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## Research Article

### BEHAVIORS AND OUTCOMES IN PERCEIVED HEALTH COMPETENCE: CROSS-CULTURAL STUDY

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#### ABSTRACT

The aims of study were 1) to present a unified Portuguese-language version of the Perceived Health Competence Scale (PHCS) and to evaluate their psychometric properties in unifactorial and bifactorial models, and 2) to estimate the influence of demographic variables and body mass index (BMI) on perceived health competence in Brazilian, Portuguese and Mozambican students. Face and content validity of PHCS were performed. The convergent, discriminant, concurrent validity and the reliability were assessed. The invariance was estimated using multi-group analysis. In structural models, the PHCS' factors were used as dependent variable and demographic variables and BMI as independent variables. The probability for low expectations about outcomes and perceived competence in health-related behaviors was estimated by logistic multiple models. Overall 3,248 students participated in this study. The unified version was well understood in the three countries. PHCS' bifactorial model showed good fit. In Mozambican sample the convergent validity and reliability were limited. The invariance was showed only in the independent samples. Higher expectations about achieving desired health outcomes were associated to study-related medication use,  $BMI \geq 25.0 \text{ kg/m}^2$ , low socio-economic stratum and older age. Greater health competence in health-related behaviors was associated with no medication use,  $BMI < 25.0 \text{ kg/m}^2$ , high socio-economic stratum, younger age and male gender.

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## INTRODUCTION

Self-efficacy or perceived competence is a wide concept related to beliefs about the individual's ability to achieve the desired outcomes by performing an action. The Modified Social Learning Theory applied to health states that the probability of engagement in health-related behaviors depends on the value attributed to health and the perceived control over health (Wallston, 1992). The value attributed to health might depend on socio-cultural factors: it is possible that, in certain cultures, health management might not be perceived has a priority, comparing with other concurrent demands (Carlson & Chamberlain, 2003). Regarding to the perceived competence, many studies (Bhandari, 2014; Dempster & Donnelly, 2008; Pimenta, Leal, & Maroco, 2008a; Polchert, 2015; Smith, Wallston, & Smith, 1995; Togari *et al.*, 2004) have proven that

perceived competence has stronger relation to health behaviors and outcome expectancies. Thus, the evaluation of this construct can contribute to the development of preventive health measures and, consequently, to the identification of individuals who need encouragement and additional support to adopt better self-care strategies (Polchert, 2015; Smith *et al.*, 1995). Hence, focusing culturally diverse samples while exploring attitudes, behaviors, and influences in self-efficacy beliefs is crucial to ensure an adequate and valid health research; and, given that health competence is influenced by multi-faceted factors, this field of research requires awareness of potential cultural bias in the psychometric properties of instruments (González-Calvo, González, & Lorig, 1997; Polchert, 2015).

There are many instruments that evaluate the perceived competence in specific health conditions (e.g. healthy eating

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behavior, cancer screening); however, few assess general health conditions. Concerned about this matter, Wallston mentioned, in 1989, one measure to assess the perceived health competence beliefs. In 1995, Smith, Wallston, and Smith presented the instrument designated as Perceived Health Competence Scale (PHCS) to measure health management capability. The PHCS was developed in English to assess, in a unifactorial model, the perceived competence beliefs regarding general health. The scale has 8 items (4 formulated through negative wording), assessed in 5-point Likert response scale (which ranges from strongly disagree to strongly agree) and has been used in many studies, both with clinical and healthy population (Aroraa *et al.*, 2002; Bhandari, 2014; Dempster & Donnelly, 2008; Kripalani *et al.*, 2015; Meyers *et al.*, 2014; Pimenta *et al.*, 2008a; Polchert, 2015; Togari *et al.*, 2004). Regarding the PHCS' score, the author originally proposed that an average score above the scale's midpoint (i.e. higher than 3.0) would indicate that the individuals perceived themselves as competent to manage their own health. Some studies (Bhandari, 2014; Pimenta *et al.*, 2008a; Polchert, 2015) have also explored the PHCS' factorial structure and, differently from the original one, have suggested a two-factor structure.

PHCS' items have been translated and adapted to Nepali (Bhandari, 2014), Spanish (Polchert, 2015), Japanese (Togari *et al.*, 2004) and Portuguese (Pimenta, Leal, & Maroco, 2008b). The Portuguese version has been tested only with a sample of participants from Portugal (therefore, not yet proven to be valid in other Portuguese-speaking countries); furthermore, there is an absence of studies using the PCHS, in other Portuguese-speaking countries. Therefore, there is the need to further explore the PCHS and to develop and encourage the use of an adapted version, valid to different countries sharing the same language, allowing a comparison of results about the perceived competence over health in different Portuguese-speaking countries.

Despite the wide use of PHCS in different contexts, only the Polchert's study analyzed the scale in a cross-cultural study. The evaluation of one measure in distinct populations simultaneously allows evaluating the psychometric properties of that instrument in the different social and cultural contexts of each sample. In addition, the implementation of cross-cultural studies strengthens the results and the discussions of the researchers, besides improving the possibilities of achieving more accurate measures.

Moreover, the implementation of cross-cultural studies allows the identification of factors (e.g. age and body weight) that may be related to the perceived health competence of individuals from different countries, increasing the likelihood of identifying the impact of socio-cultural differences. Smith *et al.* (1995) and Polchert (2015) have reported that age has a strong influence on perceived health competence, showing that younger people have a higher perceived health competence. Furthermore, Togari *et al.* (2004) have also found that body weight is an important factor for health competence. Other studies (Dempster & Donnelly, 2008; Pimenta *et al.*, 2008a) also support that health behaviors are associated with demographic, economic and academic factors. Studies evaluating the influence of these factors on transnational

samples were not found in the literature. Therefore, this study was performed to achieve two goals:

- 1) To present a unified Portuguese-language version of the PHCS and to evaluate its psychometric properties, considering the original unifactorial structure, as well as alternative models (proposed in the literature), in a sample of Brazilian, Portuguese and Mozambican college students (step 1).
- 2) To estimate the perceived health competence and its associated factors, in a sample of Brazilian, Portuguese and Mozambican college students (step 2).

