

Construct Validity of an Attention and Motor Activity Test for Brazilian Adolescents

Caroline Tozzi Reppold¹

Universidade Federal de Ciências da Saúde de Porto Alegre, Brazil

Claudio Simon Hutz

Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

Abstract

The objective of the study was to develop and establish construct validity for a self-report scale to assess attention and motor activity in adolescents. A revision about diagnostic guidelines and empirical studies, interviews with mental health professionals, and interviews with adolescents were conducted to establish content validity. To assess the instrument's dimensionality and precision, the sample was comprised of 961 participants (mean age = 14.3; *SD* = 1.68). Participants were students at schools in southern Brazil. Exploratory factor analyses led to the extraction of three factors. Factor 1 grouped items that indicate inattentive behavior and Factor 3, items that indicated hyperactivity and impulsivity. We called Factor 2 "control of executive functions". This factor grouped items that represent behavior controlled by executive functions of the frontal cortex. The results indicated that the psychometric characteristics of the test were appropriate and that it is a valid instrument for use in Brazil.

Keywords: Psychological assessment; Construct validation; Adolescence; Attention Deficit Hyperactivity Disorder.

Validade de Construto de um Teste de Atenção e Atividade Motora para Adolescentes Brasileiros

Resumo

O objetivo do estudo foi desenvolver e estabelecer a validade de construto de uma escala de auto-relato para avaliar a atenção e atividade motora em adolescentes. Foi conduzido para estabelecer a validade de conteúdo: uma revisão sobre as diretrizes de diagnóstico e estudos empíricos, entrevistas com profissionais de saúde mental, e entrevistas com os adolescentes. Para avaliar a dimensionalidade do instrumento e de precisão, a amostra foi composta por 961 participantes (idade média = 14,3, *DP* = 1,68). Os participantes foram alunos de escolas no sul do Brasil. A análise exploratória de fatores levou à extração de três fatores. No Fator 1 foram agrupados itens que indicam o comportamento desatento e, no Fator 3, os itens que indicaram hiperatividade e impulsividade. Chamamos o Fator 2 de "controle de funções executivas". Este fator agrupa itens que representam o comportamento controlado por funções executivas do córtex frontal. Os resultados indicaram que as características psicométricas do teste foram adequadas e que é um instrumento válido para uso no Brasil.

Palavras-chave: Avaliação psicológica; Validade de construto; Adolescência; Transtorno de Déficit de Atenção e Hiperatividade.

At present, researchers and clinicians agree that Attention Deficit Hyperactivity Disorder (ADHD) has a triad of markers related to inattention, hyperactivity and impulsivity problems. However, in factorial analyses, these sets of symptoms are distributed among two factors, characterizing a two-dimensional construct (inattention and hyperactivity/impulsivity) (Rasmussen et al., 2002; Rohde, 2002). The dimension related to attention problems generally refers to difficulties individuals have in remaining alert and cautious when

carrying out a task or fun activity, which frequently results in errors due to lapses in concentration.

Typical inattention behavior includes difficulties in planning activities in a sensible and coherent manner with the amount of time available, frequent changes from one unfinished activity to another and lack of organization, and carelessness with materials needed to conduct daily tasks (which constantly results in loss of belongings). It is common for adolescents with ADHD not to comply with other instructions and to avoid involvement in activities that demand constant mental effort due to distraction (American Psychiatric Association [APA], 2002). They thus present a potential risk for absenteeism, exclusion and school evasion (American Academy of Child and Adolescent Psychiatry [AACAP], 1997; Cuffe, Moore, & McKeown, 2009;

¹ Address: Fundação Universidade Federal de Ciências da Saúde de Porto Alegre, Departamento de Psicologia, Sarmento Leite, 245, sala 207, Centro, Porto Alegre, RS, Brasil, CEP 90050-170. *E-mail:* carolinereppold@yahoo.com.br

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Young, Heptinstall, Sonuga-Barke, Chadwich, & Taylor, 2005).

The youths' poor performance in school may also result from difficulties in concentration when there are external stimuli – environmental changes related to light, sound or temperature – which are relatively irrelevant to people in general. Another characteristic of this dimension is the tendency for inattentive individuals to forget their daily activities and to persevere in subjects related to their conversations (APA, 2002). Individuals with attention problems frequently seem not to listen when someone talks to them or asks them something. This results in difficulties in establishing responsive and courteous social ties with peers or family members.

