Adaptation and evidence of validity of the High Blood Pressure-Focused Health Literacy Scale into Portuguese

Adaptação e evidências de validade da High Blood Pressure - Focused Health Literacy Scale para o português

Adaptación y evidencias de validez de la High Blood Pressure - Focused Health Literacy Scale al portugués

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Abstract

Objective: To adapt and estimate the validity evidence based on the content and internal structure of the High Blood Pressure-Focused Health Literacy Scale into Brazilian Portuguese. **Method:** methodological study with translation and back-translation. The content-based evidence was obtained by a committee of nine experts and 30 people with hypertension. For evidence based on internal structure, the adapted version was applied to 1,318 people with hypertension. **Results:** The adapted version showed a content validity index of 0.92. Parallel analysis indicated a two-factor structure. Exploratory Factor Analysis with the 43 items showed a negative correlation matrix with large covariance destruction (between 29.8% and 82.6%). The matrix was corrected after 12 items were removed. The final model showed correspondence with the theory and adequacy of the fit indices. Factor 1, Functional Health Literacy, explains 7.63% of the variance. Factor 2, Print Literacy, explains 44.33% of the variance. The reliability indicators were within the standards of adequacy. **Conclusion:** The adapted instrument showed evidence of validity related to content and internal structure for its application to people with hypertension in Brazil.

Descriptors: Health Literacy; Hypertension; Validation Study; Nursing; Health Education.

Whats is already known on this?
The High Blood Pressure - Focused Health Literacy Scale (HBP-HLS) is the only instrument that has been developed to determine the level of health literacy in people with systemic arterial hypertension.

What this study adds?
The High Blood Pressure - Focused Health Literacy Scale (HBP-HLS) was cross-culturally adapted into Brazilian Portuguese and showed adequate evidence of validity related to its content and internal structure.

Resumo

Objetivo: *adaptar e estimar as evidências de validade com base no conteúdo e estrutura interna do High Blood Pressure-Focused Health Literacy Scale para o português brasileiro.* ***Método:*** *estudo metodológico com tradução e retrotradução. As evidências com base no conteúdo foram obtidas por Comitê de nove especialistas e 30 pessoas com hipertensão. Para as evidências com base na estrutura interna, a versão adaptada foi aplicada a 1318 pessoas com hipertensão.* ***Resultados:*** *A versão adaptada mostrou índice de validade de conteúdo de 0,92. Análise paralela indicou uma estrutura com dois fatores. A Análise Fatorial Exploratória com os 43 itens mostrou matriz de correlação negativa com grande destruição de covariância (entre 29,8% a 82,6%). Houve correção da matriz após a retirada de 12 itens. O modelo final mostrou correspondência com a teoria e adequação dos índices de ajuste. O fator 1, Letramento Funcional em Saúde, explica 7,63% da variância. O Fator 2, Letramento de Impressão, explica 44,33% da variância. Os indicadores de confiabilidade mostraram-se dentro dos padrões de adequação.* ***Conclusão:*** *O instrumento adaptado mostrou evidências de validade relacionadas ao conteúdo e à estrutura interna para sua aplicação a pessoas com hipertensão no Brasil.*

Descritores: *Letramento em Saúde; Hipertensão; Estudo de Validação; Enfermagem; Educação em Saúde.*

Resumén

Objetivo: *adaptar y estimar las evidencias de validez basadas en el contenido y la estructura interna de la High Blood Pressure-Focused Health Literacy Scale al portugués brasileño.* ***Método:*** *estudio metodológico con traducción y retrotraducción. La evidencia basada en el contenido fue obtenida por un comité de nueve expertos y 30 personas con hipertensión. Para la evidencia basada en la estructura interna, la versión adaptada fue aplicada a 1.318 personas con hipertensión.* ***Resultados:*** *La versión adaptada mostró un índice de validez de contenido de 0,92. El análisis paralelo indicó una estructura de dos factores. El análisis factorial exploratorio con los 43 ítems mostró una matriz de correlaciones negativas con gran destrucción de covarianza (entre 29,8% y 82,6%). La matriz se corrigió tras eliminar 12 ítems. El modelo final mostró correspondencia con la teoría y adecuación de los índices de ajuste. El factor 1, Alfabetización Funcional en Salud, explica el 7,63% de la varianza. El factor 2, Alfabetización en impresiones, explica el 44,33% de la varianza. Los indicadores de fiabilidad estuvieron dentro de los estándares de adecuación.* ***Conclusión:*** *El instrumento adaptado mostró evidencias de validez relacionadas al contenido y estructura interna para su aplicación a personas con hipertensión en Brasil.*

Descriptores: *Alfabetización en Salud; Hipertensión; Estudio de Validación; Enfermería; Educación em Salud.*

INTRODUCTION

Worldwide, Systemic Arterial Hypertension (SAH) represents the predominant modifiable risk factor for cardiovascular disease and premature mortality. Its prevalence is increasing on a global scale, especially in low- and middle-income countries,[1] and the importance of factors related to its control is indisputable. Adherence to treatment is a primary factor contributing to inadequate control,[2] influenced by the level of health literacy (HL) among individuals with SAH.[3]

