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Neurobehavioral Assessment of Attention Deficit Hyperactivity Disorder in a Colombian Sample

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We present a factor analytic study of the Conners Rating Scales for parents and teachers in this article. A comparison is established with the original factor analytic studies (Conners, 1979a, 1979b) and the results obtained by Farré-Riba and Narbona (1997), using a Spanish sample. Five hundred and forty children, ages 4 to 17, were randomly selected in Manizales, Colombia. The shortened Spanish version of the Conners Parents Rating Scale (CPRS; Conners, 1979a) and the Conners Teacher Rating Scale (CTRS; Conners, 1979b) were used. Parsimonious factor analyses for both scales were developed. Three stable factors were found in the CPRS: hyperactivity, somatic symptoms, and inattention. Twenty-two out of 48 items were significantly saturated by these 3 factors. In the CTRS, 4 different factors were found that accounted for 63.5% of the total variance: uncontrolled temperament, inattention, hyperactivity, and difficulties in social relationships. Twenty out of 28 items were significantly saturated by these 3 factors. Factor structure was closer to the Spanish Farré-Riba and Narbona report than to the original findings. We concluded that the CPRS and the CTRS Spanish versions, when used by Colombian children and adolescents, do not seem to evaluate exactly the same underlying behavioral dimensions. We propose selecting only 22 items of the CPRS and 20 items of the CTRS (brief versions) for further epidemiological and clinical use.

Key words: attention deficit hyperactivity disorder, Hispanic, Colombian children

Attention deficit hyperactivity disorder (ADHD) is a cognitive and behavioral disorder characterized by a pattern of persistent symptoms of inattention, hyperactivity–impulsivity, or both. It must be more frequent and severe than in individuals of the very same level of development. Some of the symptoms must be present before age 7, for at least 6 months, and in two or more settings, and they must result in significant impairment in social, academic, or occupational functioning (American Psychiatric Association, 1994). Multiple research data have produced the hypothesis that hyperactivity and impulsivity form part of the same factor dimension. Inattention, on the other hand, represents a somehow separated dimension (Barkley, 1990; Barkley, DuPaul, & McMurray, 1990; Fletcher, Morris, & Francis, 1992; Goldman, Genel, Bezman, & Slanetz, 1998; Hynd et al., 1991; Kirby & Grimley, 1992; Lahey et al., 1994; Lamminmaki, Ahonen, Narhi, Lyytinen, & Todd de Barra, 1995; Pellock, 1996; Pineda, 1996; Pineda & Rosselli, 1997; Wender, 1987).

The *Diagnostic and Statistical Manual of Mental Disorders* (4th ed. [*DSM–IV*]; American Psychiatric Association, 1994) distinguishes three diagnostic categories or ADHD subtypes: attention deficit hyperactivity–impulsivity disorder combined type, attention

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deficit disorder predominantly inattentive type, and attention deficit disorder predominantly hyperactive–impulsive type. For this reason and to control confounding variables, the selection of the study samples should be restricted to children with only one subtype of this complex disorder (Hynd et al., 1995; Lamminmaki et al., 1995).

In a national study (Goldman et al., 1998) using a meta-analysis approach, the prevalence of ADHD has been estimated to be around 3% to 6% in the United States. In Colombia, using the *DSM–IV* criteria and including a general school population sample, the prevalence of ADHD symptoms has been estimated to be about 16% (Pineda et al., 1999). This prevalence is higher than found in other studies (American Psychiatric Association, 1994; Cantwell, 1996; Goldman et al., 1998; Milberger, Biederman, Faraone, & Tsuang, 1995; Pellock, 1996). However, it has been postulated that the prevalence of ADHD throughout several countries using the *DSM–IV* criteria and studying the general school population could be around 10% to 25%, depending on the age, sex, and socioeconomic status (Bhatia, Nigam, Bohra, & Malik, 1991; Eyestone & Howell, 1994; Kanbayashi, Nakata, Fuiji, & Wada, 1994; Madoki, Summer, & Mathews-Ferrari, 1991; Shealy, 1994).