These interaction problems are mainly observed when, besides inattention symptoms, there are also behaviors that reveal impulsivity, limitations in their capacity to postpone rewards, and excess motor activity. In these cases there is a high rate of rejection of such adolescents by their peers (Connor & Doerfler, 2008; Hampel, Manhal, Roos, & Desman, 2008; Weiss et al., 2008). The reason is that adolescents with such behavior tend to develop a more controlling and aggressive interaction style with their peers, with little verbal reciprocity (Hoza, Waschbusch, Pelham, Molina, & Milich, 2000). Symptoms of impulsivity that contribute towards this distancing include the individuals' frequent difficulty in waiting to express their opinion or to be waited on, jumping to answer a question even before someone has finished asking it and the habit of interrupting other conversations or intervening in conversations between third parties (APA, 2002). All of these behaviors demonstrate invasive social conduct.

Hyperactivity's typical symptoms include difficulties in keeping quiet while performing a task, the need to be in constant movement (swinging hands or legs, for example) and difficulty to remain seated or still for any period of time (APA, 2002). As a result of this agitation, they are often prone to recklessness and accidents (injuries, trampling, collisions, falls, etc.) and reveal unpremeditated disciplinary problems (Davidson, 2008). Consistent evidence indicates that this disorder is more frequent in males. The male-female ratio ranges from 2:1 to 9:1 depending on the type of disorder and context (APA, 2002). The highest disproportion is found in hyperactive/impulsive types and in clinical samples.

Despite the great clinical impact of behaviors that typically represent a lack of attention and hyperactivity, there are very few currently validated psychodiagnostic resources for assessing Brazilian adolescents suspected of having ADHD. There are no valid self-report instruments for use by clinical psychologists in Brazil. Due to this need, the objective of the present study was to develop and establish construct validity for a scale to be used

in assessing attention and motor activity in adolescents between the ages of 11 and 17 years.

Development of the Instrument

Several procedures were used for elaborating the items. Initially, ADHD's diagnostic guidelines described in the *Mental Disorder Diagnosis Manual* (APA, 2002) and empirical studies about psychological health conducted using a Clinical Epidemiology approach were considered. Interviews were conducted with eight psychiatrists or psychologists who work with adolescents about ADHD clinical manifestations and the preliminary items in the instrument to establish content validity. Interviews were also conducted with 24 adolescents between 12 and 17 years of age to gather suggestions about the most appropriate and intelligible means for the juvenile population to express representative behaviors of ADHD in the form of items. The test's content validity was evidenced in different semantic validity and apparent validity studies and an evaluation by judges.

The scale consists of three sets: (a) instructions for filling out the test, (b) a list of items that comprise the test and (c) answer sheet. All of the items describe adolescent behaviors, feelings or beliefs, and were elaborated as statements alluding to the construct covered by the test. The answer sheet contains the participant's demographic data and a five-point Likert scale where the adolescents indicate how appropriately each sentence describes them.

Assessing Instrument Dimensionality and Precision

Sample

The sample was comprised of 961 participants (mean age = 14.3; $SD = 1.68$), 50.8% of which were females. The randomly selected participants were students at schools in Porto Alegre, in southern Brazil.

Instruments and Procedures

The administration of instruments was done collectively and included an explanation about the study's objectives and the joint reading of instructions. An informed consent form was requested from the adolescent's legal guardian beforehand. The participants were informed of the voluntary nature of their adherence to the study and the anonymity of the results.

Results

Exploratory factor analyses with the 63 original items showed that the best solution was the extraction of three factors. A scree plot suggested the extraction of up to four factors, but a semantic assessment of the items

and possible factors revealed that three factors would represent the most appropriate theoretical solution.

Once the items for the scale's final version were defined, the factors' theoretical pertinence once again underwent content validity by five experts in Psychology, Psychiatry or Neuropediatrics with experience in clinical assessments. The objective of this procedure was to assist in the clinical understanding of item grouping.

Factor 1 gathered items indicating inattentive behavior and Factor 3 was for hyperactivity and impulsivity indicators. Factor 2, called "control of executive functions", gathered items that represented behavior con-

trolled by executive functions of the frontal cortex. In order to interpret the scores, the decision was made to assess the factors separately and not produce a total score for the scale because the factors assess theoretically independent constructs. The correlation value obtained between factors 1 and 2 was -.44, between factors 1 and 3, -.18, and between 2 and 3, .65.

The scores for each factor were raised by directly adding results obtained in the items in question. There were no items to be inverted. The three factors means, standard deviations, internal consistency, and factorial loads are shown in Table 1.