## MATERIALS AND METHODS

### *Participants*

The minimum sample size of this cross-sectional research was calculated through power analysis, using a significance level of 5%, a statistical power equal to 80%, the goodness-of-fit index root mean square error of approximation (RMSEA) equal to 0.08 and the degrees of freedom of the model equal to 512 (Kim, 2005). Still, we have doubled the sample size in order to assess the factorial model's invariance in independent samples; additionally, a 30% attrition rate has been taken into account. Considering the latter, a minimum sample size of 174 individuals for each country was established.

Students enrolled in Brazilian, Portuguese and Mozambican institutions were invited to participate in the study. A total of 3,493 students agreed to participate; however, 243 (6.96%) individuals did not complete all questionnaires' items and were consequently excluded. Thus, 3,248 (63.6% women) college students (Brazil:  $n = 1,500$ , Portugal:  $n = 1,259$  and Mozambique:  $n = 489$ ) were included in the analysis.

### *Variables*

Demographic and academic characteristics, as well as, the social-economic stratum were assessed by a socio-demographic questionnaire. Gender, age, area and year of graduate course, study-related medication use (frequency; Have you ever needed to take some type of medication due to his studies?), and social-economic stratum were investigated to characterize the sample. The social-economic stratum was classified according to the average household income. In Brazil the classification was made by Brazilian Economic Classification Criteria (ABEP, 2015); in Portugal and in Mozambique a self-reported student's household income was used. Given that the literature shows that body weight may influence the perceived health competence, and that the body mass index (BMI) is an important indicator of body weight, we asked the students to report their current weight and height. The weight and height were used to estimate individuals' nutritional status according to BMI (Onis *et al.*, 2007; WHO, 2000). We used self-reported weight and height because in the pilot study (subsample with 356 students) both measures showed excellent reproducibility by intraclass correlation coefficient (weight = 0.979 [CI<sub>95%</sub>0.974–0.983] height = 0.968 [CI<sub>95%</sub>0.957–0.976]). Perceived health competence was assessed by the unified Portuguese-language version of PHCS, which was elaborated according to the steps below.

**Elaboration of unified Portuguese-language version of the PHCS**

**Face validity**

Currently, the literature presents only one Portuguese version (Pimenta *et al.*, 2008b) of PHCS, elaborated to be applied to the Portuguese population. Considering the orthographic agreement established between the Portuguese-speaking countries, a unified Portuguese-language version of the PHCS (to be used in Brazil, Portugal, and Mozambique) was created in this study. To support the development of the unified version, we used the Portuguese version (Pimenta *et al.*, 2008b) and the original version in English (Smith *et al.*, 1995). The Portuguese and English versions were analyzed by four researchers (two Brazilian, one Portuguese and one Mozambican), specialized in both health-related and psychometry areas, in order to create a unified Portuguese-language version. The researchers considered that the unified version corresponded to the original one and would be clearly understood by citizens of the three countries. After obtaining agreement between researchers, the unified version was sent to a Portuguese language professor for assessing the idiomatic, semantic, cultural, and conceptual equivalence of the scale. This version was pre-tested in a pilot study (20 students of each country) to determine the incomprehension index of the items. All students reported understanding well all items of the scale. Table 1 shows the unified Portuguese-language version of the applied PHCS.

**Table 1** Original and unified Portuguese-language version of the Perceived Health Competence Scale (PHCS)

Item	Original version (Smith et al. 1995)	Unified Portuguese-language version
1 <sup>r</sup>	It is difficult for me to find effective solutions to the health problems that come my way.	Para mim é difícil encontrar soluções eficazes para os problemas de saúde que me vão aparecendo.
2 <sup>r</sup>	I find my efforts to change things I don't like about my health are ineffective.	Eu acho que os esforços que faço para mudar coisas que eu não gosto em relação à minha saúde são ineficazes.
3	I handle myself well with respect to my health.	Eu consigo lidar bem com meu estado de saúde.
4	I am able to do things for my health as well as most other people.	Eu sou capaz de fazer coisas pela minha saúde tão bem quanto a maior parte das outras pessoas.
5	I succeed in the projects I undertake to improve my health.	Eu consigo ter sucesso nos projetos que empreendo para melhorar a minha saúde.
6 <sup>r</sup>	Typically, my plans for my health don't work out well.	Normalmente, os meus planos para melhorar a minha saúde não resultam bem.
7 <sup>r</sup>	No matter how hard I try, my health just doesn't turn out the way I would like.	Não importa o quanto eu me esforce, a minha saúde nunca acaba por ser do modo que eu gostaria.
8	I'm generally able to accomplish my goals with respect to my health.	Geralmente, sou capaz de atingir as minhas metas em relação à minha saúde.

Note: r = Reverse items.

**Content validity**

Content validity ratio (CVR) was calculated to assess the content of each PHCS' item (Lawshe, 1975). Eight qualified experts in the field of health, psychology, and psychometry evaluated content validity. The essentiality of each item was assessed by experts, using a 3-point Likert-type response scale (essential; useful, but not essential; and unnecessary). The significance of CVR was assessed using  $\alpha = 5\%$  and  $n = 8$  (Wilson, Pan, & Schumsky, 2012). Items presenting values above 0.693 were considered essential by experts to assess the perceived self-efficacy (in the health behavior domain).

**PHCS' models and Instruments**

In this study, we assessed three PHCS' different models proposed in the literature, namely, i) the original model (Smith *et al.*, 1995) which proposed to assess perceived health competence in a unifactorial model, ii) the bifactorial model showed by Pimenta, Leal and Maroco (2008b) which proposed to assess high (items: 3, 4, 5, 6 and 8) and low perceived health

competence (items: 1, 2 and 7) in a sample of Portuguese college students and iii) the bifactorial model showed by Bhandari (2014) and Polchert (2015), composed of two factors which mirror both positive (3, 4, 5 and 8) and negative items (1, 2, 6 and 7). Polchert (2015) has designated the set of negative items as competence in health-related behaviors and the group of positive items as expectations about achieving desired health outcomes. To assess the concurrent validity of PHCS, the World Health Organization Quality of Life Questionnaire-Short Form—WHOQOL-bref (Fleck *et al.*, 2000) was used; WHOQoL-bref assesses the health-related quality of life. The questionnaire is composed of 26 items with, a 5-point Likert-type response scale and four factors, including Physical, Psychological, Social Relationships and Environment.

