

Construction and validation of the ADHD knowledge scale

Construção e validação da escala de conhecimentos sobre o TDAH

Construcción y validación de la escala de conocimiento sobre el TDAH

Construction et validation de l'échelle de connaissances sur le TDAH

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Abstract

The objective of this study was to present the validity construction and evidence of a scale that assesses knowledge about Attention Deficit/Hyperactivity Disorder (ADHD). The steps for psychological instrument development were followed: operationalization of the construct, theoretical analysis of the items, and search for evidence of validity. 761 people of both sexes, aged between 18 and 76 years old, with incomplete and complete higher education, participated in it. Data collection occurred electronically. A fit analysis of the IRT Three-Parameter Logistic Model was performed. The final version of the scale has 15 items and an acceptable internal consistency index ($\alpha=0.73$), besides five anchor levels (-2, -1, 0, 1, and 2) that allow identifying differences in knowledge about ADHD. It is suggested that more studies using this instrument be produced, contributing to a more robust validity and, consequently, contributing to the psychoeducation of ADHD.

Keywords: attention deficit hyperactivity disorder, psychometrics, psychoeducation

Resumo

O objetivo desse estudo foi apresentar a construção e evidências de validade de uma escala que avalia conhecimentos sobre o Transtorno de Déficit de Atenção/Hiperatividade (TDAH). Foram seguidas as etapas para o desenvolvimento de instrumentos psicológicos:

operacionalização do construto, análise teórica dos itens, busca de evidências de validade. Participaram 761 pessoas de ambos os sexos, com idade entre 18 e 76 anos, com ensino superior incompleto e completo. A coleta de dados ocorreu por meio eletrônico. Foi realizada uma análise de ajuste do Modelo Logístico de Três Parâmetros da TRI. A versão final da escala possui 15 itens e índice de consistência interna aceitável ($\alpha=0,73$), além de cinco níveis âncora (-2, -1, 0, 1 e 2) que permitem identificar diferenças no conhecimento sobre TDAH. Sugere-se que mais estudos utilizando esse instrumento sejam produzidos, colaborando para uma validade mais robusta e, conseqüentemente, contribuindo para a psicoeducação do TDAH.

Palavras-chave: transtorno da falta de atenção com hiperatividade, psicometria, psicoeducação

Resumen

El objetivo de este estudio fue presentar la construcción y evidencias de validez de una escala que evalúa conocimientos sobre el Trastorno de Déficit de Atención/Hiperactividad (TDAH). Fueron seguidas las etapas para el desarrollo de instrumentos psicológicos: operacionalización del constructo, análisis teórico de los elementos, búsqueda de evidencias de validez. Participaron 761 personas de ambos los sexos, con edades entre 18 y 76, con enseñanza superior incompleta y completa. La recogida de datos ocurrió por medio electrónico. Fue realizado un análisis de ajuste del Modelo Logístico de Tres Parámetros de la TRI. La versión final de la escala posee 15 elementos e índice de consistencia interna aceptable ($\alpha=0,73$), además de cinco niveles ancla (-2, -1, 0, 1 e 2) que permiten identificar diferencias en el conocimiento sobre TDAH. Se sugiere que más estudios sean producidos utilizando este instrumento, colaborando para una validez más robusta y, consecuentemente, contribuyendo para la psicoeducación del TDAH.

Palabras clave: trastorno de la falta de atención con hiperactividad, psicometría, psicoeducación

Résumé

Le but de cette étude était de présenter la construction et la preuve de validité d'une échelle qui évalue les connaissances sur le Trouble Déficitaire de l'Attention avec ou sans Hyperactivité (TDAH). Les étapes de développement des instruments psychologiques ont été suivies : opérationnalisation du construit, analyse théorique des items, recherche de preuves de validité. Un total de 761 personnes des deux sexes a participé, âgées de 18 à 76 ans, avec un enseignement supérieur incomplet et complet. La collecte des données s'est déroulée par voie électronique. Une analyse d'ajustement du Modèle Logistique à Trois Paramètres de la TRI a été réalisée. La version finale de l'échelle comporte 15 items et un indice de cohérence interne acceptable ($\alpha=0,73$), ainsi que cinq niveaux d'ancrage (-2, -1, 0, 1 et 2) qui permettent d'identifier les différences dans les connaissances sur le TDAH. On suggère que plus d'études soient produites en utilisant cet instrument, contribuant à une validité plus robuste et, par conséquent, à la psychoéducation du TDAH.