Table 1
Factor Matrixes, Descriptive and Precision Data of the Attention/Motor Activity Scale

Item	Factor 1: Inattention		Factor 2: Control of Executive Functions		Factor 3: Hyperactivity/Impulsivity	
	Item	Factor Load	Item	Factor Load	Item	Factor Load
28		.60	25	.51	45	.57
32		.59	49	.49	07	.55
37		.56	31	.48	14	.48
52		.53	47	.46	05	.48
12		.51	55	.46	44	.47
30		.51	51	.44	50	.43
57		.51	27	.43	46	.41
22		.49	60	.40	10	.38
08		.49	01	.32	43	.37
34		.48	38	.31	42	.36
23		.48			18	.36
61		.47			41	.33
13		.43			33	.31
04		.43				
09		.42				
02		.42				
21		.40				
40		.40				
54		.39				
56		.38				
03		.32				
15		.31				
11		.30				
<i>Eigenvalue</i>		7.76		2.80		2.39
Var. explained		16.93		8.52		6.35
Number of items		23		10		13
Mean (SD)		64.3 (16.11)		34.1 (6.47)		35.0 (8.91)
Cronbach's Alpha		.92		.73		.88

Mean comparison analyses did not show significant differences for age, gender, school grade, and type of school). In relation to score distribution, the graphs in Figure 1, 2 and 3 show a normal distribution of results in the three assessed factors. They were computed using

the Lilliefors formula ($p < .01$). The asymmetry observed in Factor 1 was equal to .16 and kurtosis was -.38. In Factor 2, these indexes were -.02 and -.37, respectively, and in Factor 3 they were .34 and -.19.

Factor 1 attention : inattention
 K-S $d=,04409$, $p<,10$; Lilliefors $p<,01$

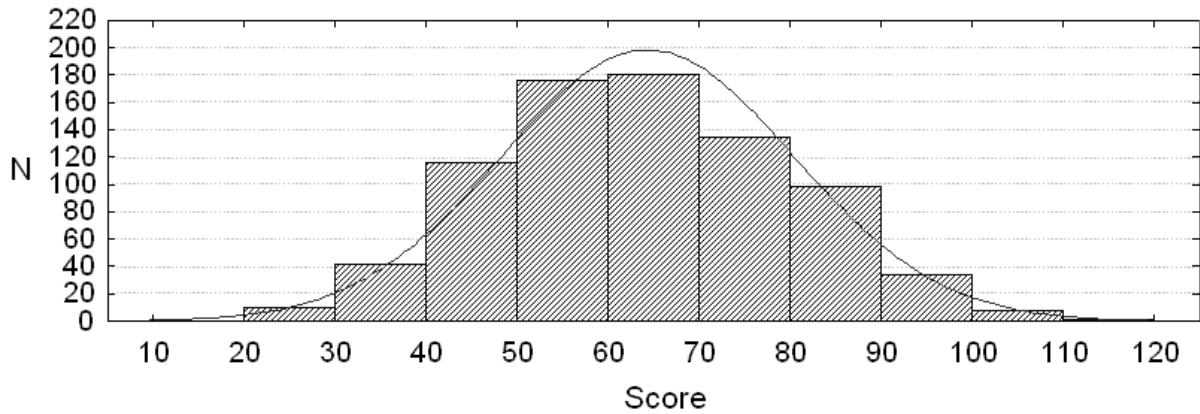


Figure 1. Histogram of score distribution in factor 1 of the Attention/Motor Activity Scale.

Factor 2 attention : control of executive functions

K-S $d=,04114$, $p<,15$; Lilliefors $p<,01$

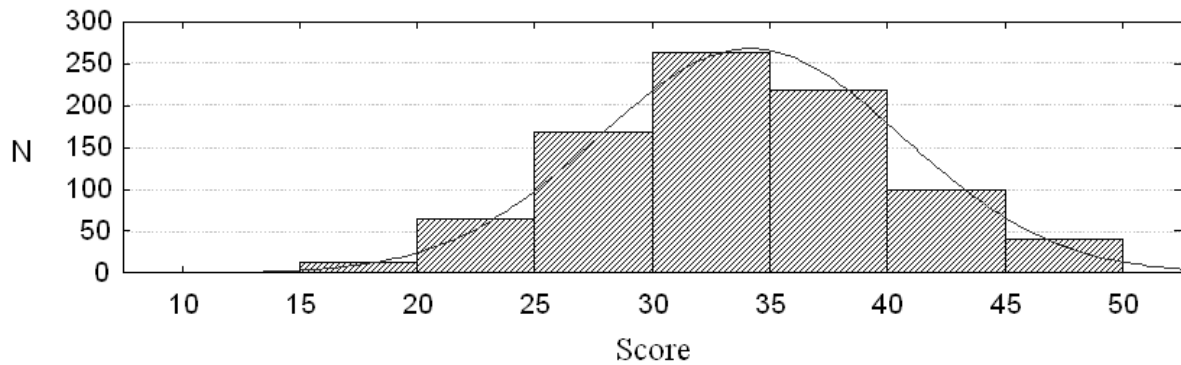


Figure 2. Histogram of score distribution in factor 2 of the Attention/Motor Activity Scale.