**Procedures**

São Paulo State University—UNESP (Brazil), University Institute of Psychological, Social and Life Sciences—ISPA, Institute of Health Sciences Egas Moniz—ISCSEM, University of Coimbra-Faculty of Pharmacy—FFUC, Nursing School of Lisbon—ESEL, Polytechnic of Porto-School of Engineering—ISEP (Portugal) and School of Educational Sciences and Psychology—FACEP (Mozambique) were invited to participated in the study. All academic institutions approved the application of the questionnaires to the enrolled students. The institutions' professors were informed about the research and agreed to give 20 minutes of their theoretical class for the interested students to complete the questionnaires.

In the classroom, the students were informed about the aim of the research; this study included all students older than 18 years, who agreed in participating and signing the informed consent document.

Two Ethic Committees approved this study: one from the Department of Pharmaceutical Sciences at UNESP (C.A.A.E.: 29896214.0.0000.5426) and the other one from Nursing School of Lisbon—ESEL (Process number: 1413). The College of Educational Sciences and Psychology—FACEP approved the research in Mozambique.

**Psychometric Analysis (Step 1)**

The psychometric properties of the PHCS' models (unifactorial and bifactorial) were assessed in the overall sample, as well as in the Brazilian, Portuguese and Mozambican samples separately, according to the following topics. The software MPLUS (v.7.2, Muthén & Muthén, Los Angeles, CA) was used for these analyses.

### Factorial Validity

PHCS' models were assessed by confirmatory factorial analysis (CFA). We used the polychoric correlation matrix and the Weighed Least Squares Mean and Variance Adjusted (WLSMV) method. To assess the models' fit the goodness-of-fit indices, chi-square by the degree of freedom ( $X^2/df$ ), comparative fit index (CFI), Tucker-Lewis index (TLI), Root mean square error of approximation (RMSEA), and factorial weight ( $\lambda$ ) of each item were used (Kline, 1998). Values of  $X^2/df \leq 2.00$ ,  $CFI \geq 0.90$ ,  $TLI \geq 0.90$ ,  $RMSEA \leq 0.10$  and  $\lambda \geq 0.40$  indicated an adequate fit of the models. RMSEA' values (including CI95%) were used to compare the models; the one having lower values was chosen as the best one (León & Fachel, 2011). Still, to verify if there were correlations between the items' errors, we assessed the modification indices by Lagrange Multipliers (LM). The LM with values greater than 11 were observed for models' fit improvement (Marôco, 2014).

### Convergent Validity

To evaluate the behavior of the items of in each corresponding factor we used the convergent validity. Average variance extracted (AVE) was calculated and considered indicative of convergent validity when greater than 0.50 (Fornell & Larcker, 1981; Hair, Black, Babin, Anderson, & Tatham, 2005; Marôco, 2014).

### Discriminant Validity

For bifactorial models the discriminant validity was estimated. When  $AVE_i$  and  $AVE_j \geq r_{ij}^2$  ( $r_{ij}^2$ : a square of the correlation between the factors  $i$  and  $j$ ) discriminant validity was confirmed (Fornell & Larcker, 1981).

### Reliability

We assessed the reliability of PHCS through internal consistency, using both Composite Reliability (CR; (Fornell & Larcker, 1981) and Cronbach's alpha ( $\alpha_p$ ), calculated on the items' Polychoric correlations matrix (Gadermann, Guhn, & Zumbo, 2012). An adequate reliability was considered when  $\alpha_p$  and CR were greater than 0.70 (Marôco, 2014; Marôco & Garcia-Marques, 2006).

### Transnational and Factorial Invariance

To assess if the PHCS' fitted models were invariant in different groups (between countries and between independent random samples) we performed the invariance test by multi-group analysis using the chi-square difference ( $\Delta X^2$ ). Initially, the transnational invariance (Brazil vs. Portugal, Brazil vs. Mozambique, and Portugal vs. Mozambique) was assessed (Brazil:  $n = 1,500$ , Portugal:  $n = 1,259$ , Mozambique:  $n = 489$ ). Subsequently, the sample of each country was randomly divided in two equal parts, in order to assess the factorial invariance in independents samples (Brazil [test:  $n = 933$ , validation:  $n = 567$ ], Portugal [test:  $n = 770$ , validation:  $n = 489$ ], Mozambique [test:  $n = 287$ , validation:  $n = 202$ ]). First, it was assessed if the factorial weights were equivalent (metric invariance [ $\lambda$ ]); second, if the factorial weights and intercepts were equivalent (scalar invariance [Int]); and third, if factorial weights, intercepts, and residues' variance/covariance were equivalent (strict invariance [Cov]) (Kaplan, 2000; Marôco, 2014).

### Concurrent Validity

The concurrent validity was performed to assess the degree to which the PHCS was in fact related with the WHOQoL-bref. The correlational analysis between the two instruments was used (Marôco, 2014). It should be noted that this analysis was performed using the PHCS' model with better psychometric properties.

Psychometric properties of WHOQoL-bref in the total sample were not good ( $X^2/df = 22.33$ ,  $CFI = 0.86$ ,  $TLI = 0.84$ ,  $RMSEA = 0.09$ ,  $\alpha_p = 0.68-0.89$ ), so the WHOQoL-bref was refined. In the Brazilian and Portuguese samples, the items 3, 4 and 8 were excluded; moreover, in the Mozambican sample the items 3, 4, 9, 11 and 26 were excluded. After the refinement, the scale showed anadequate validity and restricted reliability regarding the social relationships' in all samples (Total:  $X^2/df = 15.52$ ,  $CFI = 0.92$ ,  $TLI = 0.91$ ,  $RMSEA = 0.07$ ,  $\alpha_p = 0.68-0.74$ ; Brazil:  $X^2/df = 6.81$ ,  $CFI = 0.93$ ,  $TLI = 0.92$ ,  $RMSEA = 0.07$ ,  $\alpha_p = 0.68-0.76$ ; Portugal:  $X^2/df = 7.08$ ,  $CFI = 0.93$ ,  $TLI = 0.91$ ,  $RMSEA = 0.07$ ,  $\alpha_p = 0.65-0.77$ ; and Mozambican:  $X^2/df = 2.25$ ,  $CFI = 0.91$ ,  $TLI = 0.90$ ,  $RMSEA = 0.07$ ,  $\alpha_p = 0.55-0.74$ ). It should be noted that the restricted reliability of the social relationships' factor probably occurred due to its 3-item composition, which limits the estimation of the concept.

