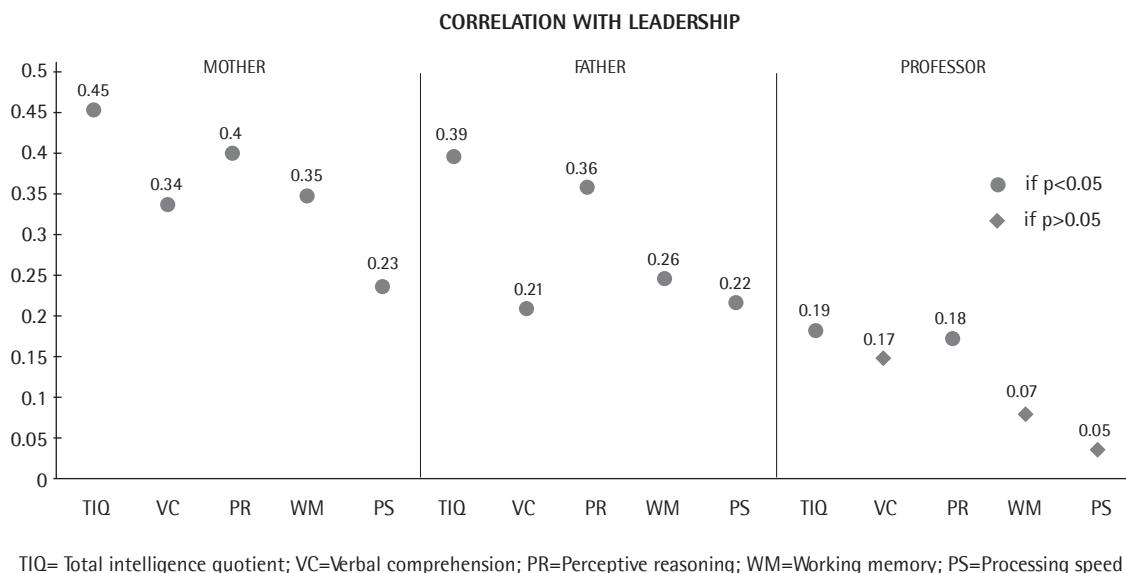


Figure 4

Pearson correlation index between cognitive variables of the WISC-IV (Wechsler Intelligence Scale for Children, version IV) and mean scores in the "leadership" section of the BASC filled out by the parents and tutor (values transformed into Z scores)



