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Adaptation and validation of the Psychological General Well-Being Index: confirmatory factor analysis of the short version

Adaptação e validação do Questionário Geral de Bem-Estar Psicológico: análise fatorial confirmatória da versão reduzida

Adaptación y validación del Cuestionario General de Bienestar Psicológico: análisis factorial confirmatorio de la versión reducida

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Abstract

Background: Psychological well-being is a personal perception which can impact students' health behaviors. To evaluate psychological well-being, instruments should be preferably short and have adequate psychometric properties.
Objective: To validate the *Questionário Geral de Bem-Estar Psicológico, versão reduzida* (QGBEP-R) and verify its psychometric properties, after translation of the 6-item short version of the Psychological General Well-Being Index (PGWB-S). This Index was chosen because of the excellent psychometric properties of its original version.
Methodology: The original factor structure was validated using confirmatory factor analysis through structural equation modeling and maximum likelihood estimation. A total of 300 students were randomly selected from a total sample of 1,400 Portuguese university students.
Results: The confirmatory factor analysis revealed a fit 6-item one-factor model.
Conclusion: The QGBEP-R has good psychometric properties and is valid for use in Portuguese university students.

Keywords: well-being; factor analysis, statistical; students; education, higher

Resumo

Enquadramento: O bem-estar psicológico é uma perceção pessoal que pode ter repercussões nos comportamentos de saúde dos estudantes. Para avaliar o bem-estar psicológico são necessários instrumentos, preferencialmente em versão reduzida, com propriedades psicométricas adequadas.
Objetivo: Validar o Questionário Geral de Bem-Estar Psicológico, versão reduzida (QGBEP-R) e verificar as suas propriedades psicométricas, após a tradução a partir do *short version Psychological General Well-Being Index* (PGWB-S) com 6 itens, escolhido pelas excelentes propriedades psicométricas na versão original.
Metodologia: Foi utilizada a análise fatorial confirmatória, através da modelagem de equações estruturais e técnica de máxima verossimilhança, para validar a estrutura fatorial original. Participaram no estudo 300 estudantes universitários portugueses, cuja seleção aleatória resultou de uma amostra global de 1400.
Resultados: A análise fatorial confirmatória evidenciou um modelo ajustado unifatorial, com 6 itens.
Conclusão: Os resultados permitiram concluir que o QGBEP-R possui boas propriedades psicométricas e é válido para ser utilizado em estudantes universitários portugueses.

Palavras-chave: bem-estar; análise fatorial; estudantes; educação superior

Resumen

Marco contextual: El bienestar psicológico es una percepción personal que puede tener repercusiones en los comportamientos relativos a la salud de los estudiantes. Para evaluar el bienestar psicológico son necesarios instrumentos, preferentemente en versión reducida, con propiedades psicométricas adecuadas.
Objetivo: Validar el *Questionário Geral de Bem-Estar Psicológico, versão reduzida* (QGBEP-R), y verificar sus propiedades psicométricas, después de traducirlo a partir del *short version Psychological General Well-Being Index* (PGWB-S) con 6 ítems, escogido por las excelentes propiedades psicométricas de la versión original.
Metodología: Se utilizó el análisis factorial confirmatorio, a través del modelado de ecuaciones estructurales y una técnica de máxima verosimilitud con el objetivo de validar la estructura factorial original. En el estudio participaron 300 estudiantes universitarios portugueses, a los cuales se seleccionó de forma aleatoria de una muestra global de 1400.
Resultados: El análisis factorial confirmatorio demostró un modelo ajustado unifactorial, con 6 ítems.
Conclusión: Los resultados mostraron que el QGBE-P-R tiene buenas propiedades psicométricas y es válido para usarlo en estudiantes universitarios portugueses.