Mots-clés : trouble déficitaire de l'attention avec hyperactivité, psychométrie, psychoéducation

Attention-Deficit/Hyperactivity Disorder (ADHD) is characterized by inattention, hyperactivity, and impulsivity (*American Psychiatric Association* [APA], 2022), whose main etiological factors are neurobiological (Wagner et al., 2016). The diagnosis is clinical, based on well-defined criteria, as described in manuals such as the DSM-V-TR (APA, 2022). Symptoms must manifest before the age of 12 and be present in more than one environment. They are evaluated according to persistence and severity relative to behaviors typically observed in individuals of an equivalent level of development (APA, 2022).

ADHD can manifest itself in different ways and be specified as predominantly inattentive, predominantly hyperactive, and mixed presentation. The predominantly inattentive specifier corresponds to six or more symptoms of inattention, but less than six symptoms of hyperactivity-impulsivity. For example, they frequently lose important everyday objects (keys, documents) or forget important deadlines at work. The predominantly hyperactive-impulsive specifier, in turn, occurs in individuals who present six or more symptoms of hyperactivity-impulsivity, but less than six symptoms of inattention. For example, the individual cannot wait his or her turn to speak and interrupts others and feels great discomfort if he or she needs to stay for long periods of time in meetings or conversations, even important ones, related to work or personal life. Finally, the combined presentation specifier is attributed when six or more symptoms of inattention and six or more symptoms of hyperactivity-impulsivity are indicated. For example, in addition to having difficulty remembering important tasks and deadlines, such as payment dates or where they left their belongings, the individual also displays agitated behavior in social situations that require calm and waiting, as they can hardly wait their turn to speak or remain in the same environment for more than a few hours (APA, 2022).

The prevalence of ADHD is estimated to be 2.5% in the global adult population (APA, 2022). Although ADHD usually appears in childhood, it is common for it to persist into adulthood in 60% to 70% of cases (Lara et al., 2009), and, even if the disorder persists, the symptoms change according to the individual's stage of development and the contexts in which they are inserted (Agnew-Blais et al., 2016; APA, 2022). Therefore, it is common for people diagnosed with ADHD to present impairments in different spheres of development, mainly social, professional and academic, due to the symptoms of the disorder (Castro & Lima, 2018). Regarding treatment, the most effective currently is the combination of stimulant psychotropic drugs, to minimize symptoms such as inattention and hyperactivity, with cognitive-behavioral psychotherapy, to maximize the use of strategies to deal with residual symptoms, which prevent the patient from having their functionality fully restored (Faraone et al., 2015).

The general population's lack of knowledge about ADHD can be detrimental to those diagnosed with this disorder (Murtani et al., 2020). Symptoms can be misinterpreted by both the individual and others around them. Inattention resulting from symptoms can cause poor performance in tasks that require prolonged focus, frustration at not being able to achieve academic and professional goals, and attribution of these losses to personal characteristics, such as lack of willpower (Coutinho & França, 2020). Thus, a lack of knowledge about the disorder can compromise the functionality, self-efficacy, and personal relationships of individuals with ADHD (Coelho et al., 2016).

The harm caused by a lack of knowledge about ADHD can be even greater when it occurs on the part of health professionals. It is possible that the lack of scientific and updated information about ADHD may delay the recognition of the disorder. As a consequence, adequate treatment cannot be offered and social problems may increase (Cornejo et al., 2019; Park et al., 2018).

The stigma resulting from a lack of knowledge about ADHD and its symptoms makes psychoeducation about this disorder essential (Lúcio, 2020). There are reports in the literature of several psychoeducational interventions for ADHD (Oliveira & Dias, 2018). The dissemination of relevant information about the disorder (diagnosis, etiology, functioning), treatment, and prognosis, as well as the correction of distorted information is associated with greater knowledge about this condition, greater adherence to treatment by patients and family members, lower levels of stress, higher levels of self-esteem and higher levels of quality of life (Maia et al., 2018; Oliveira & Dias, 2018).

However, in a recent literature review, it was found that only 3 of 17 studies reporting psychoeducational interventions assessed whether the information provided in ADHD psychoeducation was understood by patients, family members, and teachers. One of the reasons for this may be the lack of instruments constructed and validated for this purpose (Oliveira & Dias, 2018). Therefore, the objective of this study is to present the construction and evidence of the validity of a scale that assesses knowledge about ADHD. It is expected that this instrument can assist in identifying distorted information to be addressed during clinical care, as well as in evaluating the effectiveness of psychoeducational interventions on this disorder.

Method

This is a cross-sectional study to construct a knowledge scale on ADHD and present its psychometric properties, which is part of a more comprehensive project on psychoeducation of this disorder in the university context.