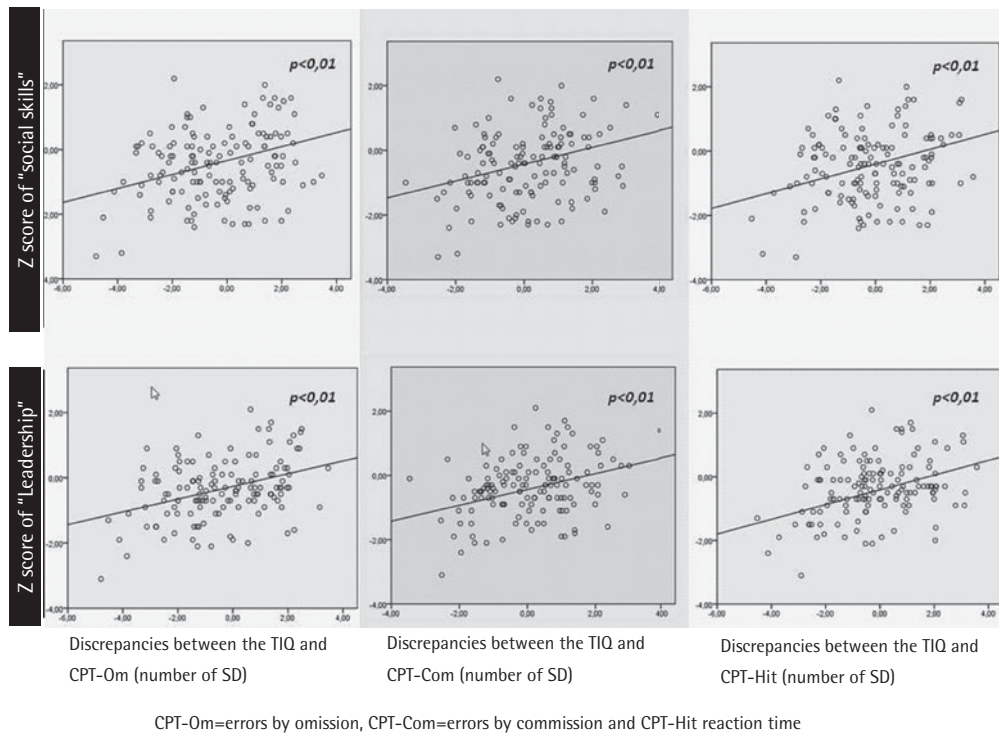


Figure 5

Linear relation between mean scores in the sections of "social skills" and "leadership" according to the BASC filled out by the mother and the different, measured in standard deviation (SD) between the total intelligence quotient (TIQ) of the WISC-IV (Wechsler Intelligence Scale for Children, version IV) and the variables of the CPT (Continuous Performance Test)

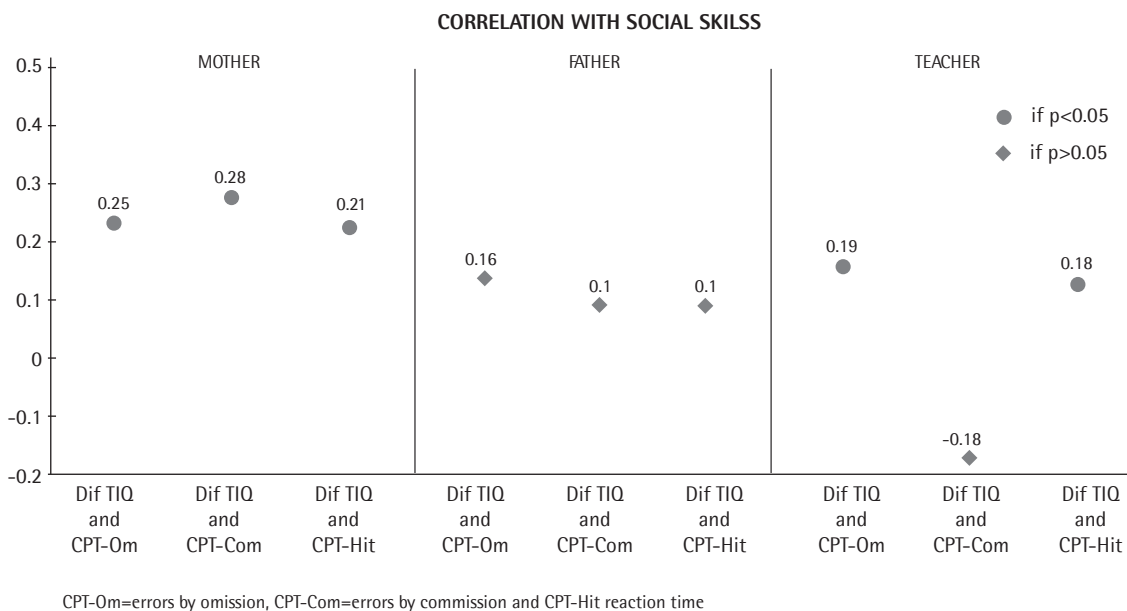


Figure 6

Pearson's correlation indexes between the mean scores in the section of "social skills" according to the BASC, transformed into Z values, and the discrepancy, measured in standard deviations (SD), between the total intelligence quotient (TIQ) of the WISC-IV (Wechsler Intelligence Scale for Children, version IV) and the variables of the CPT (Continuous Performance Test)