### Structural Model (Step 2)

A structural model was built (considering PHCS' best-fit model) and analyzed separately for each country since configurational invariance was not shown along the different samples (Table 3). In this analysis only individuals who have completed all socio-demographic questionnaire and PHCS' items were included (Brazil:  $n = 1,440$ , Portugal:  $n = 1,212$ , Mozambique:  $n = 276$ ). The influence of the studied variables on perceived health competence (dependent variable) was estimated. Gender, age, study-related medication use, social-economic stratum and BMI were explored as independents variables. Goodness-of-fit indices  $X^2/df$ , CFI, TLI, RMSEA were used to assess the models' fit. The path coefficient ( $\beta$ ) of each independent variable was estimated and the significance ( $p < 0.05$ ) was assessed by z-test. The coefficient of determination ( $R^2$ ) was used to calculate the model's explanatory power (Marôco, 2014). Mplus software (v.7.2; Muthén & Muthén, Los Angeles, CA) was used to perform the analysis.

### Behaviors and outcomes in perceived health competence

Previous studies have opted to use PHCS' sum scores. However, this study used the original suggestion (Smith *et al.*, 1995), which recommended the use of the mean score. Considering the use of a 2-factor model of PHCS, the mean scores were computed separately for each factor. Subsequently, the individuals were classified in their response to PHCS (which response scale ranges from 1 to 5), using the percentiles 25, 50 and 75, specifically i) very low ( $P < 25 = \leq 1.75$ ), ii) low ( $P_{25-50} = 1.75 - \uparrow 3.00$ ), iii) medium ( $P_{50-75} = 3.00 - \uparrow 4.00$ ) and iv) high ( $P > 75 = > 4.00$ ) expectation about achieving desired health outcomes (PHCS' factor 1) and competence in health-related behaviors (PHCS' factor 2). The prevalence of individuals with i) very low, ii) low, iii) medium and iv) high outcomes expectations and competence in health-related

behaviors was estimated using 95% confidence interval (95% CI). The evidence of predictive criterion validity (odds ratio) of mean scores of the PHCS' factors on independent variables was estimated by logistic regression using Mplus (v.7.2; Muthén & Muthén, Los Angeles, CA). Both PHCS' factors were used as dependent variables.

**Table 2** Demographic, academic characteristics and nutritional status of samples

Characteristic	Sample n (%)			
	Brazil	Portugal	Mozambique	Total
Gender				
Male	570 (38.0)	443 (35.2)	169 (34.6)	1,182 (36.4)
Female	930 (62.0)	816 (64.8)	320 (65.4)	2,066 (63.6)
Course area				
Human Sciences	950 (63.4)	357 (28.4)	489 (100.0)	1,796 (55.3)
Exact Sciences	266 (17.7)	306 (24.3)	-	572 (17.6)
Health Sciences	284 (18.9)	596 (47.3)	-	880 (27.1)
Course year				
First	524 (34.9)	348 (27.7)	207 (42.3)	1,079 (33.3)
Second	392 (26.1)	272 (21.7)	48 (9.8)	712 (21.9)
Third	322 (21.5)	227 (18.1)	164 (33.5)	713 (22.0)
Fourth	171 (11.4)	298 (23.7)	69 (14.1)	538 (16.6)
≥ Fifth	91 (6.1)	110 (8.8)	1 (0.3)	202 (6.2)
Frequency study-related medication use				
Frequently	51 (3.4)	39 (3.1)	1 (0.2)	91 (2.8)
Sometimes	338 (22.7)	319 (25.4)	52 (10.9)	709 (22.0)
Never	1,100 (73.9)	900 (71.5)	425 (88.9)	2,425 (75.2)
Nutritional status				
Underweight	70 (4.7)	76 (6.1)	30 (6.9)	176 (5.5)
Eutrophic	1,054 (70.3)	959 (76.7)	276 (63.9)	2,289 (72.2)
Overweight	284 (19.0)	177 (14.2)	88 (20.4)	549 (17.3)
Obesity	83 (5.6)	37 (3.0)	38 (8.8)	158 (5.0)
Social-economic stratum*				
A	7 (0.5)	91 (7.4)	74 (20.8)	172 (5.6)
B	290 (19.4)	563 (45.5)	166 (46.8)	1,019 (33.0)
C	786 (52.5)	483 (39.0)	82 (23.1)	1,351 (43.7)
D and E	415 (27.7)	100 (8.1)	33 (9.3)	348 (17.7)

\* The social-economic stratum was classified for each country using the official currency converted to US dollars (exchange rate as of May, 2016). A: Brazil = > \$6,725.02 USD, Portugal = > \$2,866.63, Mozambique = > \$365.48, B: Brazil = \$1,468.69-\$2,884.68 USD, Portugal = \$1,146.65-\$1,719.98, Mozambique = \$219.29-\$365.48, C: Brazil = \$479.76-\$799.14 USD, Portugal = \$573.33-\$1,146.65, Mozambique = \$73.10-\$146.19, D and E: Brazil = < \$212.23 USD, Portugal = < \$573.33, Mozambique = < \$73.10.

In the logistic model, the individuals were classified in either low ( $\leq 3.00$ ) or high ( $> 3.00$ ) expectation about achieving desired health outcomes, and in either low ( $\leq 3.00$ ) or high ( $> 3.00$ ) competence in health-related behaviors. After refining structural model, the following independent variables were included: gender (0 = man, 1 = woman), age (0 = < 21 years old, 1 =  $\geq 21$  year old), study-related medication use (0 = no, 1 = yes), social-economic stratum (0 = high, 1 = low) and BMI (0 = eutrophic and underweight, 1 = overweight and obesity).