Participants

The sample consisted of 761 individuals (77.6% women), aged 18 to 76 years ($M = 28.75$ years, $SD = 9.46$). Most participants lived in Rio Grande do Sul (63%), São Paulo (7.0%), and Santa Catarina (5.3%), with the remainder from other Brazilian states. Regarding education, 58.2% had completed higher education and 41.8% had incomplete higher education. Regarding profession, health sciences had the greatest representation (7.5%), followed by human sciences (5.9%), applied social sciences (4.2%), exact sciences (3.1%), engineering (1.7%), agricultural sciences (0.7%), linguistics (0.7%) and educational sciences (0.5%). The inclusion criteria were: being 18 years or older and having at least incomplete higher education. The exclusion criterion was not having answered the instruments in their entirety.

Instrument

The ADHD Knowledge Scale was specially structured for this study. Its objective is to assess people's knowledge about ADHD, which can be useful in evaluating psychoeducational interventions for this disorder. The steps for developing psychological instruments were followed: operationalization of the construct and theoretical analysis of the items (Pasquali, 2016).

The operationalization of the construct was carried out based on the scientific literature in the area and interviews. First, the topics generally addressed in psychoeducational interventions for ADHD and other instruments used in international research were identified: characteristics of ADHD, etiology, course, diagnosis, and treatment (Bramham et al., 2009; Kooij

& Francken, 2010; Oliveira & Dias, 2018; Palacios-Cruz et al., 2013; Safren, 2008). Then, interviews were conducted with university professors from different courses, such as mechanical engineering and agronomy, to identify what they knew about ADHD and questions regarding the disorder. The 17 items were constructed from this information. To test the respondents' knowledge, some items contain correct statements and others, incorrect ones.

The theoretical analysis of the items was then carried out. The first version of the items was assessed for relevance and difficulty by five judges, whose selection criteria were that they worked in an outpatient clinic specializing in the care of people with ADHD or in support services for university students. All items were maintained due to their relevance. The experts suggested changes and additions to questions, such as: "ADHD is caused by a lack of effort", "ADHD can be inattentive, hyperactive and combined", "people with ADHD quickly lose interest in the activities they perform". After the suggested changes were made, a pilot study was conducted with seven university students from different courses (social communication, dentistry, medicine, electrical engineering and computer science) who explained what they understood about each item to check the clarity of the content. The items that presented writing problems were reformulated according to the suggestions received. The 22 items were then randomized to make up the final version of the instrument. A three-point Likert response scale was used, ranging from *completely disagree* to *agree*, with the intermediate option being a way of identifying when participants were unsure of the answer.

Procedures

The research was submitted to and approved by the Research Ethics Committee of the Federal University of Santa Maria (CAAE 72074017.6.0000.5346). The research followed the ethical guidelines set forth in Resolution 510/16 of the National Health Council. It was disseminated through social media and email lists. Those who agreed to participate signed the Electronic Informed Consent Form (ICF). Participants responded to all instruments through the online platform *Survey Monkey*. Data collection took place in August and September 2017.

Data analysis

To develop a knowledge scale about ADHD using the Three-Parameter Logistic Model (3ML) of IRT, a dichotomization procedure of the original data is necessary. 3ML is specifically used for educational assessments of proficiency or knowledge, and is used internationally in several educational assessments, mainly large-scale (Andrade et al., 2010). Therefore, it is necessary that the data be organized in such a way that there are only two possible answers: correct and incorrect or correct and incorrect.

Initially, the 22 items were made available on the instrument on a three-point Likert scale of agreement (*disagree*, *partially agree*, and *agree*). These items could contain a correct or incorrect statement, and participants were asked to respond to one of the options on the scale. If the statement was true, the option "*agree*" was the correct alternative, otherwise the option "*disagree*" was the correct alternative. For the purposes of applying ML3, the data were dichotomized to assess participants' knowledge as follows: if the statement was true, the option "*agree*" was considered the correct answer and the other options were considered incorrect; if the statement was false, the option "*disagree*" was considered the correct answer and the other options were considered incorrect.

With the database organized, a preliminary analysis based on Classical Test Theory (CTT) was first performed, which involved analysis of Cronbach's Alpha Coefficient, percentages of hits and errors, and the Point Biserial Coefficient. Next, a factor analysis (FA) was performed with the aim of identifying the presence of a dominant factor, a necessary assumption for analysis by IRT, using ML3, which was conducted in sequence. The item parameters were estimated by *Maximum Likelihood*, and the latent trait was estimated by the Bayesian *posterior expectation method*. The analyses were performed in the *software* R, through the *psych* (Revelle, 2008), *LTM* (Rizopoulos, 2006) and *IRTOYS* (Partchev et al., 2017) packages.