HL, a polysemic construct, has received limited exploration in Brazil, integrating two major fields of knowledge: health and education.[4] It can be defined as the degree to which individuals possess the capacity to obtain, process, and comprehend fundamental health information and services, necessary for making informed health decisions.[5] Low HL makes it impossible to understand and acquire different habits due to a lack of understanding of the disease and its treatment, resulting in less use of preventive services, poorer control of chronic diseases, low adherence to medication, increased hospitalization and higher mortality rates.[6-9]

The importance of determining the HL of an individual or population has led to the development of instruments to measure HL and to classify individuals according to their HL stratum, thus contributing to the planning and implementation of successful educational actions. [8-9] Consequently, the High Blood Pressure - Focused Health Literacy Scale (HBP-HLS) was developed to determine the level of HL in people with hypertension and to assist in the planning of educational interventions to promote adherence to treatment that are appropriate to each individual's level of HL.[10] It is the only instrument available to measure HL in hypertension. The instrument was developed in English for Korean Americans based on focus group studies and literature reviews of three validated and widely used instruments for measuring HL: the Rapid Estimate of Adult Literacy in Medicine (REALM), the Test of Functional Health Literacy in Adults (TOFHLA) and the Newest Vital Sign (NVS).[10] The theoretical structure of the instrument is based on print and functional health literacy. Print literacy is defined as the ability of an individual to decipher and verbalise the written code. Functional health literacy is defined as the use of literacy to perform a specific task.[11]

The construct validity of the HBP-HLS was tested by the convergent validity of the print literacy subscale with the functional health literacy subscale, modified TOFHLA and NVS, with positively correlated results of r=0.82; r=0.80 and r=0.76, respectively. The internal consistency of the HBP-HLS demonstrated a Kuder-Richardson (KR)-20 coefficient of 0.98, with item-total correlations ranging from 0.32 to 0.91. For the print literacy subscale, the KR-20 was found to be 0.98, with an item-total correlation

ranging from 0.38 to 0.87. For the functional literacy subscale, the KR-20 was determined to be 0.93, with an item-total correlation ranging from 0.32 to 0.91.[10]

In the Chinese version of the HBP-HLS, the structure comprised five dimensions (print literacy, medication label, comprehension skills, vital sign test and food allergy avoidance), accounting for 77.7% of the total variance and exhibiting favourable fit indices (AGFI=0.91, GFI=0.95, RMSEA=0.048, IFI=0.92).[12] In their analysis, the authors aggregated the print literacy items into three clusters of ten items each. These clusters were designated (print literacy 1, 2 and 3), and the aggregate instrument was thus comprised of fifteen items.

The original instrument's validity evidence was formulated on the basis of the trinitarian model (criterion-related, content-related, construct-related) of validation, a model which has now been officially abandoned.[13] The fourth edition of the Standards recommends the pentagonal model for psychometric studies, proposing the estimation of validity evidence related to the content of the test, the response process, the internal structure, the relationship with other variables and the consequences of the test.[14] In this model, the centre of the evaluation revolves around the composition of the construct, and the internal structure validity stage is essential to demonstrate that the items are measuring the latent variable.

In view of the necessity for a robust instrument to measure health literacy in hypertension in Brazil, the cross-cultural adaptation of the HBP-HLS may prove promising in identifying levels of print literacy and functional health literacy. Furthermore, the Portuguese version must delve into its internal structure, as the original and Chinese versions exhibit divergent characteristics.

This prompts the following question: Does the adaptation of the HBP-HLS into Brazilian Portuguese present evidence of validity based on content and internal structure? The hypothesis of this study is that the adapted version of the HBP-HLS for Brazilian Portuguese has content that is compatible with the latent trait hypertension literacy and an internal structure made up of two domains corresponding to print literacy and functional health literacy.

There were no instruments designed for the measurement of health literacy (HL) with a specific focus on hypertension in the Brazilian population. In general, studies carried out in Brazil utilise generic instruments, such as the TOFHLA and its derivatives, to measure the HL of hypertensive patients.[4,15-16] Therefore, due to the absence of an HL measurement instrument specific to SAH in Portuguese, the aim of this study was to adapt and estimate the validity evidence based on the content and internal structure of the High Blood Pressure-Focused Health Literacy Scale for Brazilian Portuguese.

METHODS

Cross-cultural adaptation study carried out from May 2015 to June 2016. The translation and cross-cultural adaptation process was based on international guidelines.[17] consisting of: 1- Initial translation; 2- Synthesis of translations; 3- Back-translation; 4- Expert committee; 5- Evidence of validity related to content; 6- Pre-test-application for evidence of validity related to internal structure. Authorization for the cross-cultural adaptation of the HBP-HLS in Brazil was granted by the main author via e-mail.