**RESULTS**

The students' average age in the total sample was 21.7 (standard derivation [SD] = 3.6) years old (Brazil: 21.1 [SD] = 3.3, Portugal: 21.4 [SD] = 4.0, Mozambique: 29.3 [SD] = 7.9). Table 2 shows the demographic characterization of the samples. The average time to complete the PHCS was 2 minutes and 9 seconds (SD = 37 seconds). The experts have only considered the item 4 (CVR8;  $0.05 \leq 0.693$ ) as not essential to assess perceived health competence. Table 3 shows the psychometric properties of PHCS' models in the total sample, as well as in Brazilian, Portuguese and Mozambican samples. The original model (Smith *et al.*, 1995) and the model of Pimenta, Leal and Marôco (2008b) did not show a good fit for the samples. The model of Bhandari (2014) and Polchert (2015) showed a satisfactory fit and the lowest values of RMSEA for all samples; therefore, it was considered the best model. Convergent and discriminant validity were not adequate in most models. Reliability (that is  $\alpha_p$  and CR) was not adequate in the Mozambican sample (in all models) and in the total and Brazilian samples (considering all models tested with Pimenta, Leal and Marôco's suggested structure). The invariance test in independent samples (test vs. validation), within of each country, indicated metric, scalar and strict invariance for all countries. However, the transnational invariance test (Table 3) evidenced that all PHCS' models tested show metric invariance between Brazil and Mozambique, and also between Mozambique and Portugal; however, invariance between Brazil and Portugal was not

**Table 3** Psychometric properties of the Perceived Health Competence Scale (PHCS) models

Model	Sample	n	$\lambda$	$\chi^2/df$	CFI	TLI	RMSEA (IC95%)	$r^2$	AVE	CR	$\alpha_p$	$R^2$
Unifactorial (original)	Total	3,248	0.47-0.76	78.18	0.92	0.88	0.154 (0.148-0.161)	-	0.43	0.86	0.80	0.22
	Brazilian	1,500	0.56-0.81	30.43	0.95	0.93	0.140 (0.131-0.150)	-	0.50	0.89	0.85	0.31
	Portuguese	1,259	0.48-0.82	37.15	0.93	0.90	0.169 (0.159-0.180)	-	0.51	0.89	0.84	0.23
	Mozambique	489	0.31-0.66	6.89	0.81	0.73	0.110 (0.093-0.127)	-	0.27	0.72	0.59	0.09
Bifactorial (Pimenta, Leal & Maroco, 2008)	Total	3,248	0.53-0.78	65.13	0.93	0.90	0.141 (0.134-0.147)	0.66	0.46-0.49	0.71-0.83	0.63-0.77	0.28-0.38
	Brazilian	1,500	0.59-0.81	27.57	0.95	0.93	0.133 (0.123-0.143)	0.77	0.50-0.54	0.75-0.85	0.68-0.81	0.35-0.37
	Portuguese	1,259	0.51-0.83	34.25	0.94	0.91	0.163 (0.152-0.173)	0.76	0.52-0.56	0.76-0.86	0.67-0.81	0.26-0.40
	Mozambique	489	0.42-0.68	5.26	0.87	0.81	0.093 (0.076-0.112)	0.27	0.30-0.34	0.56-0.71	0.44-0.56	0.22-0.39
Bifactorial (Bhandari, 2014) (Polchert, 2015)	Total	3,248	0.52-0.81	24.82	0.98	0.96	0.086 (0.079-0.092)	0.55	0.47-0.53	0.78-0.82	0.70-0.75	0.27-0.41
	Brazilian	1,500	0.58-0.84	19.11	0.97	0.95	0.110 (0.100-0.120)	0.72	0.53-0.55	0.82-0.83	0.76-0.78	0.34-0.38
	Portuguese	1,259	0.51-0.85	15.76	0.97	0.96	0.108 (0.098-0.119)	0.62	0.54-0.60	0.82-0.86	0.75-0.80	0.26-0.43
	Mozambique	489	0.44-0.70	2.47	0.95	0.93	0.055 (0.035-0.075)	0.20	0.30-0.41	0.62-0.73	0.51-0.60	0.19-0.41
Invariance	Brazil vs. Portugal			$\Delta X^2: \lambda (6) = 21.491, p = 0.001$ ; Int (28) = 99.93, $p < 0.001$ ; Cov/Res (22) = 81.30, $p < 0.001$								
	Brazil vs. Mozambique			$\Delta X^2: \lambda (6) = 11.14, p = 0.084$ ; Int (28) = 58.38, $p < 0.001$ ; Cov/Res (22) = 52.98, $p < 0.001$								
	Mozambique vs. Portugal			$\Delta X^2: \lambda (6) = 10.47, p = 0.106$ ; Int (28) = 50.82, $p = 0.005$ ; Cov/Res (22) = 44.36, $p = 0.003$								
	Brazil: test vs. validation			$\Delta X^2: \lambda (6) = 9.42, p = 0.151$ ; Int (28) = 32.62, $p = 0.249$ ; Cov/Res (22) = 23.52, $p = 0.372$								
	Portugal: test vs. validation			$\Delta X^2: \lambda (6) = 5.84, p = 0.441$ ; Int (28) = 36.58, $p = 0.129$ ; Cov/Res (22) = 31.48, $p = 0.086$								
Mozambique: test vs. validation			$\Delta X^2: \lambda (6) = 3.03, p = 0.805$ ; Int (28) = 33.93, $p = 0.203$ ; Cov/Res (22) = 33.67, $p = 0.053$									

Note.  $\lambda$  = factorial weight,  $\chi^2/df$  = chi-square by degrees of freedom, CFI = comparative fit index, TLI = Tucker-Lewis Index, RMSEA = root mean square error of approximation,  $r^2$  = square of the correlation between the factors, AVE = average variance extracted, CR = composite reliability,  $\alpha_p$  = Cronbach's alpha for Polychoric correlations matrix,  $R^2$  = coefficient of determination, Int = intercept, Cov/Res = covariance/residue.

showed, hence confirming a weak transnational invariance of the PHCS when used with university students.

In the analysis of concurrent validity we found significant moderate correlations ( $p < 0.001$ ) between the PHCS' factors and the WHOQoL-bref' factors, in all samples (Samples: Total:  $r = 0.36-0.58$ , Brazil:  $r = 0.36-0.56$ , Portugal:  $r = 0.38-0.59$ , Mozambique:  $r = 0.27-0.37$ ), showing an adequate concurrent validity. Table 4 presents the influence of the study variables ( $\beta_{\text{standardized}}$ ) on perceived health competence, considering the PHCS' two factors.

In the Brazilian model, a higher frequency of study-related medication use ( $p < 0.001$ ) and higher BMI ( $p < 0.001$ ) were associated with higher expectations about achieving desired health outcomes (factor 1). Being male ( $p = 0.028$ ), using fewer study-related medication ( $p < 0.001$ ), had lower BMI ( $p < 0.001$ ), were older ( $p = 0.005$ ) and had a better social-economic stratum ( $p = 0.023$ ) predicted higher competence in health-related behaviors (Factor 2).