Results

Preliminary analysis through TCT

The Cronbach's Alpha of the scale was 0.6904. Although the minimum value for acceptable internal consistency is 0.7, a value of 0.60 can be considered acceptable in exploratory research (Hair et al., 2009), as is the case with this instrument.

The frequency analysis (Table 1) of correct answers for each item indicates which information about ADHD is most and least known by the sample studied. The items "ADHD is caused by a person's lack of effort to pay attention" and "ADHD is a disorder that only occurs in childhood", both with incorrect information, presented the highest accuracy rates (over 90%). This indicates that most participants knew that these statements were incorrect and that, for most people, it is not difficult to know that ADHD also occurs in adults, for example.

Table 1*Percentage of accuracy and correlation Point Biserial*

Item	Percentage of correct answers	Point Biserial Correlation
ADHD is a disorder that can last a lifetime.	61.89%	0.4607
People with ADHD tend to be disorganized (they lose things, forget deadlines, etc.).	50.85%	0.4497
Treatment consists of developing organizational strategies.	36.40%	0.3831
ADHD symptoms are caused by difficulty controlling impulsive reactions.	24.70%	0.4257
ADHD can be controlled without medication.	83.84%	0.0594
ADHD can be diagnosed by a psychiatrist, psychologist or teacher.*	67.67%	0.1407
People with ADHD get easily irritated.	21.02%	0.2914
ADHD is caused by a person's lack of effort to pay attention.*	91.20%	0.3147
ADHD is a disorder that only occurs in childhood.*	90.41%	0.3489
Medication eliminates ADHD symptoms in all cases.*	77.14%	0.3866
ADHD has a neurobiological origin.	42.58%	0.4635
The exclusive use of the symptom list is sufficient to diagnose ADHD.*	67.02%	0.3167
Symptoms can be extinguished with willpower alone.*	85.41%	0.397
People with ADHD quickly become disinterested in all the activities they do.*	34.69%	0.1544
People with ADHD prefer activities with immediate gratification rather than waiting for long-term rewards.	44.42%	0.4809
ADHD can be of the Inattentive type, the Hyperactive type, and the Combined type (inattentive and hyperactive).	68.59%	0.5264
The number of ADHD cases has increased in recent decades.*	6.31%	0.1259
ADHD treatment is lifelong.	35.74%	0.4229
People with ADHD tend to act without thinking.	25.76%	0.4272
People with ADHD have difficulty maintaining attention on what they are doing.	77.00%	0.4513
One of the goals of treatment is to reduce the tendency to be distracted.	72.01%	0.4537
Diagnosis of ADHD requires assessment of the intensity of symptoms, the damage caused by them and the age of onset.	80.42%	0.4683

Note. * Items with incorrect content

On the other hand, the item “the number of ADHD cases has increased in recent decades,” which was an incorrect statement, was the only one with a hit rate lower than 10%. This indicates that most participants believe that ADHD cases have increased in recent decades, although this information has no scientific basis.

Three items with true statements also had a low percentage of correct answers (between 20% and 30%). They are: “ADHD symptoms are caused by difficulty controlling impulsive reactions”, “people with ADHD get easily irritated” and “people with ADHD tend to act without thinking”. Apparently, most respondents are unaware of the causes of ADHD symptoms, in addition to believing that individuals with the disorder do not get irritated easily and tend to think before acting.

The Point Biserial Coefficient (Table 1) shows the correlation between the individual's correct/incorrect responses and their total score (sum of all correct responses). Individuals who correctly answer a given item are expected to have a higher total score than those who incorrectly answer the item, resulting in a positive correlation. Items that present a negative correlation are not suitable, as this means that individuals who correctly answer that item had a lower total score than those who incorrectly answered the item. Likewise, coefficients close to zero are not suitable and indicate that individuals who correctly answer the item have the same total score as those who incorrectly answer the item. Items with a negative Point Biserial Coefficient or close to zero are strong candidates for elimination in the IRT analysis.

There were no cases of items with a negative Point Biserial Coefficient, which means that the items are consistent. However, some low values close to zero were obtained. The lowest Point Biserial Coefficient value was 0.0594 for the item “ADHD can be controlled without medication”. Although this item had a high percentage of correct answers (83.84%), this does not mean that the individuals who answered this item the most correctly are the individuals who understand ADHD the most. In other words, it seems that this item was answered randomly by the respondents, or it may cause confusion in

its interpretation and understanding. These results give an indication of how the item discrimination parameter will behave in ML3, in the sense that items with negative Point Biserial Coefficient values tend to have a negative discrimination coefficient as well, and vice versa.