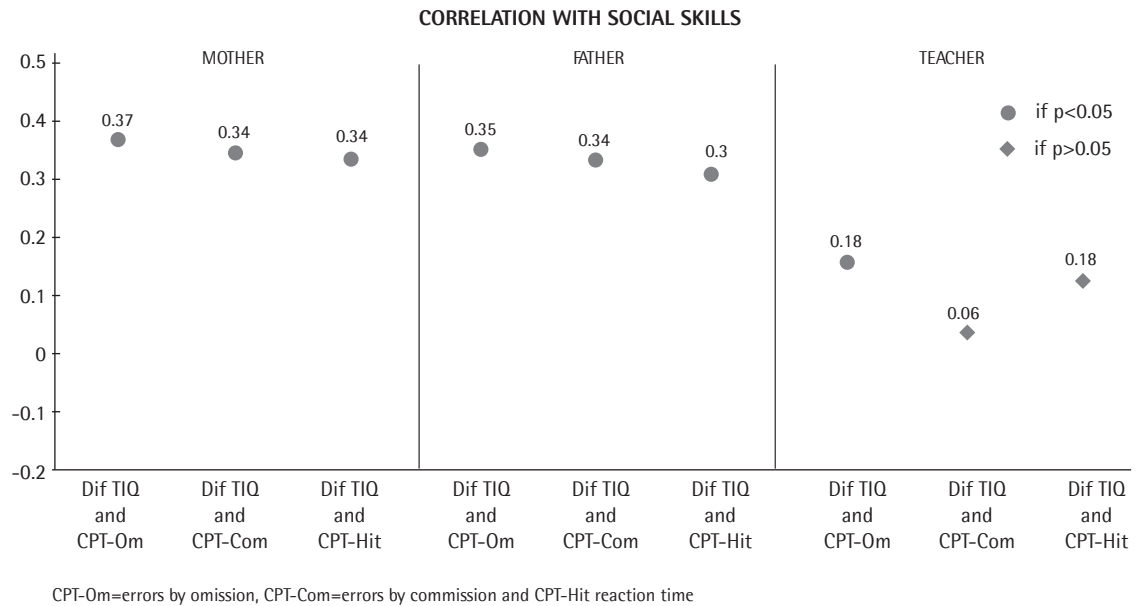


Figure 7

Pearson's correlation indexes between the mean scores in the section of "leadership" according to the BASC, transformed into Z values, and the discrepancy, measured in standard deviations (SD), between the total intelligence quotient (TIQ) of the WISC-IV (Wechsler Intelligence Scale for Children, version IV) and the variables of the CPT (Continuous Performance Test)

present work, in which the IQ was lower in the patients with combined type at the expense, fundamentally, of a decrease of verbal comprehension, which constitutes a finding of great interest since there is scarce previous evidence in this regards.<sup>18</sup> Barkley, et al.<sup>17</sup> and García, et al.<sup>25</sup> have found worse processing rate and perceptive-motor reasoning in patients with predominantly inattentive ADHD. The latter aspect does not coincide with that recorded in the present work. Our results are probably conditioned by a lower prevalence of the *tempo cognitivo lento* subtype<sup>26</sup> than in other publications, although this has not been evaluated independently in this work or in most of the studies published.<sup>18</sup>

The results published up to now in relation to the differences observed in the performance of the neuropsychological tests, between the different subtypes of ADHD, are contradictory.<sup>18</sup> In one study<sup>27</sup>, the combined ADHD performed most of the neuropsychological tests proposed worse, as is shown in our work. In others, no significant differences were found between the subtypes;<sup>18, 28-30</sup> Hynd, et al.<sup>31</sup> hardly found any differences between the two subtypes of ADHD when analyzing cognitively different types of tasks of "reaction time." Derefinko, et al.<sup>32</sup> found a greater amount of errors by "omission" in patients with predominantly inattentive ADHD than those of the combined type using the *go/no-go* task analysis, similar to the CPT used in this work. These discrepancies are probably