The HBP-HLS consists of 43 items divided into the subscales of print literacy and Functional Health Literacy (FHL). The print literacy subscale was modeled after REALM and consists of 30 items listed in three columns of increasing difficulty (10 items per column) and scored as correct/incorrect, with possible total scores ranging from 0 to 30. The FHL subscale, made up of 13 items, was modeled on the TOFHLA and NVS, adapting seven and six items, respectively, for the context of SAH patients. These were scored as correct/incorrect, with possible total scores ranging from 0 to 13. In addition to the 43 items, the HBP-HLS has four annexes: 1) drug label 1; 2) drug label 2; 3) consultation form and 4) nutritional information for the Newest Vital Sign (NVS) test, which are applied to obtain the individuals' responses.[10]

In stage 1, the HBP-HLS was translated by two sworn, independent and bilingual translators, proficient in both languages (original and target), with experience in translating instruments; however, only one had knowledge of the objectives of the translation, resulting in the Portuguese version of each translator (T1 and T2).

In stage 2, the translations were synthesized and the first consensus on the translated version was reached at a meeting between researchers and translators. The two Portuguese versions, together with the original English version, were evaluated and compared, and the items with semantic

equivalence with those of the original instrument were listed. This stage resulted in the consensual Portuguese version 1 (PV1) of the HBP-HLS.

Stage 3, back-translation, consisted of re-translating the instrument (PV1) into the original language, English. It was carried out by two sworn, bilingual translators who had not taken part in the translation. Both were unfamiliar with the instrument and one was a health professional. The aim of this stage was to check that the Portuguese version reflected the content of the original. This resulted in back-translated versions 1 (BT1) and 2 (BT2). In order to obtain a common version of the back-translations, a meeting was held with the translators and researchers, in which some differences in the meaning of the words identified in the back-translation were discussed. The document produced at this stage was named the back-translation synthesis (BT1&2).

In phase 4, the expert committee reviewed the instrument. The consensus versions in Portuguese 1 (PV1) and English (BT1&2) and the original instrument were reviewed by a committee of nine experts to produce a final, modified and adapted version that would guarantee its replicability in Brazil. To select the judges, the characteristics of the instrument, training, qualifications and availability of the professionals were taken into account, and it was decided to form a multi-professional committee, with self-reported English language proficiency and specialists in the area of knowledge of the construct, as they would be able to adequately assess the content of the items submitted for analysis. This committee assessed the semantic, idiomatic, cultural and conceptual equivalence of the items in the consensus version of the instrument in Portuguese and compared it to the original English version.[17] After selecting the judges, an instrument characterizing the experts, instructions for their assessment and versions of the instrument were sent by email. After incorporating the expert committee's considerations, the final Portuguese version (PV2) was obtained.

PV2 of the instrument was subjected to semantic analysis by 30 people with SAH, selected for convenience at the Integrated Hypertension and Diabetes Center (CIDH), a secondary care referral unit for SAH and diabetes in Fortaleza-Ceará. The comprehension, pertinence, approval and cultural relevance of the items assessed individually by the patients during the interview were verified, and the participants' demands about the items were recorded, analyzing the difficulty of understanding the words/terms present and which word/term was most appropriate for their culture. The items that were difficult to understand were modified, including the cross-cultural adaptation of the instrument and the Brazilian version of the HBP-HLS, called HBP-HLS-BR.

The scale (versions PV2 and BT1&2) was sent for evaluation by the foreign author, with a view to preserving the original meaning of the instrument, and was approved by her.

The HBP-HLS-BR was administered to people with hypertension who were being monitored at the CIDH and at twelve Primary Health Care Units (PHC). Two PHC were selected from each of the six Health Coordinating Units of Fortaleza-Ceará, Brazil, covering all regions of the municipality. These services are part of the network of care for people with chronic diseases and make up the primary and secondary care levels at the state and municipal health levels. The inclusion criteria were: having hypertension and having been taking antihypertensive drugs for at least six months, being aged 18 or over, being followed up at the selected unit, conscious, oriented, able to read and write, and agreeing to take part in the research. Hypertensive patients who could not communicate verbally and those with cognitive deficits, dysarthria, hearing impairment (deaf-mute) or visual impairment were excluded.

The approach was carried out in the waiting rooms, while they were waiting for their appointments. The researcher was introduced, explaining the research, the objectives and the relevance of the study. Participation in the study was invited. Initially, visual acuity was assessed using the Snellen Sign Scale, and those with a minimum score of 0.7 were considered fit, as this is the reference value for a good measurement of visual clarity and sharpness. A total of 690 hypertensive patients from the CIDH and 628 from the PHC took part, totaling 1318 participants.

After informed consent and an adequate score on the Snellen Scale, the researcher filled in the identification and characterization form and handed out the HBP-HLS-BR to the participants. To assess health print literacy, the participants were given a list of the first 30 items on the scale. They were asked to pronounce each of the 30 words, leaving the researcher with a similar list on which to check which items had been pronounced correctly. If the participant took more than 5 seconds on a particular item, they were told to skip that item and move on to the next word. For any word not attempted or mispronounced, the item was considered wrong.

In order to assess FHL with a focus on hypertension, the HBP-HLS-BR annexes (drug label 1, drug label 2, consultation form and nutritional information for the NVS test) were handed out.

Participants were instructed to apply their health literacy skills by reading and understanding the prescription, consultation form and nutritional information on the food labels. While the interviewer stood next to the participant, available to clarify instructions, they answered the last 13 items of the instrument. Most participants spent 15 to 20 minutes completing the HBP-HLS-BR.