The data set appears to have at least two factors. The first factor explains 24% of the total variance (almost 1/4 of the total) and stands out slightly as a dominant factor, being sufficient to justify the adjustment by a one-dimensional IRT model. However, since the evidence for this dominant factor is not very strong, some items will probably be eliminated during the ML3 adjustment in the IRT analysis.

IRT ML3 Adjustment

In the first attempt to adjust the ML3 of the IRT, the computational algorithm did not converge, and it was not possible to generate the results. Therefore, it was decided to eliminate from the analysis the items with the lowest Point Biserial Coefficient values of the TCT until the algorithm converged. In this procedure, the item with the lowest Point Biserial Coefficient (“ADHD can be controlled without medication”) was eliminated and ML3 adjustment was attempted again with the remaining 21 items, but the computational algorithm did not converge. Next, the item with the second lowest Point Biserial Coefficient (“the number of ADHD cases has increased in recent decades”) was eliminated and the adjustment using ML3 was attempted, which failed again. Next, the item with the third lowest Point Biserial Coefficient (“ADHD can be diagnosed by a psychiatrist, psychologist or teacher”) was eliminated and the adjustment using ML3 was attempted, which failed again. Continuing the procedure, the item “people with ADHD quickly become uninterested in all the activities they carry out” was eliminated, attempting adjustment using ML3, which finally obtained convergence of the computational algorithm.

However, it was observed that some items were not adequately adjusted by ML3. Items with discrimination lower than 0.65 (Baker, 2001) do not distinguish individuals who know from those who do not know. Items with very high discrimination and items positioned well beyond ± 3 standard deviations from the zero mean of the scale or items with a high standard error (SE) are also inadequate. Thus, the items “medication extinguishes ADHD symptoms in all cases”, “the exclusive use of the symptom list is sufficient to make the diagnosis of ADHD” and “people with ADHD tend to act without thinking” were eliminated. The analysis was rerun and stronger evidence of a dominant factor in PA was identified. All parameters had adequate estimates (Table 2), resulting in a total of 15 items.

Table 2

ML3 parameters and their standard errors (SE)

Item	the	b	w	EP(a)	EP(b)	EP(c)
1. ADHD is a disorder that can last a lifetime.	0.91	-0.62	0.00	0.12	0.12	0.00
2. People with ADHD tend to be disorganized (they lose things, forget deadlines, etc.).	1.19	0.12	0.07	0.30	0.27	0.11
3. Treatment consists of developing organizational strategies.	1.52	1.23	0.20	0.66	0.17	0.06
4. ADHD symptoms are caused by difficulty controlling impulsive reactions.	1.48	1.16	0.03	0.35	0.12	0.03
5. People with ADHD get easily irritated.	1.12	1.82	0.06	0.44	0.26	0.05
6. ADHD is caused by a person’s lack of effort to pay attention.*	0.84	-3.12	0.00	0.16	0.50	0.01
7. ADHD is a disorder that only occurs in childhood.*	0.91	-2.80	0.00	0.16	0.41	0.02
8. ADHD has a neurobiological origin.	1.09	0.36	0.00	0.06	**	**
9. Symptoms can be extinguished with willpower alone*.	0.86	-2.33	0.00	0.14	0.32	0.01
10. People with ADHD prefer activities with immediate gratification rather than waiting for long-term rewards.	1.47	0.28	0.02	0.27	0.12	0.05
11. ADHD can be of the Inattentive type, the Hyperactive type, and the Combined type (inattentive and hyperactive).	1.46	-0.73	0.00	0.17	0.09	0.00
12. ADHD treatment is lifelong.	0.98	0.72	0.00	0.13	0.11	0.00
13. People with ADHD have difficulty maintaining attention on what they are doing.	1.47	-1.12	0.00	0.18	0.11	0.00
14. One of the goals of treatment is to reduce the tendency to be distracted.	1.32	-0.93	0.00	0.16	0.11	0.00
15. The diagnosis of ADHD requires an assessment of the intensity of the symptoms, the damage caused by them and the age of onset.	1.34	-1.38	0.00	0.17	0.14	0.00

Note. * Items with incorrect content. ** Unable to estimate.

The FA was repeated with the remaining 15 items. An increase in the variance explained by the dominant factor (32%) was obtained, almost 1/3 of the total. Cronbach's Alpha was recalculated and rose to 0.7268.