conditioned by the type of cognitive task used in the populations studied. Independently of these aspects, the neuropsychological tests are still "experimental" instruments whose object is to measure or evaluate specific cognitive characteristics which, in their comparison and statistical relation to the mean, make it possible for us to establish or classify "clinically" an individual, which, by definition, may be generically inaccurate<sup>18</sup>. In the present work, we have verified a greater number of errors by omission in the CPT in patients with combined ADHD than in the greatly inattentive and, paradoxically, a greater number of errors by omission in the patients with predominantly inattentive ADHD than in the others. "Clinical" impulsiveness is not always consistent with "cognitive" impulsiveness. Analogically, Schmitz et al.<sup>33</sup> observed that adolescents with predominantly inattentive ADHD had less inhibitory control in the digit numbering task and in the Stroop paradigm (this measured capacity to inhibit interferences produced when someone carried out an "unexpected and non-automatized" behavior"),<sup>34</sup> than those that had combined ADHD.

In regards to the social skills, different studies have consistently documented a decrease of adaptive function (defined as performance of the daily activities required for social and personal sufficiency) in children with ADHD compared to children without this disorder, in spite of generally having average intelligence.<sup>5, 18</sup> Although children with other neuropsychiatric or development disorders often



show low adaptive functioning, the discrepancy between the TIQ and said functioning is greater in children with ADHD than in other groups. This indicates that it is the ADHD itself that negatively affects adaptive functioning, and not only the "statistical" evidence of a TIQ tending "downward" in this group of patients.

Stein, et al.<sup>35</sup> observed that there was no significant difference between combined ADHD, predominantly inattentive ADHDs, patients with generalized development disorder or with mental retardation in the "socialization" domain of the Vineland adaptive behavior scale in relation with the TIQ, if there were no associated behavior problems (ODD and/or AD). Clark, et al.<sup>36</sup> obtained similar results. Children with ADHD obtained worse scores on the "socialization" section when behavior problems were associated. Combined ADHDs have greater tendency to associate behavior problems (that is, ODD and/or AD) than patients with predominantly inattentive ADHD.<sup>6</sup> It would be expected that children with combined ADHD would have lower social skills. However both groups seem to have social difficulties with similar prevalences given the lack of greater self-control in the first subtype and probably the greater frequency of passivity, shyness, lack of assertiveness and tendency to social withdrawal in the second subtype.<sup>6</sup>

In the comparative analyses of our study, we were not able to demonstrate any significantly stable relation between "attentional capacities" and social or leadership skills quantified through the BASC for parents. When analyzing the data provided by the tutor, a linear and significant relation was found between intensity of the attentional problems recorded in the performance of the CPT and social skill. The directly proportional relation found in the present study between the TIQ of the WISC-IV and social skills according to the mother and leadership according to both parents does not seem to be due only to a deficit of WM, since several items of the WISC-IV are related in these skills. It is unquestionable that the social functioning of patients with ADHD is not only going to depend on their attentional skills or a possible common substrates for social competence and executive dysfunction of these children but also on other aspects (cognitive, psychoeducational, emotional, etc.). On the other hand, dysfunction generated by the attention problem itself in the evaluation of the cognitive capacities should not be overlooked.

From a strictly neurocognitive perspective, it is the discrepancy between the intelligence quotient and attentional capacity that most reliably is translated into an attentional disorder. Parallely to the definition or classification of the specific learning disorders where said learning should be significantly unbalanced regarding the intellectual capacity of the individual,<sup>1</sup> the cognitive parameter that has provided the greatest sensitivity and specificity in the diagnostic support of the ADHD on the