Factor 3 attention : hyperactivity/impulsivity

K-S $d=,05925$, $p<,01$; Lilliefors $p<,01$

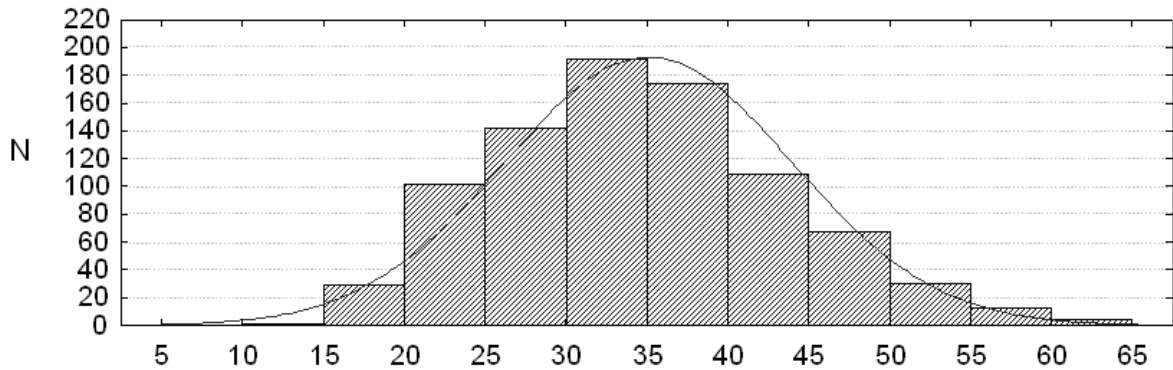


Figure 3. Histogram of score distribution in factor 3 of the Attention/Motor Activity Scale.

Discussion

The items in the first factor are characterized as indicators of inattention. The main markers grouped in this dimension were distractibility, failure to follow instructions, carelessness/lack of interest in school tasks, lack of caution, difficulty in planning activities, difficulty in concentration because of irrelevant external stimuli, and carelessness/disorganization. Above all, these markers represent cognitive difficulties.

Factor 2, named Control of Executive Functions, has items that refer to attention and the capacity to control other executive functions related to attaining goals and to the selection of strategic behavior for solving problems. This implies the capacity to (a) cognitively plan and anticipate the possible consequences of an action, (b) appropriately select actions (which is understood as the choice of one answer and the inhibition of others) and (c) remain alert/concentrated while carrying out an activity.

The investigation of these characteristics can be very important for the prognostic assessment of adolescents who present indications of inattention and impulsivity because executive functions seem to be essential for developing empathy, organization and the search for alternative strategies for problem solving. The mediation of executive functions on these capacities, especially self-control, seems to be moderated by age, becoming progressively influential over the manifestation of impulsive behavior.

The study conducted by Lijffijt, Kenemas, Verbaten, and Van Engeland (2005) with samples diagnosed with ADHD showed that clinical adults have more difficulty to inhibit powerful and impulsive answers when compared to children. According to the authors, it is possible to explain these data by the deficit in behavior inhibition, which is related to different cerebral areas in both populations and moderated by executive functions, especially in adult life. In this sense, it can be hypothesized that individuals who manifest difficulties in attention/motor activity, but have high scores in the 'control of executive functions' factor can present greater social adaptation during development than those with low scores. In other words, they have greater capacity to inhibit socially inappropriate behaviors. However, new studies are needed to check the pertinence of this hypothesis.

Studies that assess ADHD's impact on child development also show that one of the major harm of this disorder is the social exclusion that results from the manifestation of intrusive and little empathetic behaviors. As these behaviors depend on the capacity to anticipate an action's consequences and, in these cases, interventions related to assertiveness training are effective in increasing well-being and the adolescent's capacity for adaptation to ADHD (AACAP, 1997; Weiss et al., 2008),

it can be said that the assessment of items which belong to this factor is an important clinical resource, especially for accompanying interventions.

In relation to Factor 3, the items grouped in this subscale represent markers for hyperactivity and impulsivity. They are descriptions that involve difficulty in keeping quiet, the need to be in movement, reckless behavior, precipitation, difficulty in postponing rewards and interest in activities involving action. All of the items refer to behaviors generally related to invasive/nonassertive social conduct.