Figure 1 shows the Item Characteristic Curves (ICC) graph for the 15 items evaluated. All curves are adequately adjusted according to the properties of ML3, increasing in order to accumulate probability as the individual's latent trait (or ability) increases. Individuals with very low ability (below 2 standard deviations from the zero mean of the scale) have a probability close to zero of answering most of the questions correctly. On the other hand, those with very high ability (above 2 standard deviations from the zero mean of the scale) have a probability close to one of answering most of the questions correctly.

Figure 1

Characteristic Curves of the Items of the Knowledge Scale about ADHD

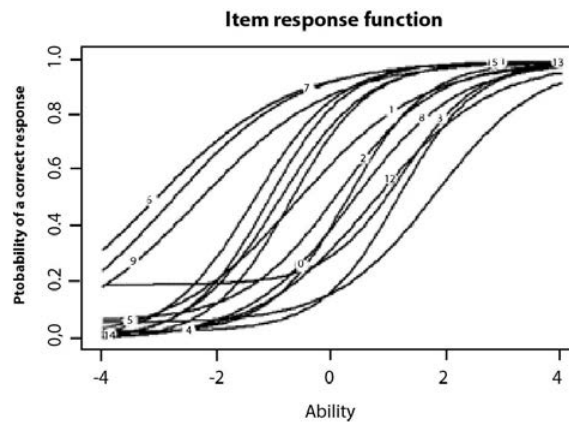
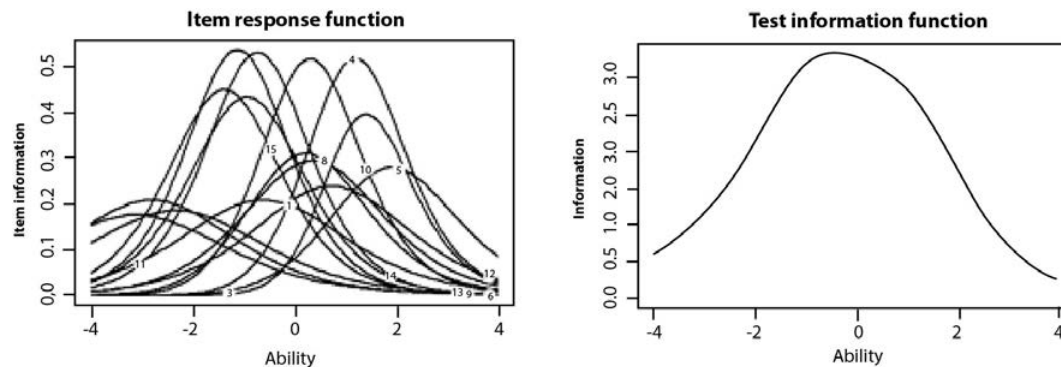


Figure 2 presents the Item Information Function (IIF) and the Total Information Function (TIF) of the scale. The IIF graph shows that all 15 items of the instrument are of good quality and contribute significantly to the construct (TIF). It is also observed that the most informative items are in the central region of the graph, between -2 and 2 standard deviations from the zero mean of the scale. This justifies the fact that the instrument has more information between -2 and 2 (according to the TIF), that is, the instrument is able to better measure the ability of individuals who are up to two standard deviations away from the zero mean of the scale, which corresponds to 98.03% of the samples (Table 3).

Figure 2

Item Information Curves and Total Information Function of the ADHD Knowledge Scale



A scale with a mean equal to zero and a standard deviation equal to one was created to establish anchor categories for the items and anchor levels. Regarding the creation of the scale, of the 15 items evaluated, three items were identified as anchors and six were identified as "almost anchors". Five anchor levels (levels -2, -1, 0, 1 and 2) of knowledge about ADHD were characterized, as shown in Table 3. No item of knowledge about ADHD was characterized at level -3.

Table 3

Second Level Anchor Characteristic Items

Anchor levels	Interpretation	Anchor and quasi-anchor items	Percentage of respondents in the sample
-3	-	-	1.97%
-2	Very low	7. ADHD is a disorder that only occurs in childhood.*	10.51%
-1	Low	13. People with ADHD have difficulty maintaining attention on what they are doing. 15. The diagnosis of ADHD requires an assessment of the intensity of the symptoms, the damage caused by them and the age of onset.	36.66%
0	Moderate	11. ADHD can be of the Inattentive type, the Hyperactive type, and the Combined type (inattentive and hyperactive). 14. One of the goals of treatment is to reduce the tendency to be distracted.	39.95%
1	High	2. People with ADHD tend to be disorganized (they lose things, forget deadlines, etc.). 8. ADHD has a neurobiological origin. 10. People with ADHD prefer activities with immediate gratification rather than waiting for long-term rewards.	9.72%
2	Very high	4. ADHD symptoms are caused by difficulty controlling impulsive reactions.	1.18%

Note. * Item with incorrect content.