neuropsychological level is the discrepancy between the TIQ and the attentional capacities evaluated using the continuous performance test.<sup>37</sup> On analyzing this differential and its possible relation to the "social skills" and "leadership" sections of the BASC, we were able to verify that the greater the attentional problem expected for the patient (especially reflected in the CPT-Om, an item with a greater size of effect in the discrimination of patients with ADHD than the CPT-Com),<sup>15</sup> the lower the score on the "social skills" sections according to the BASC of the mother and the teacher (without reaching statistical significance when the father was the informer) and "leadership" sections according to all the informers. Discrepancies between the subjective scores provided by the parents and teachers have been well known for years,<sup>38</sup> with coefficients of agreement between parents and teachers less than 0.5. Agreement between the father and mother is generally more consistent but persistently defective (0.6-0.7), as is also seen in the data shown. In fact, children with ADHD are generally perceived as less problematic by the fathers than by the mothers.<sup>18, 39</sup> Considering the results of this study, social functioning seems to be better evaluated by the mother, given the greater relation with the objective-cognitive measures presented.

CPTs are the neuropsychological tests that best discriminate groups of children with ADHD from healthy children.<sup>40</sup> In fact, it is the only neuropsychological measure that directly evaluates the central symptoms of the disorder.<sup>15</sup> Social competence of patients with ADHD and its evaluation by the parents may be mediated by the intensity of the hyperactivity symptoms<sup>41,42</sup> and by the presence of behavioral disorders (ODD and AD) associated to the ADHD<sup>18, 43, 44</sup> in addition to other factors.<sup>18</sup> However, the inverse relation existing between attentional capacity versus TIQ, measured objectively, and social and leadership skills, show that the executive dysfunction itself involved in the poor attentional regulation could justify a large part of these problems. In this sense, Podolski, et al.<sup>45</sup> confirm how parental relation and stress were unsatisfactory in families with ADHD children compared to controls, independently of the subtype. In this same work, the mothers observed a linear and significant relation between the intensity of the attentional problems and parental stress, but not so much with hyperactivity as a symptom. Uekermann, et al., in their recent review on social cognition in ADHD,<sup>46</sup> consider that the poor social functioning of these patients is inherent to the disorder through the frontal-striatal dysfunction it characterizes. The fact that the relations, although statistically significant and linear, are sometimes accompanied by a low Pearson's coefficient, collaborates the multifactorial dimension that conditions low social performance.<sup>7</sup>

Very few studies have correlated the performance of CPT with social skills. Forbes<sup>47</sup> observed, as in the present work, an inverse correlation between the social skills

measured with a scale for teachers called "ADD-H Comprehensive Teacher's Rating Scale" and omission errors in the *Test of Variables of Attention* (TOVA) -a test of visual auditory continuous performance, although without reaching statistical significance. The methodological differences between this and the present study limit, however, possible comparative analysis. In 1983, Klee, et al.<sup>48</sup> did not obtain significant results when they attempted to correlate the omission results with the results of "sociability" of the "Conners Teaching Rating Scale." However, they used the CPT designed by the investigator team itself, and different from the task used in the present study. Both the methodological differences as well as the diagnostic ones (the DSM-IV still did not exist and cases of "predominantly inattentive" were hardly evaluated) limit any possible comparison with this latter study.

The absence of significant correlates in relation to the scores of the other attention tests or their differentials regarding the TIQ suggest their lower utility. These cancellation tasks show a modest correlation with other instruments and scales that are more sensitive in the evaluation of attention and their diagnostic sensitivity and specificity are still disputed.<sup>49</sup> The short duration of some in the interference in the execution of the visual-perceptive disorders may also condition their diagnostic validity.<sup>50</sup>