To demonstrate evidence of content validity, the data from the expert evaluation was submitted to the Content Validity Index (CVI) for each item, considering CVI ≥ 0.78 excellent, CVI between 0.60 and 0.71 good, and CVI < 0.59 poor.[18]

To demonstrate the evidence of validity related to the internal structure, the construct was studied using Exploratory Factor Analysis (EFA) carried out in Factor Software. The Optimal implementation of Parallel Analysis with tetrachoric correlation, suitable for dichotomous items, was used to extract the number of factors.[19] EFA using the Robust Unweighted Least Squares (RULS) estimator, 2000 bootstraps to stabilize the sample and tetrachoric correlation matrix.[20-21] Promin-type oblique rotation, suitable for correlated factors.[20] The Sweet Smoothing algorithm was used to correct the non-positive matrix, considering it appropriate when the Percentage of covariance destroyed in each variable (PCDi) preserved a large amount of information and allowed the matrix to converge.[22] Factor loading >0.3 was considered for loading the item on the factor. Items shared between factors, heywood case (factor loadings >1), those with intercorrelation >0.9 and/or factor loadings <0.3 were eliminated.[22]

The model was tested using the following indices: Root Mean Square Error of Approximation (RMSEA), Root Mean Square of Residuals (RMSR), Weighted Root Mean Square Residual (WRMR), Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI). The following values were established as parameters: RMSEA and SMSR of 0.05 to 0.08; WRMR below 1.0; NNFI, CFI, GFI and AGFI greater than 0.90.[22] Reliability estimates were then obtained using inter-factor correlation, ORION (Overall Reliability of fully-Informative prior oblique N-EAP scores), FDI (Factor Determinacy Index) and Cronbach's alpha. FDI values >0.90 and ORION >0.80 were considered adequate reliability,[19] and Cronbach's Alpha coefficient according to reference values: <0.6=low; moderate=0.6|-0.7 and 0.7|-|0.9=high reliability.[23]

In line with the provisions of Resolution 466/2012 of the National Health Council, the project was submitted to and approved by the Research Ethics Committee of the State University of Ceará (UECE), under opinion 984.429.

RESULTS

With regard to the evidence of validity related to content, it was observed that in the initial translation, despite the HBP-HLS being an extensive instrument, there were few discrepancies found. These were related to words or terms with similar meanings in Brazil (e.g. breath and breathing; prescription and medical prescription; take and ingest; pill and tablet; medicine and medication; packaging and package; empty stomach and fasting). In summation of the translations, the discrepancies identified were subjected to rigorous scrutiny, and the experts elected to adopt the most prevalent term in Brazilian Portuguese. The back-translated versions BT1 and BT2 exhibited 64% identical terms, with all discrepancies in the back-translations deemed synonymous. The synthesis version BT1&2 demonstrated correspondence to the original instrument.

The content analysis committee comprised nine female experts, with an average age of 41.8 years, six nurses, one nutritionist, one physiotherapist and one biologist, all of whom held PhDs, with an average training period of 19.2 years. Two of the participants had experience in translation and health literacy, four in adapting SAH instruments, and three in SAH literacy.

In the expert committee's assessment of PV1, the cultural equivalence of the items was the most affected in the translation from the source language into Brazilian Portuguese, especially in relation to the composition of the FHL subscale, whose items Q1, Q2, Q3, Q4, Q5, Q8, Q9 and Q10 underwent minor interventions to improve comprehension. Furthermore, the labelling of the drug was adapted to align with prescriptions and guidelines consistent with the daily operations of the Brazilian Unified Health System (SUS). Notably, the annex providing nutritional information for the NVS test, which previously included a typical Korean noodle, was adapted to an instant noodle, a widely consumed food item in Brazil. It was ascertained that solely items 3 and 13 of the Print Literacy subscale underwent adaptation. The modifications made resulted in a more profound comprehension of the significance of the terminology and directives contained within the HBP-HLS-BR.

The CVI was 0.92 for the whole instrument, 0.95 for the Print Literacy subscale and 0.83 for FHL, revealing excellent content validity (see Table 1). The majority of items obtained excellent evidence of content validity (CVI ≥ 0.78). However, items Q9 and Q10 demonstrated a CVI of 0.67, thus indicating their classification as 'good'.

The semantic analysis was conducted on a cohort of 30 patients, of whom 56.7% were female, with a mean age of 56.43 years. The mean number of years of study was 9.73 years (± 4.4). Incomplete primary education was observed in 30% of cases, while 20% had completed primary education, 36.7% had completed secondary education, and 13.3% had higher education. With regard to semantics, items Q9 and Q11, drug label 1 and 2, and the consultation form necessitated alterations, with some words and terms being modified to enhance their comprehensibility for patients. In items 9 and 10, the terms were modified to more accurately reflect the quantities in question. The labels of medication 1 and 2 were updated to provide clearer instructions regarding the time frame for tablet intake. Additionally, the consultation form was revised to include information regarding the location of the hypertension consultation.

In order to provide evidence of validity related to the internal structure, 1,318 hypertensive patients participated in the study, the majority of whom were female (61.9%), with a mean age of 60.6 years (± 10.2). The majority of these patients were married or living in a consensual union (59.3%), Catholic (72.9%), white (51.3%) and retired (42.8%). With regard to educational attainment, 33.3% of the sample had not completed primary education, 11.3% had completed primary education, 37% had completed secondary education and 14.2% had completed higher education. The average duration of education was 9.6 years (± 4.4).

The sedimentation graph (Figure 1) from the Parallel Analysis was utilised to explore the factors, indicating a two-factor structure. In order to obtain the most suitable model, EFA was carried out using the two dimensions that were observed in the sedimentation diagram (see Figure 1).

Figure 1. Sedimentation diagram of the HBP-HLS-BR Parallel Analysis. Fortaleza-CE-Brazil, 2016.
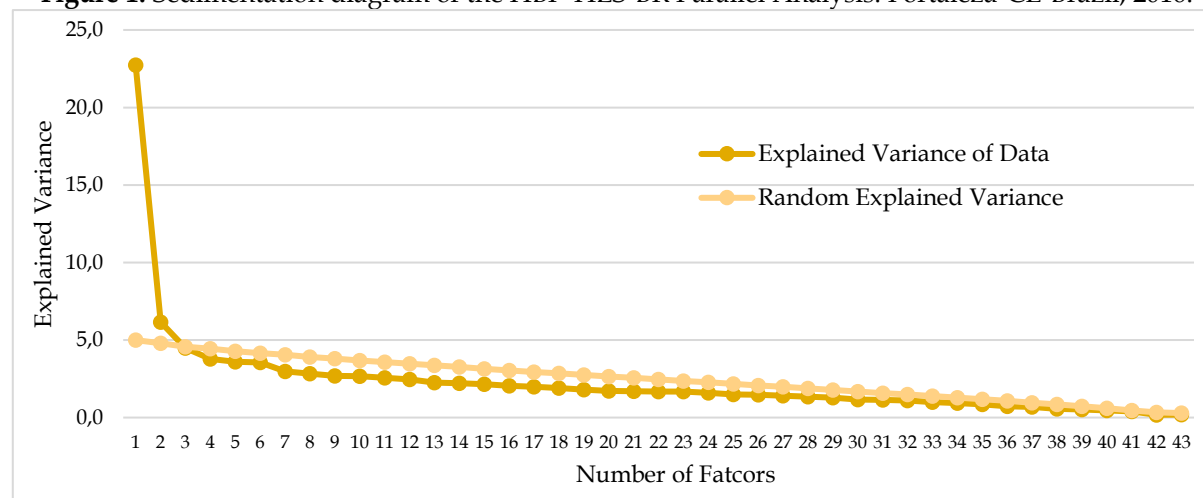
Source: Research data (2016).

The EFA was initiated with the 43 items and exhibited a negative correlation matrix with substantial covariance destruction (PCDi ranging from 29.8% to 82.6%), impeding the convergence of the tetrachoric correlation matrix (see table 1). A descriptive inspection of this initial analysis indicated that item 5 exhibited significant asymmetry, with a percentage of correct answers of only 0.6% (8 out of 1318). The elimination of item 5 from the matrix revealed that it possessed a total of four negative eigenvalues. In pursuit of a positive matrix, the following sequence of analyses was employed for the removal of items: item 32 exhibited a correlation >0.9 with item 31; items 11, 42, 35, 03 and 04 demonstrated low factor loadings and communalities; items 40 and 38 exhibited double factor loadings; item 33 exhibited low communality; item 22 exhibited double factor loadings; and item 8 exhibited low communality. This process involved the removal of 12 items from the original model, resulting in a plausible model with a tetrachoric matrix exhibiting positive eigenvalues and no destruction of covariance (PCDi=0%).

The HBP-HLS-BR, following the removal of items, exhibited a theoretical structure in the EFA that was compatible with the theory, without compromising the integrity of the original scale. Factor 1 comprised seven items consistent with Functional Health Literacy, while Factor 2 comprised 24 items consistent with the field of Print Literacy.

Table 1 shows the Content Validity Indices of the item and the elements of the Exploratory fator Analysis of the BHP-HLS-BR.

Table 1. Content Validity Index (CVI) and elements of the Exploratory Factor Analysis (EFA) of the HBP-HLS-BR. Fortaleza-CE-Brazil, 2016.

Print Literacy Items	CVI	PCDi*	EFA**		Functional Health Literacy Items	CVI	PCDi*	EFA**	
			F1	F2				F1	F2
1. Brain	1.00	82.5%	-0.056	**0.690**	Q1. If you take the first pill at 7am, what time should you take the next one?	0.78	42.6%	**0.560**	-0.062
2. Breathing	1.00	82.1%	-0.230	**0.825**					
3. Emergency	0.78	30.0%	-	-	Q2. And the next one after that?	0.78	79.5%	-	-
4. Fiber	0.89	82.4%	-	-	Q3. If you have lunch at noon and have to take your medicine BEFORE your meal, what time should you take it?	0.78	83.3%	-	-
5. Heart	1.00	35.5%	-	-					
6. Kidney	0.89	82.5%	0.047	**0.602**	Q4. If you have lunch at noon and have to take the medicine AFTER the meal, what time will you take the medicine?	0.78	31.7%	**0.562**	-0.098
7. Medicine	0.89	83.3%	0.036	**0.465**					
8. Salt	1.00	29.0%	-	-	Q5. Pretend that your blood pressure is 140x100 today. Is this normal?	0.78	81.5%	-	-
9. Acute	0.89	81.5%	0.129	**0.546**					
10. Weight	1.00	31.9%	0.191	**0.602**	Q6. What is the date of your appointment?	1.00	33.0%	**0.607**	-0.225
11. Appointment	1.00	29.8%	-	-	Q7. Where is it?	1.00	81.4%	**0.620**	0.085
12. Bleeding	1.00	82.0%	-0.116	**0.841**	Q8. If you eat the whole amount on the packet of noodles, how many calories will you consume?	0.78	31.6%	-	-
13. Blood pressure	0.78	32.6%	-0.020	**0.782**					

Item		PCDi		F1	F2	Question		PCDi		F1	F2
14. Cancer	1.00	30.2%	0.111	**0.582**		Q9. If you can eat 2,400 milligrams of sodium a day, how much instant noodles could you consume?	0.67	80.9%	**0.827**	-0.187
15. Diabetes	1.00	32.7%	0.035	**0.627**						
16. Follow-up	1.00	32.1%	0.013	**0.676**		Q10. Your doctor has advised you to reduce the amount of saturated fat in your diet. If you decided not to eat a packet of noodles today, how many grams of saturated fat would you be reducing?	0.67	30.9%	-	-
17. Obesity	1.00	81.5%	0.059	**0.627**						
18. Oxigen	1.00	30.8%	0.050	**0.743**						
19. Stroke	1.00	32.1%	0.098	**0.683**						
20. Swelling	1.00	32.5%	-0.089	**0.836**		Q11. If you normally consume 2900 calories a day, what percentage of your daily calorie intake will you have had if you eat just one portion of this noodle?	0.89	29.5%	**0.588**	0.004
21. Angioplasty	0.89	33.3%	0.070	**0.786**						
22. Cardiologist	1.00	82.3%	-	**-**						
23. Cholesterol	1.00	82.3%	-0.176	**0,807**		Q12. Pretend you are allergic to the following substances: monosodium glutamate, wheat, shrimp, honey: is it safe for you to eat this noodle?	0.89	49.5%	-	-
24. Circulation	1.00	36.6%	-0.127	**0,799**						
25. Electrocardiogram	0.89	33.5%	-0.015	**0,865**						
26. Hypertension	1.00	82.6%	0.148	**0,551**		Q13. Why not?	1.00	79.4%	**0.381**	0.061
27. Monitoring	1.00	82.6%	-0.012	**0,759**		Drug label 1	0.67	-	-	-
28. Potassium	1.00	31.2%	0.174	**0,617**		Drug label 2	0.67	-	-	-
29. Prescription	0.89	82.5%	-0.048	**0,819**		Consultation form	0.89	-	-	-
30. Rehabilitation	1.00	82.1%	-0.035	**0,822**		Nutritional information for the Newest Vital Sign test	0.67	-	-	-

Legend: PCDi=Percentage of covariance destroyed; *analysis with all items showed 4 negative eigenvalues; **EFA with the exclusion of twelve items; F1=factor loadings on the Print Literacy subscale; F2=factor loadings on the Functional Health Literacy subscale.
Source: Research data (2016).

Table 2 shows the fit indices in the Exploratory Factor Analysis and reliability of the HBP-HLS-BR.

Table 2. Fit Indices in the Exploratory Factor Analysis and reliability of the HBP-HLS-BR. Fortaleza-CE-Brazil, 2016.

Fit Indices	Indice	CI
RMSEA	0.045	0.047 - 0.049
RMSR	0.056	0.055 - 0.066
WRMR	0.017	0.016 - 0.021
NNFI	0.988	0.978 - 0.997
CFI	0.990	0.981 - 0.997
GFI	0.982	0.977 - 0.989
AGFI	0.979	0.974 - 0.988
GFI with no diagonal values	0.978	0.978 - 0.983
AGFI with no diagonal values	0.975	0.975 - 0.981
Reliability	**F1**	**F2**
Explained variance	7.63%	44.33%
Inter-factor correlation	0.595	0.433 - 0.643
ORION	0.840	0.967
FDI	0.917	0.983
Cronbach's alpha	0.648	0.886

Legend: CI=Confidence Interval; RMSEA= Root Mean Square Error of Aproximation; RMSR=Root Mean Square of Residuals; WRMR= Weighted Root Mean Square Residual; NNFI= Non-Normed Fit Index; CFI= Comparative Fit Index; GFI= Goodness of Fit Index; AGFI= Adjusted Goodness of Fit Index; F1= Functional health literacy; F2= Print literacy; ORION= Overall Reliability of fully-Informative prior oblique N-EAP scores; FDI= Factor Determinacy Index.
Source: Research data (2016).