Most clinical and epidemiological studies have used unidimensional or multidimensional behavioral questionnaires for parents, teachers, or both to disclose the presence or absence of ADHD symptoms and its comorbidities (Barkley, 1990; Cantwell, 1996; Cantwell & Baker, 1992; Glow, Glow, & Rump, 1982; Hynd et al., 1991; Mannuzza, Gittelman, Bonagura, Horowitz, & Shenker, 1988; Mannuzza, Gittelman, Bonagura, Horowitz, & Giampino, 1989; Pineda & Rosselli, 1997; Riccio et al., 1994). Unidimensional questionnaires have been the instruments used in the evaluation of children based on the symptoms of the *DSM–III* (3rd ed.; American Psychiatric Association, 1980) and *DSM–III–R* (3rd ed., rev.; American Psychiatric Association, 1987) ADHD diagnostic criteria. The symptoms are placed in lists or checklists that are either registered in a dichotomic (*yes* or *no*) system in some cases or in a 0 to 3 score (ADHD Rating Scale). A zero is scored when the symptoms have never occurred, and 3 is scored when the symptoms almost always appear (Achenbach, 1978, 1986; Barkley, 1990; DuPaul, 1990; Kirby & Grimley, 1992; Pelham, Milich, Murphy, & Murphy, 1989; Witt, Heffer, & Pfeiffer, 1990).

The most widely used multidimensional behavioral questionnaire was developed by Conners in 1979 and includes two parts: the Conners Parents Rating Scale (CPRS; Conners, 1979a) and the Conners Teacher Rating Scale (CTRS; Conners, 1979b). The initial version of the CPRS had 93 items, and the CTRS had only 39 items. After a factor analysis study (Goyette, Conners, & Ulrich, 1978; Witt et al., 1990), a shortened version was developed (Conners Rating Scale–Revised [CRS–R]), with only 48 items for CPRS and 28 items for CTRS. In addition, the Abbreviated Symptom Questionnaire was introduced. All these instruments have Spanish authorized versions for clinical and research use (Barkley, 1990). The CRS and CRS–R appear to have satisfactory utility where the purpose of the evaluation is to briefly assess a broad array of psychopathological symptoms (e.g., hyperactivity, depression, aggression). The majority of items, however, assess conduct problems or externalizing disorders rather than neuroses or internalizing disorders. Interrater reliability between parents and different examiners has been widely reported (Barkley, 1990; Barkley et al., 1990; Conners & Wells, 1986; Glow et al., 1982; O'Connor, Foch, Sherry, & Plomin, 1980; Witt et al., 1990). The cutoff point that is usually recommended is 1.5 *SD* over average of the expected scores (Barkley, 1990; Kirby & Grimley, 1992).

Very little research has been directed toward the assessment of ADHD in Spanish speakers. Recently, research with a Hispanic population using the CRS–R Shortened Version translated into Spanish found a factor structure of only three dimensions: hyperactivity, inattention, and conduct problems. The authors proposed a new Spanish Conners version using 20 questions with high reliability. This shortened Spanish version was validated in Spanish children with ADHD (Farré-Riba & Narbona, 1997).

A factor analytic study of the CRS for parents and teachers in a Colombian population is presented in this article. A comparison is established with the original factor analytic studies (Conners, 1979a, 1979b) and the results obtained by Farré-Riba and Narbona (1997).