**Table 4** Influence of study variables (independents) in the perceived health competence of Brazilian, Portuguese and Mozambican college students

Model	Variable	Factor 1 / Factor 2 (PHCS)				
		$\beta$	$\beta$ standardized	Standard error	p	
Brazil Complete	Age	-0.008/0.017	-0.046/0.087	0.032/0.031	0.150/0.005*	
	Gender	0.014/0.085	0.011/0.066	0.031/0.030	0.718/0.028*	
	Medication use because of studies	0.243/-0.194	0.216/-0.163	0.027/0.028	<0.001*/<0.001*	
	Body mass index	0.024/-0.030	0.158/-0.189	0.028/0.028	<0.001*/<0.001*	
	Socioeconomic status	-0.035/0.058	-0.041/0.065	0.029/0.028	0.156/0.023*	
	$\chi^2/df = 6.471$ , CFI = 0.972, TLI = 0.961, RMSEA = 0.066					
Refined	Age	- /0.017	- /0.087	- /0.031	- /0.005*	
	Gender	- /0.085	- /0.066	- /0.030	- /0.028*	
	Medication use because of studies	0.243/-0.194	0.216/-0.163	0.027/0.028	<0.001*/<0.001*	
	Body mass index	0.024/-0.030	0.158/-0.189	0.028/0.028	<0.001*/<0.001*	
	Socioeconomic status	- /0.058	- /0.065	- /0.028	- /0.023*	
	$\chi^2/df = 5.282$ , CFI = 0.980, TLI = 0.973, RMSEA = 0.055					
Portugal Complete	Age	-0.009/0.005	-0.072/0.032	0.034/0.033	0.034*/0.327	
	Gender	-0.016/-0.053	-0.015/-0.038	0.033/0.032	0.648/0.230	
	Medication use because of studies	0.092/-0.100	0.094/-0.080	0.032/0.031	0.004*/0.011*	
	Body mass index	0.026/-0.037	0.174/-0.189	0.033/0.031	<0.001*/<0.001*	
	Socioeconomic status	-0.091/0.086	-0.134/0.098	0.031/0.030	<0.001*/0.001*	
	$\chi^2/df = 5.973$ , CFI = 0.977, TLI = 0.968, RMSEA = 0.064					
Refined	Age	-0.009/ -	-0.072/-	0.034/-	0.035*/-	
	Medication use because of studies	0.090/-0.107	0.092/-0.085	0.032/0.031	0.004*/0.006*	
	Body mass index	0.027/-0.035	0.176/-0.180	0.032/0.031	<0.001*/<0.001*	
	Socioeconomic status	-0.091/0.088	-0.133/0.100	0.031/0.030	<0.001*/0.001*	
	$\chi^2/df = 5.578$ , CFI = 0.981, TLI = 0.974, RMSEA = 0.061					
	Mozambique Complete	Age	0.008/0.002	0.141/0.025	0.096/0.089	0.142/0.779
Gender		-0.017/0.196	-0.018/0.172	0.084/0.077	0.827/0.025*	
Medication use because of studies		0.268/-0.191	0.192/-0.108	0.077/0.066	0.012*/0.104	
Body mass index		-0.008/0.002	-0.081/0.014	0.088/0.071	0.357/0.843	
Socioeconomic status		-0.087/0.061	-0.170/0.095	0.081/0.073	0.036*/0.198	
$\chi^2/df = 0.965$ , CFI = 1.000, TLI = 1.000, RMSEA = 0.037						
Refined	Gender	- / 0.186	- / 0.168	- / 0.074	- / 0.022*	
	Medication use because of studies	0.267 / -	0.190 / -	0.077 / -	0.014* / -	
	Socioeconomic status	-0.087 / -	-0.168 / -	0.081 / -	0.038* / -	
	$\chi^2/df = 1.379$ , CFI = 0.977, TLI = 0.970, RMSEA = 0.026					

Note. PHCS = Perceived Health Competence Scale, Factor 1 = expectation about achieving desired health outcomes, Factor 2 = competence in health-related behaviors,  $r^2$  = determination coefficient. Indices of goodness-of-fit of models:  $\chi^2/df$  = chi-square by degree of freedom, CFI = comparative fit index, TLI = Tucker-Lewis index, RMSEA = root mean square error of approximation and. \* values below the minimum significant value ( $p < 0.05$ ).

**Table 5** Prevalence of expectation about achieving desired health outcomes and competence in health-related behaviors in Brazilian, Portuguese and Mozambican college students

Factor	Classification	Brazil		Portugal		Mozambique	
		n (%)	CI95%	n (%)	CI95%	n (%)	CI95%
F1	Very low	642 (42.8)	40.1-45.3	586 (46.5)	43.8-49.3	131 (26.8)	22.9-30.5
	Low	639 (42.6)	40.1-45.2	548 (43.5)	40.7-46.3	239 (48.9)	44.6-53.6
	Moderate	180 (12.0)	10.5-13.7	111 (8.8)	7.1-10.6	87 (17.8)	14.3-21.1
	High	39 (2.6)	1.9-3.3	14 (1.1)	0.6-1.7	32 (6.5)	4.3-8.8
F2	Very low	66 (4.4)	3.3-5.4	16 (1.3)	0.6-2.0	22 (4.5)	2.7-6.3
	Low	492 (32.8)	30.4-35.3	203 (16.1)	14.1-18.3	142 (29.0)	24.9-33.3
	Moderate	593 (39.5)	36.9-42.0	584 (46.4)	43.8-49.1	149 (30.5)	26.2-34.8
	High	349 (23.3)	21.0-25.3	456 (36.2)	33.5-38.8	176 (36.0)	31.9-40.1

Note. F1 = expectation about achieving desired health outcomes, Factor 2 = competence in health-related behavior

In the Portuguese model, being younger ( $p = 0.035$ ) and having lower social-economic stratum ( $p < 0.001$ ), a higher frequency of study-related medication use ( $p = 0.004$ ) and higher BMI ( $p < 0.001$ ) was associated with greater the expectations about achieving desired health outcomes (Factor 1). On the other hand, students with a lower study-related medication use ( $p = 0.006$ ) and lower BMI ( $p < 0.001$ ), as well as and having a higher social-economic stratum ( $p < 0.001$ ) presented a more elevated competence in health-related behaviors (Factor 2).