Palabras clave: bienestar; análisis factorial; estudiantes; educación superior

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Introduction

The study of psychological well-being is particularly important during higher education. This life stage event is characterized by adaptation processes which can sometimes compromise health and the consolidation of healthy lifestyles (Pedroso & Brito, 2014). Higher education students are exposed to challenges and demands from the moment of their admission to the institution, together with expectations and ambitions for a successful professional future. As a result, there is an increase in students' psycho-emotional problems, such as depression and anxiety (Freire & Tavares, 2011), licit and illicit psychoactive substance use and dependence (Prince, Carey, & Maisto, 2013), inadequate diet, and physical inactivity (Sousa, José, & Barbosa, 2013), with a negative impact on health and well-being. Thus, a healthy socialization and the establishment of appropriate standards, as well as the relationship with teachers, peers, and family can minimize the adverse effects (Matos et al., 2015).

The importance of studying higher education students' psychological well-being lies with the fact that this is a period of major changes due to their need to adapt to new demands, but also an opportunity for consolidation of healthy lifestyles. During this period, students should be able to enhance their mental and emotional health and be provided with the conditions necessary for their full development and well-being promotion, as a result of their vulnerability at this life stage transition (Pedroso & Brito, 2014).

Within the scope of the project on Peer-education Engagement and Evaluation Research - Healthy Higher Education Institutions (PEER-IESS), the use of extensive self-report tools to assess psychological well-being has been an obstacle to participation. The authors conducted a literature review and found only a few short versions of psychological well-being questionnaires with adequate psychometric properties. They selected the short version Psychological General Well-Being Index (PGWB-S), which was validated for the Italian population by Grossi et al. (2006). It includes dimensions such as vitality, self-control, and anxiety. Vitality is the self-perceived positive energy that contributes to well-being and results from enthusiasm and excitement, thus being a complex and dynamic construct. Anxiety, as a universal phenomenon, is a subjective experience. It is defined as a transient emotional state characterized by uneasiness, tension, and concern which is reflected in subjective emotions that vary in intensity throughout the lifecycle (Davidoff, 2001). Self-control, as a cognitive change, involves changing how one assesses a given situation so as to change its emotional meaning. Response modulation indicates an efficient self-control, helping to cope with emotions (Gross & Thompson, 2007).

This study aimed to adapt and validate the Portuguese version of the PGWB-S: the *Questionário Geral de Bem-Estar Psicológico - Reduzido* (QGBEP-R).

Background

The concept of well-being is recent and its study has raised interest among the scientific community. In recent decades, it has been strengthened as the studies confirm its structure (Galinha, 2008).

At the end of the last century, several authors were studying the psychological well-being construct. According to Deci and Ryan (2008), the hedonistic approach (subjective well-being) defines well-being as being associated with pleasure and happiness; the eudaimonic approach (psychological well-being) defines well-being in terms of self-determination, the search for a purpose in life, continuous improvement, and personal growth (Deci & Ryan, 2008; Ryff, 2013). Ryff proposed the theoretical model of well-being based on the Aristotelian concept of eudaimonia, which

> means seeking personal excellence, in which psychological well-being can be identified through the individual's psychological resources, namely cognitive, affective, and emotional processes which are generally described based on six key dimensions of positive psychological functioning: self-acceptance, personal growth, purpose in life, positive relations with others, environmental mastery, and autonomy. (Lopes, 2015, p. 2)

Revista de Enfermagem Referência - IV - n.º 18 -2018

Adaptation and validation of the Psychological General Well-Being Index: confirmatory factor analysis of the short version

10

Therefore, psychological well-being integrates psychological aspects such as vitality, self-control, and low anxiety.

The study of university students' psychological well-being is relevant because this period is characterized by major changes, but also major development opportunities.

Academic life is also a transition period with significant changes, requiring students to use specific skills and resources to facilitate their cognitive and emotional adaptation (Shojaee & French, 2014). Data on psychological well-being deserve special attention because of their potential impact on these young adults' quality of life and health. This is also a concern of the faculty and of all those who are involved in higher education students' development process.