Method

Participants

Participants were taken from Manizales, Colombia (population = about 600,000). According to the Manizales Secretary of Education, there are 80,000 4- to 17-year-old children attending preschool and school programs. From this group, 540 children were randomly selected through the computer program Epi Info 6.0

(Centers for Disease Control and Prevention, 1994), using a sample fraction, $f = n/N$, where n was the number of participants to be selected in each group and N was the total number of participants found in each strata. A factorial 2 × 3 design was used with 90 children in each cell. Two sex groups (boys and girls) and three age groups (ages 4–5, 6–11, and 12–17) were included. Because age and schooling were highly correlated, the latter was not used in the analyses. An equivalent number of participants was selected from low, middle, and high socioeconomic status divisions. Table 1 presents the distribution of the sample.

Instruments and Procedures

The CPRS (48 items) and the CTRS (28 items) shortened versions (Conners, 1979a, 1979b) were used. Once the sample was selected, contacts were established with the different schools. The purpose of this research was explained, and permission was obtained to contact the children's parents or guardians. Parents or guardians were initially contacted by phone. Once their approval was obtained, they were requested to complete both a brief developmental history of the child and the CPRS checklist. No specific mention was made of pathologies, abnormalities, or diagnoses to avoid bias in completing the checklist. Parents were told that information was being collected to know and understand the characteristics of our preschool and school children.

Statistical Analyses

Data were manually introduced in a database for SPSS Base 8.0 statistical software (SPSS, Inc., 1998).

Table 1. *Characteristic of the Sample 4- to 17-Year-Old Participants for CPRS and CTRS Factor Structure*

Characteristic	*M*	*SD*	*n*	%
Sex				
Male			272	50.4
Female			268	49.6
Age (Years)	9.1	4.3		
4–5			181	33.5
6–11			182	33.7
12–17			177	32.8
Schooling (Years)	3.5	3.5		
Preschool			187	34.6
Primary			189	35.0
Secondary			164	30.4

Note: N = 540. CPRS = Conners Parent Rating Scale (Conners, 1979a); CTRS = Conners Teacher Rating Scale (Conners, 1979b).

Parsimonious factor analyses were developed. Only those factors that showed very stable components were accepted. A factor was considered stable when (a) the variable load was higher than 0.55; (b) the same variable loaded on two or more factors had a difference of load higher than 0.20, and the factor did not lose more than .10 in its reliability (Cronbach's α coefficient) if the item was eliminated; (c) theoretical coherence existed among all items in each factor; and (d) the factor had at least three variables clearly loading it. Factors that did not meet these criteria were eliminated.

Results

Only three dimensions were found as stable factors in the CPRS. Twenty-two out of 48 items were significantly saturated by these three factors, according to the established criteria. The first dimension integrated by 12 items corresponded to symptoms of hyperactivity, impulsivity, and uncontrolled temperament (e.g., fighting, bothering, disobeying, destroying, impulsivity, hyperactivity). It is not clear if some of these questions are accurate enough to consider that they are detecting symptoms of conduct disorder according to the new *DSM–IV* criteria (American Psychiatric Association, 1994). Factor 1 was named *Hyperactivity and Uncontrolled Temperament.* Factor 2 was formed by 5 questions that corresponded to somatic symptoms. It could not be determined whether these symptoms could be attributed to emotional disorders or to real medical problems (e.g., nausea, headache, pains). For this reason, the second factor was named *Somatic Symptoms.* Factor 3 was formed by questions that detected symptoms related to inattention (e.g., difficulties in concentration, does not finish tasks, easily gives up). This factor was named *Inattention* (Table 2).

Factor 1 (eigenvalue = 11.11) accounted for 23% of the variance, Factor 2 (eigenvalue = 2.77) accounted for 5.7%, and Factor 3 (eigenvalue = 2.12) accounted for 4.4%. Together, these three factors explained 33.3%. The Cronbach's coefficient of reliability for the 22 items and for the Hyperactivity dimension (12 items) was .87, .76 for the Somatic Symptoms (5 items), and .80 for Inattention (5 items). These findings mean that the CPRS Spanish version, with only 22 questions and its three dimensions, has enough internal consistency for clinical and epidemiological use. These three dimensions were not totally independent. The correlation between Factors 1 and 2 and Factors 1 and 3 was .35, whereas the correlation between Factors 2 and 3 was .27.