Finally, in the Mozambican model, students with lower social-economic stratum ( $p = 0.038$ ) and who used study-related medication ( $p = 0.014$ ) displayed greater expectations about achieving desired health outcomes (Factor 1).

Moreover, Mozambican male students, as compared to female students ( $p = 0.022$ ) perceived themselves as more competent in health-related behaviors (Factor 2). All models showed an adequate fit for each sample.

Table 5 presents the prevalence of both health behaviors and health outcomes expectations (i.e., the two components of perceived health competence), in the three samples.

Most students, in all countries, presented a ‘very low’ to ‘low’ expectations about achieving desired health outcomes (Factor 1) and ‘moderate’ to ‘high’ competence in health-related behaviors (Factor 2).

Multiple logistic models and the odds ratio considering the expectations about health outcomes and competence in health-related behaviors, in relation to the other studied variables, are presented in Table 6.

less likely to have competence in health-related behaviors (OR = 0.544).

Brazilians and Portuguese students classified as having overweight/obesity were more likely to create expectations about achieving desired health outcomes (OR: Brazil = 1.980, Portugal = 2.292) and were less likely to perceive themselves as competent in health-related behaviors (OR: Brazil = 0.552, Portugal = 0.423). Furthermore, Portuguese students with low social-economic stratum (OR = 0.720) and Brazilian female students (OR = 0.713) were less likely to report competence in health-related behaviors.

## DISCUSSION

This study presented a unified Portuguese-language version of the Perceived Health Competence Scale (PHCS) adapted to be used in Brazil, Portugal, and Mozambique. It is a simple scale, which allows a fast and easy filling, and can be used in both research and clinical contexts. The PHCS’ bifactorial model presented adequate psychometric properties in the samples of Brazilian, Portuguese and Mozambican college students, and was considered the best model. Furthermore, this study has identified important aspects associated with the achievement of desired health-related outcomes and increased competence in health-related behaviors; moreover, the probability of individuals to have a low perceived health competence was estimated. Therefore, besides promoting further collaboration studies, this study also strengthens the use of PHCS in clinical practice, as an instrument useful to identify variables likely to be associated with preventive health and health promotion, through self-care strategies.

**Table 6** Multiple logistic model and odds ratio for behaviors and outcomes to health competence in Brazilian, Portuguese and Mozambican college students

Country (Factor <sup>#</sup> )	Variable	$\beta$	Standard error	p	Odds ratio (OR)	95% CI	
Brazil F1	Medication use because of studies	0.826	0.154	<0.001*	2.284	1.688–3.091	
	Body mass index	0.683	0.158	<0.001*	1.980	1.452–2.700	
	Constant	1.469	0.082	<0.001*	4.346		
	F2	Age	0.077	0.111	0.486	1.081	0.869–1.343
		Gender	-0.339	0.119	0.004*	0.713	0.565–0.899
		Medication use because of studies	-0.609	0.123	<0.001*	0.544	0.427–0.693
Portugal F1	Body mass index	-0.595	0.128	<0.001*	0.552	0.429–0.708	
	Socioeconomic status	-0.161	0.136	0.237	0.851	0.652–1.112	
	Constant	-0.243	0.080	0.002*	0.784		
	F2	Age	-0.234	0.197	0.234	0.791	0.538–1.163
		Medication use because of studies	0.633	0.199	0.001*	1.883	1.275–2.779
		Body mass index	0.829	0.218	<0.001*	2.292	1.496–3.513
Mozambique F1	Socioeconomic status	0.324	0.198	0.102	1.383	0.938–2.039	
	Constant	1.892	0.111	<0.001*	6.630		
	F2	Medication use because of studies	-0.285	0.163	0.081	0.752	0.546–1.035
		Body mass index	-0.860	0.175	<0.001*	0.423	0.300–0.597
		Socioeconomic status	-0.328	0.155	0.034*	0.720	0.513–0.976
	F2	Constant	-1.269	0.092	<0.001*	0.281	
Mozambique F1		Medication use because of studies	0.719	0.367	0.050*	2.052	1.000–4.211
		Socioeconomic status	0.483	0.284	0.089	1.622	0.929–2.830
F2	Constant	0.960	0.195	<0.001*	2.613		
	Gender	0.094	0.201	0.640	1.098	0.741–1.627	
	Constant	-0.670	0.100	<0.001*	0.512		

Note. <sup>#</sup>dependent variable: F1 = expectation about achieving desired health outcomes, Factor 2 = competence in health-related behaviors. 0 = PHCS’ mean score > 3 and 1 = PHCS’ mean score ≤ 3  
\* values below the minimum significant value ( $p < 0.05$ ).

Brazilian, Portuguese and Mozambican students who used study-related medication were more likely to create expectations about achieving desired health outcomes (OR: Brazil = 2.284, Portugal = 1.883, Mozambique = 2.052). Brazilian participants who used study-related medication were

Although the experts’ have considered PHCS’ item 4 as not essential to assess the construct (content validity analysis), its factorial weight was above 0.65 in all tested models, for all samples; therefore, item4 was not excluded. The psychometric properties of both PHCS’ unifactorial (original) and bifactorial(Pimenta, Leal, Maroco, & Rosa, 2012)models were

not satisfactory in the present samples. The bifactorial model proposed by [Bhandari \(2014\)](#) and [Polchert \(2015\)](#) was the most parsimonious one, exhibiting an adequate validity and reliability in all samples, with the exception of the Mozambican, that showed limited convergent validity and reliability in the Mozambican sample; Although the original study of PHCS recommends the unifactorial model, the scale's items were developed based on two theoretical health concepts (outcome expectations and health behaviors). Therefore the use of a two-factor structure – which was recommended by [Polchert \(2015\)](#) - has a plausible theoretical justification, based on the original study. Furthermore, the use of two factors discriminates more accurately the behavior and outcome expectations regarding perceived health competence, supporting thereby a more detailed clinical approach since it reflects both cognitive and behavioral dimensions separately.