The process of adaptation of reliable versions to a new cultural context has to ensure conceptual equivalence to the original instrument. To this end, the adaptation of an instrument includes its translation, cultural and linguistic adaptation, and validation of its psychometric properties.

To identify psychological well-being levels, instruments should be preferably short and have adequate psychometric properties in order to obtain valid and reliable results. This study aimed to validate the QGBEP-R for use in Portuguese higher education students.

Research Question

Does the short Portuguese version of PGWB-S (QGBEP-R) have adequate psychometric properties of convergent validity and internal consistency for measuring higher education students' psychological well-being?

Methodology

A descriptive study was conducted to validate the QGBEP-R, which assesses university students' psychological well-being. The sample was composed of 300 students from different undergraduate programs of a higher education institution in the northern region of Portugal. The sample was randomly selected with the condition of having at least 20% of the 1,400 students of that institution who answered a questionnaire integrated into the PEER-IESS project, in which the authors are researchers. The sampled students were on average 20.8 ± 4.8 years, with 52.7% of them being women. Most of them were single (96.3%), did not leave alone during the academic year (71.3%), and did not receive a scholarship (62.1%).

Translation is the first step in the adaptation of a questionnaire, followed by its application and analysis of the psychometric properties. The PGWB-S by Grossi et al. (2006) was initially translated and adapted to Portuguese by Rainho et al. (2012), from its original version in English, and applied in a pilot test. The PGWB-S was back-translated by an English teacher with Portuguese proficiency, with the purpose of respecting the grammar specificities of the Portuguese language, and a psychologist with proficiency in both English and Portuguese, so as to ensure the equivalence to the underlying psychological construct.

The QGBEP-R is composed of six items. Some items are rated on a 5-point Likert-type frequency scale, ranging from *none of the time* to *all of the time*, while others are rated on a 5-point Likert-type intensity scale, ranging from *very full of energy - lots of pep* to *no energy or pep at all - I fell drained, sapped*. The scores of items 2, 3, and 6 are reversed and the total score of psychological well-being is calculated by summing the scores obtained in the six items, ranging from zero (0) to thirty (30). Higher scores correspond to higher levels of psychological well-being.

A similar factor structure between the original and the translated version should be used to assess if the translated version (QGBEP-R) measures the same construct of the original version (PGWB-S; Grossi et al., 2006). Confirmatory factor analysis (CFA) was used to test the fit of the QGBEP-R to the study sample. This analysis is justified because, in its first Italian version, the instrument also underwent the same type of analysis by Grossi et al. (2006). Then, its internal consistency was assessed using Cronbach's α coefficient. CFA is applied to a set of items to identify the factors/constructs underlying them. CFA is justified due to the existing information on the factor structure provided by Grossi et al. (2006), which allowed establishing the variables to be included in

the model. The model's overall assessment reflects the degree of fit to the population covariance matrix, if available.

In this study, structural equation modeling (SEM) was used to assess the quality of fit of a theoretical model and the structure of inter-variable correlations, as stated by Marôco (2010). The correlations between the measured variables (items) and the factors are modeled by a series of linear regressions, using a covariance matrix (Byrne, 2013). The measures used to verify model fit to the sample were those that are most often reported in the literature (Kahn, 2006). Table 1 describes the reference values for those measures, synthesizing the measures used for testing model fit.

Table 1

Fit measures for the factor models used in the CFA of QGBEP-R

	Measure	Acceptable value
Absolute fit measures	Chi-square ($\chi2$) Root Mean Square Error of Approximation (RMSEA)	Lower values result in higher levels of significance: the observed matrix is not statistically different from the expected matrix Values less than 0.08
Incremental fit measures	Comparative fit index (CFI)	Ranges from zero (no fit at all) to 1 (perfect fit), values greater than 0.90 are recommended
Parsimonious fit measures	Chi-square to df ratio ($\chi2/df$)	Values less than 1 indicate a poor fit; values greater than 5 indicate the need for fit. The acceptable value should be equal to or less than 5.