The lack of significant differences found in comparisons between boys and girls may be related to changes in cultural standards of education presented to children. Rasmussen and Levander (2009) suggest that at present girls are more frequently exposed to educational practices that encourage the development of active and independent exploratory behavior and tolerate socially nonassertive behavior. This would increase the probability of developing agitated behavior and invasive conduct. However, other studies are needed to verify whether this similar response pattern between female and male adolescents is confirmed in other samples. Results presented in the analysis of the social conduct scale show that boys have a higher score in factors that unite 'anti-social behavior' and 'challenge-oppositionism'. These data show that in local culture, impulsivity/agitation can imply sexual differences in situations that involve transgression of rules or aggressiveness, but not when restricted to socially nonassertive conduct.

Other important data in the analyses involves the extraction of three factors that present appropriate psychometric quality. The distinction between inattention and hyperactivity/impulsivity factors is frequent in exploratory studies conducted with samples of children-teens in Brazil as well as abroad (Rasmussen et al., 2002; Rohde, 2002). However, the extraction of another factor with items that can assess the control of executive functions is innovative, is theoretically pertinent and can be a resource for developing research in clinical neuropsychology.

Limitations: It is important to point out that the present study has some limitations that will require more research in the future. The most important limitation is due to the sample which has participants concentrated in a single region of the country. Also, it would be important to develop new studies to assess convergent and discriminant reliability.

References

- American Academy of Child and Adolescent Psychiatry. (1997). Practice parameters for the assessment and treatment of children, adolescents and adults with attention-deficit/hyperactivity disorder. *Journal of the American Academy of Child and Adolescent Psychiatry*, 36, 85S-121S.

- American Psychiatric Association. (2002). *Manual diagnóstico e estatístico de transtornos mentais (DSM-IV-TR)*. Porto Alegre, RS: ArtMed.
- Connor, D., & Doerfler, L. (2008). ADHD with comorbid oppositional defiant disorder or conduct disorder: Discrete or nondistinct disruptive behavior disorders? *Journal of Attention Disorders, 12*, 126-134.
- Cuffe, S., Moore, C., & McKeown, R. (2009). ADHD and health services utilization in the National Health Interview Survey. *Journal of Attention Disorders, 12*, 330-340.
- Davidson, M. (2008). Literature review: ADHD in adults: A review of the literature. *Journal of Attention Disorders, 11*, 628-641.
- Hampel, P., Manhal, S., Roos, T., & Desman, C. (2008). Interpersonal coping among boys with ADHD. *Journal of Attention Disorders, 11*, 427-436.
- Hoza, B., Waschbusch, D., Pelham, W., Molina, B., & Milich, R. (2000). Attention-deficit/hyperactivity disorder and control boys' responses to social success and failure. *Child Development, 71*(2), 432-446.
- Lijffijt, M., Kenemas, L., Verbaten, M., & Van Engeland, H. (2005). A meta-analytic review of stopping performance in attention-deficit/hyperactivity disorder: Deficient inhibitory motor control? *Journal of Abnormal Psychology, 114*, 216-222.
- Rasmussen, K., & Levander, S. (2009). Untreated ADHD in adults: Are there sex differences in symptoms, comorbidity, and impairment? *Journal of Attention Disorders, 12*, 353-360.
- Rasmussen K., Todd, R., Neuman, R., Heath, A., Reich, W., & Rohde, L. A. (2002). Comparison of male adolescent-report of attention-deficit/hyperactivity disorder (ADHD) symptoms across two cultures using latent class and principal components analysis. *Journal of Child Psychology and Psychiatry, 43*, 797-805.
- Rohde, L. A. (2002). ADHD in Brazil: The DSM-IV criteria in a culturally different population. *Journal of American Academic Child and Adolescent Psychiatry, 41*, 1131-1133.
- Weiss, M., Safren, S., Solanto, M., Hechtman, L., Rostain, A., Ramsay, J., et al. (2008). Research forum on psychological treatment of adults with ADHD. *Journal of Attention Disorders, 11*, 642-651.
- Young, S., Heptinstall, E., Sonuga-barke, E. J., Chadwick, O., & Taylor, E. (2005). The adolescent outcome of hyperactive girls: Self-report of psychosocial status. *Journal of Child Psychology and Psychiatry, 46*, 255-262.

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Caroline Tozzi Reppold. Fundação Universidade Federal de Ciências da Saúde de Porto Alegre, Brazil.
Claudio Simon Hutz. Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil.