

RESEARCH ARTICLE (ORIGINAL) 

Cross-cultural adaptation and evidence of the validity of the eHealth Literacy Scale for use in Brazil

Adaptação transcultural e evidências da validade da eHealth Literacy Scale para uso no Brasil

Adaptación transcultural y evidencias de la validez de la eHealth Literacy Scale para su uso en Brasil

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Abstract

Background: Digital health literacy is the ability to seek, find, understand, and appraise health information from electronic sources to solve health problems.

Objective: To cross-culturally adapt the European Portuguese version of the eHealth Literacy Scale and analyze the evidence on the psychometric validity of the Brazilian Portuguese version.

Methodology: Content validity was assessed using the content validity coefficient, and construct validity was examined using exploratory and confirmatory factor analysis and reliability measures. Convergent validity was analyzed using the extracted average variance, and concurrent validity was analyzed using Pearson's correlation coefficient.

Results: A content validity coefficient of 0.86, a Cronbach's alpha value of 0.90, and an acceptable construct validity were obtained. Factor loadings indicated adequate values, ranging from 0.65 to 0.88 for a one-dimensional model.

Conclusion: The Brazilian Portuguese version has consistent reliability and validity to inform studies on the digital health literacy of users of digital social networks in Brazil. However, a limitation of this study was that the sample had a higher level of education and income than the average population in Brazil.

Keywords: validation study; health education; health literacy; health promotion; psychometrics

Resumo

Enquadramento: Literacia digital em saúde é a capacidade de procurar, encontrar, entender e avaliar informações sobre saúde em fontes eletrônicas para a resolução de problemas de saúde.

Objetivo: Adaptar transculturalmente a versão portuguesa da *eHealth Literacy Scale* e analisar as evidências de validade psicométricas da versão brasileira.

Metodologia: Análise do conteúdo foi realizada pelo coeficiente de validação de conteúdo e o constructo por análise fatorial exploratória e confirmatória, e medidas de confiabilidade. A validade convergente foi obtida pela variância média extraída e validade concorrente pelo coeficiente de Pearson.

Resultados: Obteve-se coeficiente de validação de conteúdo de 0,86, alfa de Cronbach de 0,90 e índices aceitáveis para validade de constructo. As cargas fatoriais indicaram valores adequados entre 0,65 e 0,88 para modelo unidimensional.

Conclusão: A versão brasileira apresenta confiabilidade e validade consistentes para auxiliar estudos de literacia digital em saúde de utilizadores das redes sociais digitais no Brasil. Contudo, deve ter-se em consideração a limitação deste estudo, uma vez que a amostra populacional apresentou escolaridade e rendimentos superiores à média brasileira.

Palavras-chave: estudo de validação; educação em saúde; letramento em saúde; promoção da saúde; psicometria

Resumen

Marco contextual: La alfabetización digital en la salud es la capacidad de buscar, encontrar, comprender y evaluar la información sanitaria procedente de fuentes electrónicas para resolver problemas de salud.

Objetivo: Adaptar transculturalmente la versión portuguesa de la *eHealth Literacy Scale* y analizar las evidencias de validez psicométricas de la versión brasileña.

Metodología: Análisis de contenido realizado mediante el coeficiente de validación de contenido y constructo mediante el análisis factorial exploratorio y confirmatorio, y medidas de fiabilidad. La validez convergente se obtuvo mediante la varianza media extraída y la validez concurrente mediante el coeficiente de Pearson.

Resultados: Se obtuvo un coeficiente de validación de contenido de 0,86, un alfa de Cronbach de 0,90 e índices aceptables de validez de constructo. Las cargas factoriales indicaron valores adecuados entre 0,65 y 0,88 para el modelo unidimensional.

Conclusión: La versión brasileña muestra una fiabilidad y validez consistentes para apoyar los estudios sobre la alfabetización digital en la salud entre los usuarios de las redes sociales digitales en Brasil. Sin embargo, hay que tener en cuenta la limitación de este estudio, ya que la muestra de población tenía una educación y unos ingresos superiores a la media brasileña.

Palabras clave: estudio de validación; educación en salud; alfabetización en salud; promoción de la salud; psicometría



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Introduction

Health literacy (HL) refers to an individual's ability to access, understand, appraise, and apply health information for disease prevention or health promotion to maintain or improve personal and/or community quality of life (van der Vaart & Drossaert, 2017). According to the World Health Organization (WHO), low HL is related to a higher probability of a late diagnosis of diseases, choice of an unhealthy lifestyle (sedentary lifestyle, smoking), and poor adherence to medication for the treatment of chronic diseases, with a consequent increase in the number of hospitalizations and morbidity and mortality rates (Nutbeam et al., 2018).

Today, with the advances in information and communication technologies (ICTs), a large amount of health information and services can be obtained electronically, thus reinforcing the importance of digital health literacy (DHL; van der Vaart & Drossaert, 2017). Based on this principle, Norman and Skinner (2006) developed the eHealth Literacy Scale (eHEALS) as a promising tool to assess users' ability to obtain safe health-related information online.

The eHEALS comprises six skills: traditional literacy, health literacy, information literacy, scientific literacy, media literacy, and computer literacy. It is a self-report tool consisting of eight items rated on a 5-point Likert scale. The total score ranges from 8 to 40, and the higher the score, the greater the individual's ability to obtain safe information online about health-related subjects. This scale was originally developed in English and later translated, adapted, and validated in several languages: Dutch (van der Vaart et al., 2011), Japanese (Mitsutake et al., 2011), Korean (Chung et al., 2018), German (Soellner et al., 2014), Spanish (Paramio et al., 2015), and European Portuguese (Tomás et al., 2014). Overall, the eHEALS showed good internal consistency reliability, with Cronbach's alpha values higher than 0.7 in the validation studies.

In Portugal, Tomás et al. (2014) validated the eHEALS for European Portuguese-speaking users, with good psychometric indicators for adolescents (Cronbach's alpha of 0.842). This scale needs to be adapted for use in Brazil due to the cultural differences between Portugal and Brazil. Therefore, this study aimed to cross-culturally adapt the European Portuguese version of eHEALS for use in Brazil and analyze the evidence of psychometric validity and reliability of the Brazilian Portuguese version of the scale: the BR-eHEALS.

Background

Digital communication is a remarkable, collaborative tool for health literacy. The body of knowledge acquired online represents an important advancement between the field of technology and the field of health, primarily through interaction on social networks (Nutbeam et al., 2018). However, despite being easy to access health information, users must have the skills to handle the information correctly.

In the globalized world, an adequate level of DHL helps individuals make more assertive decisions about their health and the health of their community. According to WHO, the promotion of health literacy is influenced by social, environmental, and personal determinants and understood as a means of social emancipation. Other factors related to cognitive and psychosocial development can also contribute to an individual's level of health literacy (Nutbeam et al., 2018; van der Vaart & Drossaert, 2017). In 2020, the Brazilian Internet Steering Committee reported that Brazil had 152 million Internet users, corresponding to 81% of the country's population aged 10 years or more (Centro Regional de Estudos para o Desenvolvimento da Sociedade da Informação, & Comitê Gestor da Internet do Brasil, 2021). These numbers call attention to the importance of DHL. However, there are no validated instruments with the purpose described here that can be used in Brazil. Thus, the validation of eHEALS for use in Brazil will be an important milestone to direct health education strategies for health promotion.

Methodology

This methodological, cross-sectional study aimed to cross-culturally adapt the eHEALS and check its validity based on the version that was translated and adapted into European Portuguese (Tomás et al., 2014). The eHEALS was originally developed in English in Canada by Norman and Skinner (2006). It consists of eight unidimensional items rated on a 5-point Likert scale, where (1) corresponds to *strongly disagree* and (5) to *strongly agree*. In the original study, reliability analysis was performed on the eight items, producing a tight-fitting scale with an alpha coefficient (α) of 0.88. Item-scale correlations ranged from $r = 0.51$ to 0.76 . The authors also performed a principal components analysis, producing a single-factor solution (eigenvalue = 4.479; 56% of variance explained). Factor loadings ranged from 0.60 to 0.84 among the eight items (Norman & Skinner, 2006).

There were six steps in this study: 1) Cross-cultural adaptation from European Portuguese to Brazilian Portuguese; 2) Content validation; 3) Internal reliability; 4) Assessment of the psychometric properties of the instrument; and 5) Convergent and concurrent validity.

The cross-cultural adaptation of the European Portuguese version of the eHEALS into Brazilian Portuguese was carried out by a Portuguese language expert, who was previously informed about the construct and the objectives of the instrument. Subsequently, the adapted version was sent to 15 faculty members from different interdisciplinary areas of a postgraduate program in Health Promotion who were invited to participate in the expert committee. Along with the printed Brazilian Portuguese version, the experts were given a form to write down their suggestions for the cross-cultural adaptation. These suggestions were analyzed and considered, resulting in a cross-culturally adapted version of the scale.

Content analysis was performed using a quantitative approach, using the content validity coefficient (CVC).



The expert committee received a form with the eight items of the eHEALS adapted to Brazilian Portuguese for analysis and scoring of the following criteria: clarity of language (C), practical relevance (P), and theoretical relevance (T). As suggested in the literature, the results were analyzed based on the following reference values: acceptable if below 0.60, poor if between 0.60 and 0.70, acceptable if between 0.70 and 0.80, good if between 0.80 and 0.90, and excellent if above 0.90 (Hernández-Nieto, 2002).

After the cross-cultural adaptation, the instrument was made available to the general public in the form of an online self-report questionnaire built on Google Forms and disseminated in Facebook and WhatsApp and by email in September 2019. The online form included six sociodemographic questions and the translated and cross-culturally adapted instrument: the BR-eHEALS. The convenience sample was composed of 431 participants, following the recommendation of at least 5 to 15 participants per item during the cross-cultural validation process (Pasquali, 2010).

The sociodemographic data were analyzed by descriptive statistics using absolute and relative frequencies. The psychometric properties of the scale were analyzed by internal consistency through Cronbach's alpha, Omega, and composite reliability. As recommended in the specialized literature, indices equal to or greater than 0.70 were used as reference (DeVellis, 2003). The Kaiser-Meyer-Olkin (KMO) test was used to ensure an adequate interpretation of these analyses, obtaining adequate values.

Initially, an exploratory factor analysis (EFA) confirmed the unidimensional structure of the scale. Then, a confirmatory factor analysis (CFA) was performed to assess the construct. The model was adjusted according to the following indicators: Chi-square (χ^2 and p -value), Root Mean Square Error of Approximation (RMSEA, 95% CI), Tucker-Lewis Index (TLI > 0.95), comparative fit

index (CFI > 0.95), and normalized fit index (NFI > 0.95). Convergent validity was confirmed by the average variance extracted (AVE), with values greater than 0.50 being considered satisfactory indicators for construct validity (Kline, 2010). Finally, the concurrent validity between the BR-eHEALS instruments and the Health Literacy Scale was assessed by Pearson's correlation coefficient (Quemelo et al., 2017).

In all statistical analyses and tests, the maximum acceptable probability of making a Type I error of 0.05 was assumed. Cronbach's alpha values of 0.90 and acceptable indices for construct validity were obtained. All analyses were performed in the R Language software (R Core Team, 2018).

This study was approved by the Ethics Committee on Research with Human Beings of UniCesumar, in compliance with the norms established in Resolution no. 466/12 and complementary resolutions of the National Health Council, under opinion number 3.474.675 of 29 July 2019. All individuals who participated in the study gave their electronic informed consent.

Results

Among the 15 professionals who were invited to the expert committee, 10 accepted to participate in the study, constituting an interdisciplinary expert committee with doctoral participants from several areas: psychology, anthropology, biology, nutrition, physiotherapy, physical education, pedagogy, history, civil engineering, and systems analysis.

Table 1 shows three versions of the eHEALS: I) the version validated for European Portuguese (Tomás et al., 2014); II) the version adapted by an expert in Brazilian Portuguese; and III) the version resulting from the opinion of the 10 members of the expert committee.

Table 1

Comparison of the eHEALS versions in the process of cross-cultural adaptation to Brazilian Portuguese

European Portuguese version (Tomás et al., 2014)	Version adapted by the expert in Brazilian Portuguese	Version adapted based on the analysis of the expert committee
1. Sei quais são os recursos sobre saúde disponíveis na internet.	1. Sei quais são os recursos sobre saúde disponíveis na internet.	1. Eu sei quais são os conteúdos sobre saúde disponíveis na internet.
2. Sei onde encontrar recursos úteis sobre saúde na internet.	2. Sei onde encontrar recursos úteis sobre saúde na internet.	2. Eu sei onde encontrar conteúdos úteis sobre saúde na internet.
3. Sei como encontrar recursos úteis sobre saúde na internet.	3. Sei como encontrar recursos úteis sobre saúde na internet.	3. Eu Sei como encontrar conteúdos úteis sobre saúde na internet.
4. Sei como usar a internet para responder às minhas perguntas sobre saúde.	4. Sei como usar a internet para responder às minhas perguntas sobre saúde.	4. Eu sei como usar a internet para responder às minhas dúvidas sobre saúde.
5. Sei como usar a informação sobre saúde que encontro na internet para me ajudar.	5. Sei como usar a informação sobre saúde que encontro na internet para me ajudar.	5. Eu sei como usar a informação sobre saúde que encontro na internet para me ajudar.

6. Consigo avaliar os recursos sobre saúde que encontro na internet.	6. Consigo avaliar os recursos sobre saúde que encontro na internet.	6. Eu consigo avaliar os conteúdos sobre saúde que encontro na internet.
7. Sei distinguir os recursos de elevada qualidade dos de fraca qualidade entre os recursos sobre saúde da internet.	7. Sei distinguir os recursos de elevada qualidade dos de fraca qualidade entre os recursos sobre saúde da internet.	7. Eu sei diferenciar os conteúdos confiáveis dos de confiabilidade duvidosa entre os conteúdos sobre saúde da internet.
8. Sinto-me confiante a usar a informação da internet para tomar decisões sobre saúde.	8. Me sinto confiante para usar a informação da internet para tomar decisões sobre saúde	8. Eu me sinto confiante para usar a informação da internet para tomar decisões sobre saúde.

The process of adaptation of the BR-eHEALS tried to maintain the relevance of the concepts of the original instrument and adjust each original item in representative terms to the target population, considering that the scale can be used in different studies if its adaptation is reliable. The expert committee recommended adaptations to six of the eight items of the instrument. In items 1, 2, 3, 6, and 7, the term *recurso* (resource) was replaced by *conteúdo* (content); in item 4, the term *pergunta* (question) was replaced by *dúvida* (doubt); and in item 7, the

terms *elevada qualidade* (high quality) was replaced by *confiáveis* (reliable) and *fraca qualidade* (low quality) by *confiabilidade duvidosa* (doubtful reliability).

This study obtained a CVC of 0.86, indicating a good level of agreement between the members of the expert committee and the content of the instrument adapted to Brazilian Portuguese (Table 2).

The EFA was performed to measure the structural validity of the construct, indicating that the instrument had a unidimensional factor structure (Table 2).

Table 2

Items of the BR-eHEALS, values of the exploratory factor analysis (F1) and content validity coefficient (CVC): clarity of language (C), practical relevance (P), and theoretical relevance (T)

No. Item	Items	F1	C	P	T
L1	Eu sei quais são os conteúdos sobre saúde disponíveis na internet.	0.68	0.80	0.80	0.82
L2	Eu sei onde encontrar conteúdos úteis sobre saúde na internet.	0.80	0.84	0.87	0.87
L3	Eu sei como encontrar conteúdos úteis sobre saúde na internet.	0.82	0.91	0.91	0.89
L4	Eu sei como usar a internet para responder às minhas dúvidas sobre saúde.	0.84	0.91	0.91	0.91
L5	Eu sei como usar a informação sobre saúde que encontro na internet para me ajudar.	0.85	0.80	0.80	0.80
L6	Eu consigo avaliar os conteúdos sobre saúde que encontro na internet.	0.81	0.93	0.93	0.91
L7	Eu sei diferenciar os conteúdos confiáveis dos de confiabilidade duvidosa entre os conteúdos sobre saúde da internet.	0.68	0.80	0.89	0.91
L8	Eu me sinto confiante para usar a informação da internet para tomar decisões sobre saúde.	0.74	0.89	0.80	0.89
Total		-	0.86	0.86	0.87
	Percentage of variance explained	75.12	-	-	-

Note. F1 = exploratory factor analysis; C = clarity of language; P = practical relevance; T = theoretical relevance.

The next step was providing the link to the instrument through WhatsApp, Facebook, and email. A total of 431 users who belonged directly or indirectly to the leading researcher's network of contacts answered. Among these users, 288 (66.8%) were women, 143 (33.2%) were men, and most of them were married (58.7%). Concerning their education level, the majority of participants had

completed higher education and postgraduate studies (49.2%). As far as monthly income is concerned, 53.8% of the respondents reported incomes higher than four minimum wages. On the other hand, 99.5% of participants owned a smartphone, and 97.2% had access to the Internet in their homes (Table 3).

Table 3*Sociodemographic characteristics of the research participants*

Variable	n (%)
Gender	
Female	288 (66.8)
Male	143 (33.2)
Marital status	
Single	142 (33.0)
Married/ <i>Stable Union</i>	253 (58.7)
Divorced/Separated	31 (7.2)
Widowed	5 (1.2)
Education level	
Incomplete Basic Education	8 (1.9)
Basic Education	38 (8.8)
Secondary Education	173 (40.2)
Higher Education	90 (20.9)
Postgraduate education	122 (28.3)
Monthly income in Minimum Wages (MW)	
Less than 2 MW	65 (15.1)
2 to 3 MW	134 (31.1)
4 to 5 MW	148 (34.3)
5 to 8 MW	45 (10.4)
More than 8 MW	39 (9.1)
Has smartphone	
Yes	429 (99.5)
No	2 (0.5)
Has Internet	
Yes	419 (97.2)
No	12 (2.8)

Note. MW = minimum wage.

Reliability was assessed through internal consistency using Cronbach's alpha, Omega, and composite reliability. The

results indicate that the instrument is reliable, with a total alpha of 0.90. The construct was analyzed through confirmatory analysis (Table 4).

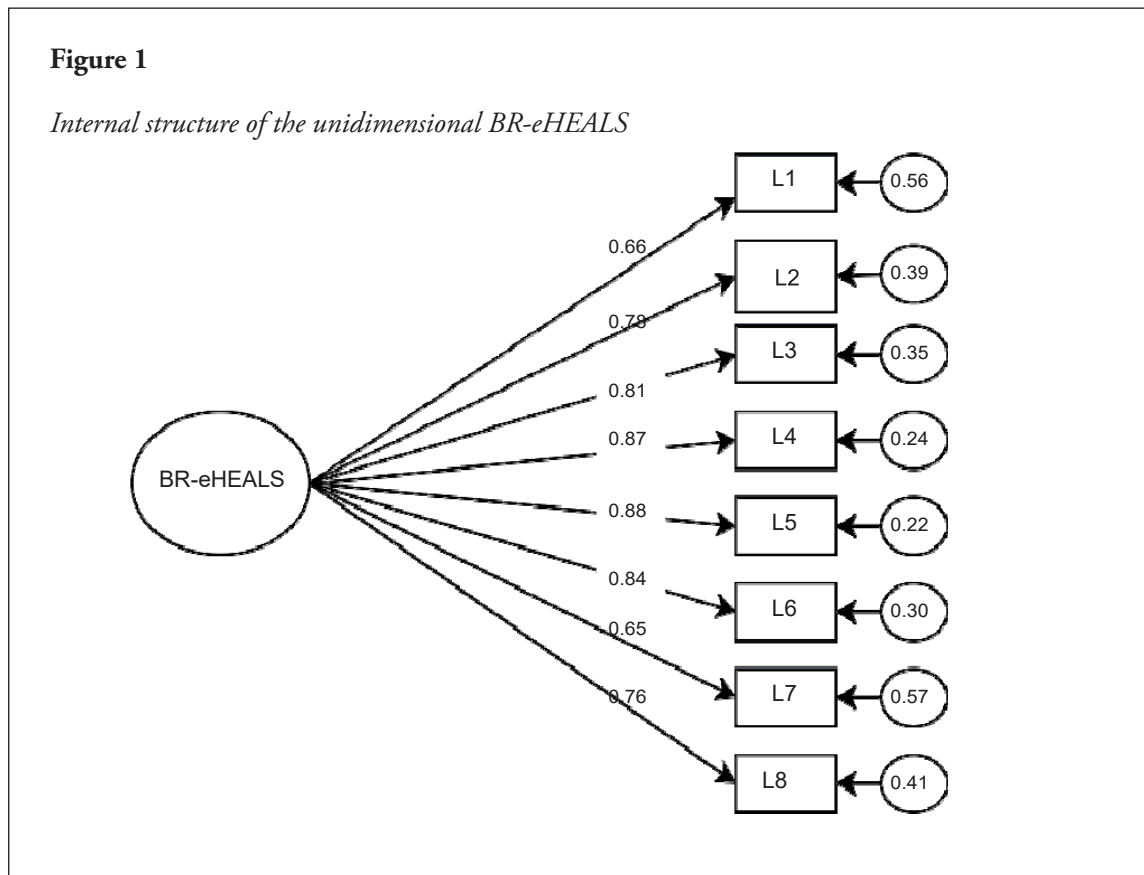
Table 4*Reliability and confirmatory factor analysis (indicators for model fit)*

Reliability	
Cronbach's alpha (95% CI)	0.90 (0.89;0.92)
Omega 6	0.91
KMO	0.87
Composite reliability	0.927
CFA	
X^2 (df) / <i>p</i> -value	74.695 (28) / 0.00

RMSEA (95% CI)	0.100 (0.079;0.123)
TLI	0.990
CFI	0.995
NFI	0.990
AVE	0.616

Note. KMO = Kaiser-Meyer-Olkin test; CFA = Confirmatory factor analysis; χ^2 = Chi-square; df = Degrees of freedom; RMSEA = Root Mean Square Error of Approximation; TLI = Tucker-Lewis Index; CFI = Comparative Fit Index.

The factor loadings indicate that all items have adequate values that explain the construct, ranging from 0.65 to 0.88 for the single-factor model (Figure 1).



Finally, an analysis was performed to check the evidence based on the relationships with the external measures, that is, the concurrent validity, which aims to measure the same construct through different instruments, hoping that this correlation is significant. Thus, the correlation between the BR-eHEALS and the Health Literacy Scale of Quemelo et al. (2017) was analyzed, showing that the BR-eHEALS score had a high correlation [$r = 0.553$ ($p < 0.001$)] with the scale of Quemelo et al. (2017); American Educational Research Association, American Psychological Association, National Council on Measurement in Education (2014).

Discussion

This study resulted in the BR-eHEALS validated for users of digital social networks in Brazil. The eHEALS was originally developed in English in Canada (Norman & Skinner, 2006) and later translated and validated in

Portugal by Tomás et al. (2014). Based on the European Portuguese version, the scale was cross-culturally adapted to Brazilian Portuguese, showing evidence of good reliability and validity for Brazilian users of digital social networks.

In this study, the cross-cultural adaptation of the BR-eHEALS proved essential given the adjustments suggested by the expert committee, confirming the relevance of the cross-cultural adaptation process. Thus, this step in the scale validation process was crucial because, even though it was previously validated in a country with the same official language, the BR-eHEALS underwent key adjustments for its use in Brazil. In this study, the CVC (= 0.86) of the adapted version was high, indicating expert agreement and that the content adequately assesses the construct it is deemed to assess. According to the guidelines established by Hernández-Nieto (2002), values equal to or greater than 0.80 indicate agreement in the individual item assessment and the overall instrument assessment. A similar study conducted in Korea by Chung

et al. (2018) with adults using online results found an acceptable CVC (0.83) for the K-eHEALS version, which is a value very close to that in this study.

Moreover, it should be noted that Portuguese-speaking countries (Portugal, Brazil, Mozambique, Macau, Angola, East Timor, Guinea-Bissau, Equatorial Guinea, Cape Verde, and São Tomé and Príncipe) are heterogeneous in terms of income and access to health care. On the one hand, most of these countries have inefficient and complex health systems, but, on the other hand, they are experiencing progress in information and communication technologies. Therefore, identifying the level of DHL will allow knowing the individual's ability to obtain, process, and interpret health information found in digital social networks and use them to increase health education (van der Vaart & Drossaert, 2017).

After the cross-cultural validation process, the BR-eHEALS showed reliability and validity to identify the level of DHL of Brazilian online social network users. In addition, although the results obtained in this study were consistent in all the analyses, it should be noted that reliability and validity are not fixed properties but rather vary depending on the population or other factors (Souza et al., 2017). This study found an adequate model fit, with TLI, CFI, and NFI values greater than 0.9 and a χ^2/df ratio of 2.66. Although the RMSEA index was 0.1, which is slightly higher than expected (0.08), it should be noted that RMSEA this coefficient can penalize more complex models (Byrne, 2010).

The sample consisted of digital social network users with higher levels of education and income than the average population in Brazil. Concerning the level of education, the majority of participants (49.2%) had completed higher education and postgraduate studies. This percentage is high given that only about 17.4% of the population in Brazil has a higher education degree (Instituto Brasileiro de Geografia e Estatística, [IBGE], 2019). Similarly, the participants' monthly incomes are also higher than the Brazilian average: 53.8% of them reported incomes of more than four minimum wages while the average in Brazil is two minimum wages (IBGE, 2019).

Finally, several studies have shown that the reliability (assessed through internal consistency) of the eHEALS was adequate in the Japanese (0.93; Mitsutake et al., 2011), Iranian (0.88; Bazm et al., 2016), Korean (0.88; Chung et al., 2018), Spanish (0.87; Paramio, 2015), Dutch (0.87; van der Vaart et al., 2011), and the original Canadian versions (0.88; Norman & Skinner, 2006). The BR-eHEALS, which was validated in this study, also proved to be reliable with a total alpha of 0.90.

Conclusion

The BR-eHEALS was cross-culturally adapted to Brazilian Portuguese and showed consistent reliability and validity to measure the level of DHL of digital social network users. This scale validated for online use is an easy and quick-to-apply tool that can be used in future studies to obtain better communication strategies to promote

the health of users of the health system and the general population. A limitation of this study is the specificity of the sample, which consisted of users of digital social networks with higher levels of education and income than the average population in Brazil. It should be noted that Brazil is a continental country with wide socioeconomic and cultural diversity in its different geographic regions. Thus, this validated version should be used with caution, given that the psychometric properties of a scale are not fixed and may vary depending on the characteristics of the study population.

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