The interpretation of an individual’s position on the scale occurs through the estimated value of their latent trait according to the level at which they are found. For example, individuals situated at level -2 (very low) know that ADHD is not a disorder that occurs only in childhood, while those situated at level -1 (low), in addition to the knowledge of the previous level, know that people with ADHD have difficulty maintaining attention on what they are doing and that the diagnosis of ADHD requires an assessment of the intensity of the symptoms, the impairments caused by them and the age of onset. The same interpretation logic applies to levels 0 (moderate), 1 (high) and 2 (very high): people have knowledge of the contents of that anchor level added to those of the lower levels, but not of the higher levels.

Discussion

The objective of this study is to present the construction and validity evidence of a scale that assesses knowledge about ADHD. To this end, it was necessary to exclude some items to improve the internal consistency of the scale and adjust the items during the statistical analyses. This procedure was based on statistical parameters and the literature in the area, as discussed below.

The item “the number of ADHD cases has increased in recent decades” did not present adequate adjustment. Furthermore, it had the lowest rate of correct answers in the sample studied, possibly due to the confusion of the terms “prevalence” with “incidence” by participants who do not belong to the health field. In recent years, information about ADHD has reached the population more effectively and contributed to the recognition of symptoms in oneself or in family members, which may justify the greater demand for mental health professionals. Thus, more cases are evaluated, and consequently, there is a greater number of diagnoses of the disorder, causing the population to have the erroneous impression that the incidence has increased. However, what has increased is information and the demand for evaluation. The rates of diagnosis and treatment do not exceed the estimates of ADHD prevalence, that is, the number of people diagnosed is still lower than the estimate of the disorder in the population (Polanczyk et al., 2014).

The items “ADHD can be controlled without medication” and “medication extinguishes ADHD symptoms in all cases” were also excluded. Their removal may be justified by the difficulty of classifying them as true or false in the absence of more information. In the first case, there is evidence that ADHD can be controlled without medication, only with psychotherapy, depending on factors such as severity, age and specifier (Alcântara et al., 2018). In the second, the literature shows that medication will extinguish symptoms in certain cases of ADHD, but not all (Ramsay, 2017).

The item “ADHD diagnosis can be performed by a psychiatrist, psychologist or teacher” was excluded due to low Point Biserial correlation, i.e., answering the question correctly does not necessarily imply knowledge about the professionals who can diagnose ADHD. The question is false because teachers without training in psychology or medicine cannot diagnose

mental disorders. However, it may be that the individual who scored the question as false considered the psychologist or psychiatrist as a professional who is not qualified to perform the diagnosis (Reis & Camargo, 2008).

The items “people with ADHD quickly lose interest in all activities they undertake” and “people with ADHD tend to act without thinking” were excluded due to the ambiguity that the terms “disinterest” and “act without thinking” may represent in the respective statements. Disinterest, while it can be considered part of the deficit in maintaining attentional focus, also sounds like an intentional choice unrelated to pathological symptoms (Murtani et al., 2020). The expression “act without thinking”, in common sense, may be related to impulsivity, because even if there is difficulty in controlling impulses in ADHD, it does not mean that it is related to the cognitive difficulty of thinking before acting (Puente & Mitchell, 2015).

The item “the exclusive use of the symptom list is sufficient to diagnose ADHD” also had to be deleted. On the one hand, its content seems obvious, but there are still lay people who trust the internet as a main source of information about mental health (Silva et al., 2021).

After the item exclusion procedures and the new analyses performed, the final version of the ADHD knowledge scale had 15 items. Of these, 9 make up 5 anchor levels. The very low level (-2) is made up of a single item: “ADHD is a disorder that occurs only in childhood”, considered the most easily answered. In fact, more than 90% of the sample studied answered correctly. This can be explained by the fact that, for the general public, the age of prevalence of a disorder may be one of the first pieces of information questioned and easily assimilated (Caliman, 2008). Furthermore, there are reports in the literature of children who, despite their symptoms, did not receive a diagnosis and treatment due to lack of information from their caregivers, but realized that their functionality was impaired by residual symptoms in adulthood, thus needing to seek professional help (Agnew-Blais et al., 2016).