Considering the best model found, the invariance test was then performed. The PHCS' invariance between countries was weak, namely between Brazil and Mozambique, and again between Portugal and Mozambique. No invariance was found between Brazil and Portugal. This fact may be related to cultural and social characteristics of these countries, which may influence the dissimilar perception of this construct. For example, it is known that attitudes (specifically, ambivalence) towards protective health behaviors can differ among participants from different cultures ([Lindsay & Swinbourne, 2014](#)). Thus, despite the PHCS similar configuration in the three countries, the operationalization of the factors is carried out differently in each country. Previous studies ([Campos & Maroco, 2012](#); [Polchert, 2015](#); [Silva, Costa, Pimenta, Maroco, & Campos, 2016](#)) have demonstrated expressive differences in the operationalization of constructs assessed by psychometric instruments, in cross-cultural samples. For independent samples (within each country) a strong invariance was found attesting the invariance in the operationalization of PHCS' factors; this fact strengthens the use of the suggested PHCS' structure.

Evidence for the concurrent validity of the PHCS' best model was found in our study. The significant correlations between PHCS' factors and WHOQoL-bref' factors showed a relationship between behaviors and outcomes in perceived health competence (PHCS) and health-related quality of life (WHOQoL-bref). [Dempster and Donnelly \(2008\)](#), and [Bhandari \(2014\)](#) also showed a correlation between the PHCS and quality of life instruments, and general health (Short Form-36 and Health Promoting Lifestyle Profile-HPLP). These results confirm the constructs' closeness and strengthen the use of PHCS as a general scale to assess behaviors and outcomes expectations in relation to perceived health competence. Regarding the reliability of PHCS, previous studies ([Bhandari, 2014](#); [Polchert, 2015](#); [Smith et al., 1995](#)) have presented a good internal consistency ( $\alpha$ ) in both unifactorial and bifactorial models. In our study, the best model showed good results for the Brazilian and the Portuguese samples. The limited reliability in the Mozambican sample may be because sample size when compared with the other samples. Likewise, [Polchert \(2015\)](#) also found limited reliability for PHCS when applied in a Spanish small sample.

After the demonstration of the best PHCS model, the influence of each independent variables on both outcomes expectations and behaviors (from the perceived health competence scale), were explored. In the three countries, a higher frequency of study-related medication use and lower social-economic stratum translated in greater expectations about achieving desired health outcomes; also, a lower frequency of study-related medication and higher social-economic stratum indicated a greater competence in health-related behaviors. House, [Lantz and Herd \(2005\)](#) also reported significant differences between social classes and aspects related to health, showing individuals from a higher class adopted more self-care strategies and health promotion behaviors. The use of medication can be a strategy adopted by students to better deal with academic situations and, consequently, students who use medication display higher expectations about achieving desired health outcomes. In the Brazilian and Portuguese samples, both BMI and age contributed significantly to both constructs of health-related competence (outcomes expectations and behaviors). Students aged 21 years or above, and with a BMI below 25 kg/m<sup>2</sup> showed better competence in health-related behaviors; additionally, students with age 20 years or below, and BMI above 25 kg/m<sup>2</sup> displayed higher expectations towards desired health outcomes. This is congruent with what both [Smith et al. \(1995\)](#) and [Togari et al. \(2004\)](#) found, when using the PHCS' unifactorial model: both studies showed a significant relationship between age and body weight, and perceived health competence. In the Mozambican and Portuguese samples, the male students had better competence with behaviors associated with health. [Hallian \(2009\)](#) reported that men are more self-confident than women in many ways. In this study, the overconfidence of male students may have resulted in the belief about the health competence in behaviors, which does not necessarily reflect the adoption of better behavior (a previous study by [Courtenay, McCreary and Merighi, 2002](#) – assessing not general health behaviors but specific ones, evidenced that male college students present both riskier behaviors and beliefs about specific health-related domains such as diet, anger, substance use, etc.). Therefore, given the results of the present research, future studies considering college students' health competence should account for specific factors such as health checkups frequency, current health status, presence of chronic diseases, health information access, frequency of both risk and protective behaviors (e.g., drinking, smoking, and physical exercise habits, condoms use); this will provide a more detailed information on specific health-related determinants of perceived health competence and to help professionals, in the clinical and community settings, targeting well-identified risk groups.

Regarding the prevalence of perceived health competence, considering both outcomes expectations and behaviors, most Brazilian and Portuguese students presented very low expectations about achieving desired health outcomes and moderate competence in health-related behaviors; on the other hand, the Mozambican participants showed low expectations and moderate behavioral competence. This indicates that the Mozambican students perceived themselves as managing health status more effectively when compared with Portuguese and

Brazilians. This fact can be explained by significant socio-cultural differences between countries.

In the last stage of the study, the probability of students displaying low expectations about achieving desired health outcomes and low competence in health-related behaviors was estimated. Those who used study-related medication and had a BMI 25 kg/m<sup>2</sup> or above, presented and increased probe ability to develop expectations about achieving desired health outcomes and a decreased probability to perceive themselves as competent in health-related behaviors. This reveals that a special attention should be given when assessing the perceived health competence of individuals who use medication and who have overweight or obesity since these groups may be at risk for low self-confidence, which might have a negative impact on health. Moreover, the combination of low social-economic stratum and female gender also decreases the probability to competence in behaviors associated with health. Generally, people with low social-economic stratum have both less health information and access to health care service and, therefore, may feel less competent in health-related behaviors. As reported by Hallinan (2009), women – unlike men - showed low confidence in many aspects of life (e.g. health self-care, body weight, insecurity); this fact may be related to lower perceived health competence in behaviors displayed by women. All these aspects are reported in the literature (Hallinan, 2009; House *et al.*, 2005; Smith *et al.*, 1995; Togari *et al.*, 2004) and corroborate with our results, highlighting specific characteristics of these samples, which had an impact on the perceived health competence.

Some limitations of this study should be reported. First, the Mozambican sample size may have been too small to adequately test the scale's fit; thus, we encouraged further investigation using a larger Mozambican sample, in order to confront with our results. Second, a more detailed assessment of health-related behaviors -measured for example through the frequency of preventive medical consultations and the existence of a private health-care system - would have been useful to be confronted with the perceived competence towards health-related behaviors. Finally, the cross-sectional design did not allow the inference of cause and effect, but it helped screening a large sample of culturally diverse college students.

Overall, our study presented a common Portuguese-language version for Brazilian, Portuguese and Mozambican students, supporting the applicability and the use of this scale in three different Portuguese-speaking countries. Furthermore, important aspects related to perceived health competence's expectations and behaviors.

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