To conclude, we want to stress certain aspects of our study. In a strictly neurocognitive section, we have observed how patients with combined ADHD tend to have a lower TIQ, basically at the expense of a deficit in verbal capacity. Equally, they generally perform attentional tasks worse than patients with predominantly inattentive ADHD. Bringing to mind the initial purposes of this study once again, social and leadership skills may be conditioned by intense hyperactive symptoms, by the presence of associated behavioral disorders (ODD and/or AD) and probably by motivational and educational factors, among others.<sup>18</sup> However, we have been able to see how cognitive skills condition leadership skills, and similarly, how they mediate or significantly relate to social functioning, when the latter is evaluated by the mother. Parallely, the greater the attentional problem expected based on the intelligence of the patient, the worse the social skills and the lower the skills for tasks in group. Thus, it is possible that these skills are conditioned, in turn, by the attentional difficulties or the executive dysfunction inherent to any subtype of ADHD. Specific prospective studies are needed to evaluate the efficacy of the current therapeutic measures for ADHD, and the social functioning of these children. It is also necessary to consider the need or convenience of specifically associated therapies aimed at improving the skills related with them.

#### CONFLICT OF INTERESTS

This study has been carried out with a scholarship granted by Lilly Pharmaceutical Co

#### REFERENCES

1. Stroes A, Alberts E, Van Der Meere JJ. Boys with ADHD in social interaction with a nonfamiliar adult: an observational study. *J Am Acad Child Adolesc Psychiatry*. 2003;42:295-302.
2. McQuade JD, Hoza B. Peer problems in Attention Deficit Hyperactivity Disorder: current status and future directions. *Dev Disabil Res Rev*. 2008;14:320-4.
3. American Psychiatric Association, American Psychiatric Association. Task Force on DSM-IV. Diagnostic and statistical manual of mental disorders : DSM-IV-TR. 4th ed. Washington, DC: American Psychiatric Association; 2000.
4. Bagwell CL, Molina BS, Pelham WE, Jr., Hoza B. Attention-deficit hyperactivity disorder and problems in peer relations: predictions from childhood to adolescence. *J Am Acad Child Adolesc Psychiatry*. 2001;40:1285-92.
5. Maedgen JW, Carlson CL. Social functioning and emotional regulation in the attention deficit hyperactivity disorder subtypes. *J Clin Child Psychol*. 2000;29:30-42.
6. Solanto MV, Pope-Boyd SA, Tryon WW, Stepak B. Social functioning in predominantly inattentive and combined subtypes of children with ADHD. *J Atten Disord*. 2009;13:27-35.
7. Pardos A, Fernandez-Jaen A, Fernandez-Mayoralas DM. Social skills in attention deficit hyperactivity disorder. *Rev Neurol* . 2009;48 (S2):S107-11.
8. Wechsler D. WISC-IV: escala de inteligencia de Wechsler para niños-IV. Madrid: TEA; 2009.
9. Thurstone LL, Yela M. Caras: percepción de diferencias. 10 ed. Madrid: TEA; 2009.
10. Brickenkamp R, Seisdedos Cubero N. d2, test de atención: manual. 3 ed. Madrid: TEA; 2009.
11. García Pérez EM, Magaz Lago Á. EMAY: Escalas Magallanes de atención visual: manual de referencia. Cruces-Barakaldo: Grupo Albor-Cohs; 2000.
12. Conners CK. Conners' continuous performance test (CPT II): version 5 for Windows: technical guide and software manual. [New York]: MHS; 2004.
13. Reynolds CR, Kamphaus RW, González Marqués J. BASC: Sistema de evaluación de la conducta en niños y adolescentes: manual. Madrid: TEA; 2004.
14. Taylor E, Döpfner M, Sergeant J, Asherson P, Banaschewski T, Buitelaar J, et al. European clinical guidelines for hyperkinetic disorder - first upgrade. *Eur Child Adolesc Psychiatry*. 2004;13(S1):S7-30.
15. Gordon M, Barkley RA, Lovett BJ. Test and observational measures. In: Barkley RA, ed. Attention-deficit hyperactivity disorder: a handbook for diagnosis and treatment. 3rd ed. New York; London: The Guilford Press, 2006; p.369-88.
16. Frazier TW, Demaree HA, Youngstrom EA. Meta-analysis of intellectual and neuropsychological test performance in attention-deficit/hyperactivity disorder. *Neuropsychology*. 2004;18:543-55.
17. Barkley RA, DuPaul GJ, McMurray MB. Comprehensive evaluation of attention deficit disorder with and without hyperactivity as defined by research criteria. *J Consult Clin Psychol*. 1990;58:775-89.
18. Barkley RA. Comorbid disorders, social and family adjustment, and subtyping. In: Barkley RA, ed. Attention-deficit hyperactivity disorder: a handbook for diagnosis and treatment. 3rd ed. New York; London: The Guilford Press, 2006; p.184-218.
19. Hinshaw SP, Morrison DC, Carte ET, Cornsweet C. Factorial dimensions of the Revised Behavior Problem Checklist: replication and validation within a kindergarten sample. *J Abnorm Child Psychol*. 1987;15:309-27.
20. McGee R, Williams S, Silva PA. Behavioral and developmental