The low level (-1) is composed of the items “people with ADHD have difficulty maintaining attention on what they are doing” and “the diagnosis of ADHD requires assessment of the intensity of symptoms, the damage caused by them, and the age of onset”. The first may have been easily understood and answered, as it refers to the symptom that gives the disorder its name. The second concerns what is necessary to diagnose ADHD, information that has interested the population in recent years and is usually accompanied by the importance of professional evaluation (Costa e Silva & Corcino, 2020).

The moderate level (zero) contains the items “ADHD can be of the inattentive type, the hyperactive type, and the combined type (inattentive and hyperactive)” and “one of the goals of treatment is to reduce the tendency to be distracted”. It makes sense that these items are at the moderate anchor level. After all, although this information arouses less interest from the general public, it is (or should be) known to professionals and students in the medical and psychological fields, as well as to individuals who have the disorder or who live with people who have the diagnosis, such as friends or family members (APA, 2022; Murtani et al., 2020).

The high level (1) is composed of the items “people with ADHD tend to be disorganized (they lose things, forget deadlines, etc.)”, “ADHD has a neurobiological origin”, and “people with ADHD prefer activities with immediate gratification rather than waiting for long-term rewards”. At this level, the information is not widely accessible, as it refers to one of the forms of manifestation of the symptom of inattention and the neuropsychology of the disorder (APA, 2022). In general, the lay population tends to think that inattention or hyperactivity will appear more literally and explicitly than it actually is, without seeking to understand the nuances of the symptoms. In addition, the neuropsychology of ADHD tends to be specific knowledge of professionals who treat patients with this diagnosis and transmit it to them when they deem it pertinent (Ferreira & Moscheta, 2019).

The very high level (2) contains only the item “ADHD symptoms are caused by difficulty controlling impulsive reactions”, considered the most difficult to get right. Again, this is the neuropsychology of ADHD and, perhaps for this reason, the difficulty in getting the item right. The three main symptoms of ADHD (inattention, hyperactivity and impulsivity) can be understood because of the delay in the development of behavioral inhibition. The disorder therefore involves great difficulty in inhibiting impulsive reactions and in considering the future to guide behavior (Costa et al., 2014). Therefore, this item requires a high level of knowledge of the disorder and is generally understood by those who are professionals and scholars in the area, or by those who have already been diagnosed and seek to understand their symptoms.

A few decades ago, there was a stigma that ADHD was a cultural construct: it was considered that the behavior of children with this diagnosis was typical of this period of development and that the intolerance of today’s society in supporting and managing it led to the classification of ADHD as a disorder. However, current scientific evidence of the neurobiological origin of ADHD, as well as the impairments in functionality and quality of life caused by the neglect of this diagnosis, contribute to the weakening of stigmas such as this (Murtani et al., 2020). The greater search for and access to scientific knowledge contributes to the reduction of the blaming of individuals with ADHD, since it is understood that their difficulties are not negative personal characteristics, but rather result from a mental disorder (Lopera et al., 2018; Philipp-Wiegmann et al., 2016). Reducing stigma can also be achieved through psychoeducation, the effectiveness of which can be assessed by applying the ADHD knowledge scale.

Final considerations

The objective of this study is to present the construction and validity evidence of a scale that assesses knowledge about ADHD. The steps for developing psychological instruments were as follows: operationalization of the construct, theoretical analysis of the items, and search for evidence of validity. The analyses conducted led to procedures to improve the internal consistency of the instrument, whose final version has 15 items and Cronbach's alpha of 0.7268. The five anchor levels of this scale allow us to identify differences in knowledge about ADHD beyond the total score of correct answers to items.

The most important limitation of this study is the instrument's response key. The data collection was performed using a 3-point Likert scale of agreement (*disagree*, *partially agree*, and *agree*), but the responses were dichotomized into true or false to assess the participants' knowledge. This adaptation may have interfered with the results and, consequently, with the quality of the instrument. In addition, the sample of this study consisted only of adults with incomplete or complete higher education. Therefore, the anchor levels are specific to populations with these same characteristics. Future research may include samples with different characteristics, especially regarding age and education, in order to verify the need for changes in the wording of the items. It is also recommended that the ADHD knowledge scale be used with a dichotomous response key, of the correct or incorrect type.

Despite its limitations, this study presents the construction of a knowledge scale on ADHD that makes a significant contribution. Thus, although it requires improvements in the future, it may be useful in the evaluation of psychoeducation for the disorder in question. In addition, the instrument can be used to assess the stigma surrounding ADHD. After all, although science has advanced, there are still myths about the disorder that may prevent individuals from seeking professional evaluation and treatments that help their functionality and quality of life.

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