As illustrated in Table 2, the quality of the model's adjustment in the EFA was assessed following the elimination of the 12 items. The RMSEA and SRMR indices are in the standard range between 0.05 and 0.08, WRMR is below 1.0, NNFI, CFI, GFI and AGFI are above 0.9, indicating plausibility of the HBP-HLS-BR two-factor structure.

Following the implementation of the HBP-HLS-BR adjustments within the EFA, the results of the reliability tests indicated a satisfactory outcome. A robust correlation was identified between the two factors. The print literacy subscale, as represented by factor 2, explained 44.33% of the variance in the HBP-HLS-BR and demonstrated high reliability (ORION, FDI and Crombach's alpha above 0.8). The functional health literacy subscale, as represented by factor 1, accounts for a mere 7.63% of the variance in the HBP-HLS-BR. Despite the satisfactory performance of the ORION and FDI indices, the study revealed a lack of reliability, as evidenced by Cronbach's alpha.

DISCUSSION

The cross-cultural adaptation of the HBL-HLS resulted in the generation of a culturally valid instrument in the Brazilian version (HBP-HLS-BR). This necessitated grammatical and cultural adjustments to ensure its adaptation to the Brazilian context, thereby ensuring the target population's comprehension, with guarantees of clarity based on the language adopted in the cross-cultural adaptation process.[17, 24]

The adaptation of the HBP-HLS necessitated that the researchers dedicate time to comprehending the original instrument in cultural and linguistic terms. This is due to the fact that its development context involved the convergence of North American and Korean cultures, which subsequently influenced the instrument. Reflection on this context was found to be pertinent to the identification of translation and adaptation alternatives that were consistent with the instrument's original commands and were linguistically and culturally comprehensible within the Brazilian context. This process bears a resemblance to the cross-cultural adaptation of the Hypertension Knowledge-Level Scale for Brazil, wherein the authors

emphasised that concerns pertaining to cultural sensitivity can emerge at any stage during the translation process, necessitating a thorough discussion to ascertain the origin of the issue.[24]

From a methodological perspective, the development of the HBP-HLS-BR version followed a similar approach to the adaptation study of the HBP-HLS into Chinese, with translation undertaken meticulously to ensure the equivalence between the adapted scales and the original, thereby facilitating adequate psychometric analysis.[12]

The content analysis was carried out by nine specialists in literacy and hypertension from two Brazilian states. This diversification enabled a more comprehensive evaluation of the items, as the body of experts had diverse characteristics, which converged on the same point: theoretical and practical experience in the translation and validation of behavioural measurement instruments. Consequently, content analysis involving a group of experts has been established as a consolidated technique in translation and validation studies.[25] The experts assess the extent to which each item in the instrument represents the phenomenon of interest.

The instrument's CVI of 0.92 demonstrated substantial evidence of content-related validity for HBP-HLS-BR, thereby substantiating the construct in theoretical terms. In the course of content validation for the Chinese version, the CVI of the items ranged from 0.86 to 1.0 for each subscale, with the total CVI registering at 0.85. In light of the recommendations proffered by the experts, a number of items were revised to align with the cultural context of China.[12] In the Brazilian version, the semantic analysis conducted by a sample of the target population enabled the assessment of certain aspects of the measurement process that had the potential to influence data collection. It was evident that the items pertaining to print literacy had been constructed within the cultural-comparative (ethical) perspective, with minimal interventions in the translation process to maintain cultural equivalence. The ethical perspective is predicated on the assumption that phenomena are universal and, as such, capable of comparison.[26]

The format of the items on Functional Health Literacy and their annexes are compatible with the culture-specific perspective (emic perspective). The emic perspective seeks to describe how members of the cultural group perceive the phenomenon through their own cultural manifestations [26]. From this perspective, the items and annexes required emic adaptation. For these items, the original content (North American-Korean) was adapted to the Brazilian context by analogy. The Brazilian culture-specific perspective was incorporated so that the commands and answers to these items could be understood. A similar approach was taken in a study in Kenya on the validation of a mental health instrument whose incorporation of ethnic criteria provided a more complete picture of how mental health is experienced locally.[27]

Regarding evidence of the validity of the internal structure of the HBP-HLS-BR, correspondence was observed between the items organized into factors and the theory for which the instrument was originally developed. Evidence of internal structural validity refers to the degree to which the relationships between test items and test components are in accordance with the construct on which the proposed test score interpretations are based which involves dimensionality, measurement invariance, and reliability.[28]

EFA demonstrated that the Brazilian version of the instrument exhibited an enhanced congruence with two dimensions. Despite the fact that the original study did not analyse the dimensionality of the HBP-HLS, the authors of said study proposed that it possessed a hypothetical organisation in a structure with two dimensions,[10] a hypothesis that was corroborated in the HBP-HLS-BR. Conversely, the cross-cultural adaptation study of the HBP-HLS for China demonstrated that the five-dimensional model is more appropriate for the sample of hypertensive patients in that country.[12] The χ^2 value of the two-factor model was found to be less satisfactory in comparison to the five-factor model.[12] A procedure undertaken in the Chinese study that may have exerted pressure on the five-factor extraction was the consideration of three clusters of items that constituted the print literacy factor. It is important to note that the HBP-HLS-BR approach employed parallel analysis to extract the factors, thereby identifying the most robust model for this analytical activity.[19] The items were considered on an individual basis.