- characteristics of aggressive, hyperactive and aggressive-hyperactive boys. *J Am Acad Child Psychiatry*. 1984;23:270-9.
21. Sonuga-Barke EJ, Lamparelli M, Stevenson J, Thompson M, Henry A. Behaviour problems and pre-school intellectual attainment: the associations of hyperactivity and conduct problems. *J Child Psychol Psychiatry*. 1994;35:949-60.
  22. Hinshaw SP. Externalizing behavior problems and academic underachievement in childhood and adolescence: causal relationships and underlying mechanisms. *Psychol Bull*. 1992;111:127-55.
  23. Lynam D, Moffitt T, Stouthamer-Loeber M. Explaining the relation between IQ and delinquency: class, race, test motivation, school failure, or self-control? *J Abnorm Psychol*. 1993;102:187-96.
  24. Cantwell DP, Baker L. Association between attention deficit-hyperactivity disorder and learning disorders. In: Shaywitz SE, Shaywitz BA, eds. *Attention deficit disorder comes of age: toward the twenty-first century*. Austin, Tex.: PRO-ED, 1992; p.145-64.
  25. Garcia-Sanchez C, Estevez-Gonzalez A, Suarez-Romero E, Junque C. Right hemisphere dysfunction in subjects with attention-deficit disorder with and without hyperactivity. *J Child Neurol*. 1997;12:107-15.
  26. Diamond A. Attention-deficit disorder (attention-deficit/hyperactivity disorder without hyperactivity): a neurobiologically and behaviorally distinct disorder from attention-deficit/hyperactivity disorder (with hyperactivity). *Dev Psychopathol*. 2005;17:807-25.
  27. Chiang M, Gau SS. Validation of attention-deficit-hyperactivity disorder subtypes among Taiwanese children using neuropsychological functioning. *Aust N Z J Psychiatry*. 2008;42:526-35.
  28. Chhabildas N, Pennington BF, Willcutt EG. A comparison of the neuropsychological profiles of the DSM-IV subtypes of ADHD. *J Abnorm Child Psychol*. 2001;29:529-40.
  29. Nigg JT, Blaskey LG, Huang-Pollock CL, Rappley MD. Neuropsychological executive functions and DSM-IV ADHD subtypes. *J Am Acad Child Adolesc Psychiatry*. 2002;41:59-66.
  30. Solanto MV, Gilbert SN, Raj A, et al. Neurocognitive functioning in AD/HD, predominantly inattentive and combined subtypes. *J Abnorm Child Psychol*. 2007;35:729-44.
  31. Hynd GW, Nieves N, Connor RT, et al. Attention deficit disorder with and without hyperactivity: reaction time and speed of cognitive processing. *J Learn Disabil*. 1989;22:573-80.
  32. Derefinko KJ, Adams ZW, Milich R, Fillmore MT, Lorch EP, Lynam DR. Response style differences in the inattentive and combined subtypes of attention-deficit/hyperactivity disorder. *J Abnorm Child Psychol*. 2008;36:745-58.
  33. Schmitz M, Cadore L, Paczko M, et al. Neuropsychological performance in DSM-IV ADHD subtypes: an exploratory study with untreated adolescents. *Can J Psychiatry*. 2002;47:863-9.
  34. Stroop JR. Studies of interference in serial verbal reactions. *J Exp Psychol*. 1935;18:643-62.
  35. Stein MA, Szumowski E, Blondis TA, Roizen NJ. Adaptive skills dysfunction in ADD and ADHD children. *J Child Psychol Psychiatry*. 1995;36:663-70.