Table 2. *Conners Parent Rating Scale (Conners, 1979b) Factor Analysis in 4- to 17-Year-Old Colombian School Children*

Questions	Factor 1: Hyperactivity and Uncontrolled Temperament	Factor 2: Somatic Symptoms	Factor 3: Inattention
Is Fighter With Peers	.69		
Fights With Others	.69	.38	
Bothers Others	.69		
Does Not Obey His Parents	.68	.40	
Seeker of Trouble	.64		
Denies His Mistakes	.63	.32	.33
Threatens Others	.63		
Is Impulsive	.62	.30	
Is Coarse and Rude	.60		
Is Hyperactive, Moves in His Seat	.58		
Is Destructive	.57		.30
Tells Lies	.57		
Has Stomachache		.70	
Has Gastric Problems		.65	
Has Nausea and Vomits		.60	
Complaints About Pains in His Body		.59	
Has Headaches		.56	
Has Trouble Concentrating on Tasks	.47		.74
Gives Up Easily	.43		.69
Does Not Finish His Tasks	.35		.67
Has Academic Difficulties			.65
Is an Absent-Minded Child or Young	.30		.61

Note: $N = 540$.

In the CTRS, four different factors were found that accounted for 63.5% of the total variance. The first factor included 7 questions related to symptoms of *Uncontrolled Temperament* (e.g., mood changes, conduct explosions, bad temperament). Factor 2 was formed by 6 questions that evaluated symptoms of *Inattention* (e.g., academic problems, difficulties finishing tasks). Factor 3 was composed of 3 questions related to symptoms of *Hyperactivity* (e.g., hyperactive, makes noises, bothers others). Finally, Factor 4 was formed by 4 questions related to *Difficulties in Social Relationships* (e.g., difficulties in relationships with others, does not cooperate, is not accepted by peers; Table 3). In total, these 20 questions were most informative and may be interpreted as a brief CTRS.

The first factor (eigenvalue = 8.13) accounted for 40.6% of the variance, the second factor (eigenvalue = 2.09) explained 10.4% of the variance, the third factor (eigenvalue = 1.37) explained 6.8% of the variance, and the last factor (eigenvalue = 1.10) accounted for 5.5% of the variance. The Cronbach's alpha coefficient of reliability for the questionnaire of 20 items was .92. This alpha was .88 for the 7 items of the Uncontrolled Temperament dimension, .84 for the 6 items of the Inattention dimension, .82 for the 3 items of the Hyperactivity dimension, and .79 for the 5 items of Difficulties in Relationships. This means that the CTRS Spanish version with only 20 items and four dimensions has a very strong internal consistency for clinical and epidemiological utility. The four dimensions were moderately correlated. Correlations between Factor 1 and Factors 2, 3, and 4 were –.32, –.36, and –.43, respectively. Factor 2 correlated at .23 and .38 with Factors 3 and 4, respectively, and Factors 3 and 4 correlated at .36.

Means and standard deviations obtained by the sample of 540 4- to 17-year-old Colombian children and adolescents on the brief version (20 questions) of the CTRS are presented in Table 4.

Discussion

Our study supports Farré-Riba and Narbona's (1997) finding that the factor structure of behavioral questionnaires traditionally used for ADHD diagnosis may differ in different national and cultural contexts. Although the initial shortened version of the CPRS had 48 questions and six dimensions and the CTRS had 28 questions and four dimensions, these factor structures were more related to *DSM–III–R* (American Psychiatric Association, 1987) criteria than to the most recently accepted *DSM–IV* (American Psychiatric Association,

Table 3. *Conners Teacher Rating Scale (Conners, 1979b) Factor Analysis of 4- to 17-Year-Old Colombian School Children*