The initial analyses indicated a non-positive correlation matrix, with substantial destruction of covariance during the attempt to converge the matrix. As variances are defined as positive quantities, negative quantities of total or common variances (ie. negative eigenvalues) are inadmissible results that lack logical coherence.[22] The conditions that render this problem more or less likely to occur are: sample size, number of items, number of response categories, item extremities and magnitude of correlations between items. It is therefore most evident in the context of a substantial set of binary items that exhibit

significant variation in extremities, with some items exhibiting a high degree of correlation (in the form of redundant content, doublets or triplets) and administered in a limited sample size.[22]

Based on these theoretical considerations, it was observed that the negative eigenvalues presented by the HBP-HLS-BR were due to the presence of items with a wide range and high correlation. Some of the print literacy items, based on reading and speaking skills and aimed at measuring low literacy, were answered correctly by almost all of the participants, pushing the answers to the extreme. On the other hand, some functional health literacy items, designed to measure the ability to act on commands, whose questions were dependent, showed high double correlations. Items with these characteristics were evaluated and eliminated in order to find a positive matrix.

It is important to note that even with a substantial sample size of over 1,000 individuals and the implementation of a 2,000 bootstrap resampling method to stabilize the sample, the errors persisted. Bootstrap resampling is a systematic method of computation that employs random sampling with replacement. This process yields thousands of resamples, each of which undergoes rigorous analysis.[21] The objective is to enhance the reliability of the outcomes by facilitating the rectification of sample size distortions. The aforementioned procedures provide a high degree of confidence in the decisions made during the analyses.

The instrument's two-factor structure, encompassing 31 items, exhibited satisfactory internal consistency estimates. The total Cronbach's alpha indicated adequate internal consistency among the items of the instrument. However, disparities were observed between the subscales, with the FHL subscale exhibiting the least consistency. The original study demonstrated high internal consistency, with KR-20 of 0.98 for the total instrument, 0.98 for print literacy and 0.93 for the FHL subscale.[10] The Chinese version of the HBL-HLS obtained a Cronbach's alpha coefficient of 0.779 for the total scale, 0.995 for the print literacy subscale and 0.810 for the FHL subscale.[12] Despite the unequal values found, it was demonstrated that the scale is reliable in its versions and the realities for which they are intended.

The HBP-HLS-BR demonstrated exceptional reliability when assessed by contemporary estimators. The Factor Determination Index (FDI) is a measure of the accuracy of factor score estimates.[29] An FDI value greater than 0.90 indicates that the estimate is an accurate measure of the "true" response of individuals. ORION is an assessment of the reliability of factor score estimates, also known as marginal reliabilities.[29] Values greater than 0.80 indicate accurate measures of the reliability of factor score estimates.[30] The HBP-HLS-BR demonstrated adequate FDI and ORION values for its subscales.

The study's limitations are evident in the adaptation and validation of the scale in a limited number of countries, which hinders the discussion and comparison of results. A further limitation is that confirmatory factor analysis was not carried out by applying hold-out to the sample. Due to the presence of items with a concentration at the extreme end of the response, it was necessary to utilise the entire sample in the EFA. Notwithstanding the aforementioned limitations, the results obtained are both robust and promising.

It is evident that the utilisation of the HBP-HLS-BR in the assessment of clinical practice, from a psychometric and scientifically recognised perspective, enables health professionals to access technology based on health promotion. In the interim period, healthcare professionals will be able to utilise a measurement tool that can assess the literacy levels of hypertensive patients. This will enable the more precise targeting of interventions, with the objective of enhancing patient adherence and preventing complications arising from inadequate blood pressure control.

CONCLUSION

The HBP-HLS was cross-culturally adapted into Brazilian Portuguese and demonstrated evidence of validity in terms of its content and internal structure. The CVI obtained was of the highest standard, and the target population demonstrated a comprehensive understanding of the content. The EFA demonstrated a structure comprising 31 items and two factors, namely print literacy and functional health literacy, thereby aligning with the underlying theoretical framework. This structure was found to be an effective measurement tool for literacy in individuals with SAH in Brazil. The study demonstrated the reliability and accuracy of the scale in measuring print literacy and functional health literacy. The utilisation of the HBP-HLS-BR in clinical practice appears to possess the potential to function as a tool for the development of effective interventions, with the objective of improving FHL and ensuring efficient blood pressure control among Brazilian hypertensive patients. However, further studies testing the evidence of validity of

internal structure, evidence of validity of response process, consequences of use and association with other variables of HBP-HLS-BR are needed.

CONTRIBUITIONS

Contributed to the conception or design of the study/research: Lima DBS, Moreira TMM. Contributed to data collection: Lima DBS. Contributed to the analysis and/or interpretation of data: Lima DBS, Andrade DF, Moreira TMM. Contributed to article writing or critical review: Lima DBS, Moreira TMM. Final approval of the version to be published: Moreira TMM, Andrade DF.

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