  36. Clark C, Prior M, Kinsella G. The relationship between executive function abilities, adaptive behaviour, and academic achievement in children with externalising behaviour problems. *J Child Psychol Psychiatry*. 2002;43:785-96.
  37. Dickerson Mayes S, Calhoun SL, Crowell EW. Clinical validity and interpretation of the Gordon Diagnostic System in ADHD assessments. *Child Neuropsychol*. 2001;7:32-41.
  38. Achenbach TM, Edelbrock C, Howell CT. Empirically based assessment of the behavioral/emotional problems of 2- and 3-year-old children. *J Abnorm Child Psychol*. 1987;15:629-50.
  39. Tallmadge J, Barkley RA. The interactions of hyperactive and normal boys with their fathers and mothers. *J Abnorm Child Psychol*. 1983;11:565-79.
  40. Corkum PV, Siegel LS. Is the Continuous Performance Task a valuable research tool for use with children with Attention-Deficit-Hyperactivity Disorder? *J Child Psychol Psychiatry*. 1993;34:1217-39.
  41. Keown LJ, Woodward LJ. Early parent-child relations and family functioning of preschool boys with pervasive hyperactivity. *J Abnorm Child Psychol*. 2002;30:541-53.
  42. Woodward L, Taylor E, Dowdney L. The parenting and family functioning of children with hyperactivity. *J Child Psychol Psychiatry*. 1998;39:161-9.
  43. Barkley RA, Anastopoulos AD, Guevremont DC, Fletcher KE. Adolescents with attention deficit hyperactivity disorder: mother-adolescent interactions, family beliefs and conflicts, and maternal psychopathology. *J Abnorm Child Psychol*. 1992;20:263-88.
  44. Fletcher KE, Fischer M, Barkley RA, Smallish L. A sequential analysis of the mother-adolescent interactions of ADHD, ADHD/ODD, and normal teenagers during neutral and conflict discussions. *J Abnorm Child Psychol*. 1996;24:271-97.
  45. Podolski CL, Nigg JT. Parent stress and coping in relation to child ADHD severity and associated child disruptive behavior problems. *J Clin Child Psychol*. 2001;30:503-13.
  46. Uekermann J, Kraemer M, Abdel-Hamid M, et al. Social cognition in attention-deficit hyperactivity disorder (ADHD). *Neurosci Biobehav Rev*. 2010;34:734-43.
  47. Forbes GB. Clinical utility of the Test of Variables of Attention (TOVA) in the diagnosis of attention-deficit/hyperactivity disorder. *J Clin Psychol*. 1998;54:461-76.
  48. Klee SH, Garfinkel BD. The computerized continuous performance task: a new measure of inattention. *J Abnorm Child Psychol*. 1983;11:487-95.
  49. Wassenberg R, Hendriksen JG, Hurks PP, et al. Development of inattention, impulsivity, and processing speed as measured by the d2 Test: results of a large cross-sectional study in children aged 7-13. *Child Neuropsychol*. 2008;14:195-210.
  50. Fernandez-Jaen A, Fernandez-Mayoralas DM, Pardos A, Calleja-Perez B, Munoz Jareno N. Clinical and cognitive response to extended-release methylphenidate (Medikinet(R)) in attention deficit/hyperactivity disorder: Efficacy evaluation. *Adv Ther* 2010.