Questions	Factor 1: Uncontrolled Temperament	Factor 2: Inattention	Factor 3: Hyperactivity	Factor 4: Difficulties in Social Relationships
Has Sudden Mood Changes	.80			
Has Conduct Explosions	.77		–.50	–.50
Has Bad Humor	.74			
Is Sensitive to Criticism	.70			
Is Coarse and Rude	.69		–.59	–.60
Is Demanding	.57		–.46	
Has Academic Problems		–.86		
Look Like Poor Capacity		–.81		
Has Difficulties Finishing Tasks		–.79		
Gives Up Easily		–.77		–.50
Is an Absent-Minded Child or Young	.46	–.68		–.52
Is Childish, Immature		.64		
Is Hyperactive, Moves in His Seat			–.85	
Makes Noises and Shouts			–.82	
Bothers Other Children			–.79	–.52
Has Difficulties in Relationships With Others	.48			–.87
Does Not Cooperate With His Peers				–.81
Is Not Accepted by Peers During Games				–.75
Does Not Play Fair			–.47	.61

Note: $N = 540$.

Table 4. *Descriptive Scores on Brief CTRS Version Stratified by Sex and Age*

	Hyperactivity		Inattention		Uncontrolled Temperament		Difficulties in Relationships	
Age (Years)	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***
Boys								
4–5	1.3	0.9	0.8	0.9	0.6	0.7	0.5	0.7
6–11	1.0	0.9	1.0	0.8	0.7	0.7	0.6	0.7
12–17	0.5	0.6	0.7	0.8	0.4	0.4	0.3	0.5
Girls								
4–5	0.5	0.5	0.3	0.3	0.4	0.3	0.2	0.3
6–11	0.7	0.7	0.9	0.7	0.6	0.6	0.7	0.7
12–17	0.4	0.5	0.8	0.7	0.6	0.6	0.4	0.5

Note: CTRS = Conners Teaching Rating Scale (Conners, 1979b).

1994) criteria. This factor structure included the mixed-factor Index of Hyperactivity, which added hyperactive and inattentive symptoms. As a matter of fact, the traditionally used CPRS and CTRS better classified ADHD combined subtype children.

Our study found that the CPRS applied to the population of Colombian children and adolescents only disclosed three stable dimensions, similar to the findings of Farré-Riba and Narbona (1997). We did not find the Emotional (anxiety) dimension or the Hyperactivity Index (mix) dimension. The questionnaire can be reduced to 22 very consistent questions. Unlike Farré-Riba and Narbona, we did not find the Conduct Disorder dimension. Our first factor met questions that evaluated hyperactivity, impulsivity, and uncontrolled temperament but not conduct disorder, at least in the restrictive sense established by the *DSM–IV*. Somatic symptoms formed the second factor. The influence of medical or psychological factors on the etiology of these symptoms was not determined. Inattention was the third factor, and its low influence on the whole variance could be explained by parents' lesser accuracy in detecting symptoms of inattention. However, contrary to Farré-Riba and Narbona, we found a solid internal consistency, with high Cronbach's alpha coefficients, for the total questionnaire and for each dimension.

We found that the CTRS Spanish version has four dimensions, but the conformation of these dimensions

is different from the original version. We did not find the Conduct Disorder dimension but did detect a similar dimension that evaluated symptoms compatible with uncontrolled temperament or inadequate school conduct but was not necessarily related to breaking the law or delinquent behavior. We did not find the Hyperactivity Index (mix) dimension either. We clearly found an inattention factor and a hyperactivity factor. We also found a factor formed by questions that evaluated difficulties in interpersonal relationships. The brief 20-item questionnaire and its dimensions had very high alpha reliability coefficients and very strong internal consistency.

We can conclude that the CPRS and the CTRS Spanish versions, when applied to Colombian children and adolescents, do not evaluate exactly the same behavioral factors assessed by the original version. We propose selecting only 22 items of the CPRS and 20 items of the CTRS (brief versions) for further epidemiological and clinical use.

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