Note. Source: Campana, Tavares, & Silva (2009)

CFA estimates were determined using the maximum likelihood estimation (MLE).

The internal reliability of the questionnaire items was assessed using Cronbach's alpha coefficient (α), whose values range from 0 to 1. Internal consistency assesses the reliability with which a particular set of items estimate a construct.

This study is part of a broader research which was approved by the Ethics Committee of University of Trás-os-Monte e Alto Douro (Opinion 1/2012). The Committee recommended the strict respect for participant anonymity during questionnaire application, conditioning the test-retest procedures. Data were collected in classrooms and students were asked to fill in a questionnaire in paper format, whose completion lasted on average 15 minutes. Students were assured confidentiality and anonymity. They were also explained the purpose of the study and assured that they could withdraw at any time during questionnaire completion without any personal or institutional penalty.

Data were analyzed using AMOS, version 22.0 and IBM SPSS Statistics, version 24.0.

Results

Total mean scores of QGBEP-R were 18.9 ± 4.9, ranging from four to 30. Skewness (-0.355) and kurtosis (-0.106) values were calculated, indicating a normal distribution of psychological well-being scores in this sample (Table 2).

Revista de Enfermagem Referência - IV - n.º 18 -2018   Adaptation and validation of the Psychological General Well-Being Index: confirmatory factor analysis of the short version

12

Table 2

Descriptive statistics of QGBEP-R

Dimension	Mean	Standard deviation	Skewness	Kurtosis
Psychological well-being	18.9	4.9	-0.355	-0.106

Factor structure

CFA was performed based on the existence of previous data on which variables measured the construct under analysis: psychological well-being (Grossi et al., 2006), which allowed for the definition of the variables to be included in the models. Structural equation modeling (SEM) was used, in which the correlations between the observed variables and the factors (dimensions) are modeled by a series of linear regressions, using a covariance matrix.

Estimates were determined using the maximum likelihood method (MLE). Fit indices were calculated, which allowed determining the fit of the tested models (measurement and structural, established based on collected data). In the QGBEP-R initial model, the observed variables (items) showed poor fit indices. Modification indices were then calculated in order to specify the initial model and find a model fit to this sample. Items 4 and 5 presented paths with other items and high modification indices. Errors were then correlated (variance of each item) between each pair of items to maintain theoretical consistency. The results were as follows: item 4 showed a path with item 5 and a modification index (MI = 30.49). Given the high value, the following correlation was adopted: error (e4) associated with item 4 "I was emotionally stable and sure of myself during the past month?" and error (e5) of item 5 "I felt cheerful, light-hearted during the past month?". Both items contribute to the definition of the same dimension of Well-being, which allowed for the correlation of errors between these two variables (items).

After the model's specification, the estimates of the parameters and the statistics of the initial and specified models were calculated (Table 3).

Table 3

Description of the fit indices of the measurement model of QGBEP-R

Fit indicators	Initial model	Specified model
χ^2/df and p	5.867 $p < 0.01$	1.836 $p = 0.06$
CFI	0.944	---
RMSEA	0.1128	0.053
p[rmsea]	$p < 0.01$	$p = 0.402$

Note. χ^2/df = Chi-square/degrees of freedom; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation.

In this study, the CFA showed that a 6-item unidimensional model of psychological well-being is fit. Table 4 shows the values obtained for the fit indices.

As can be seen in Table 4, the value of the chi-square test with degrees of freedom (χ^2/df) was lower than 5 (1.836), indicating an acceptable fit when comparing the differences between the software-generated matrix and the observed matrix; the *p*-value, which indicates significant differences between the software-generated covariance matrix and the observed matrix, can be associated with the high number of sampled participants.

The CFI is an incremental fit measure which assesses the complexity of a model by comparing the model under analysis with a more restrictive model that does not specify inter-variable

correlations. The CFI compares the discrepancy between the data and the more restrictive hypothetical model. The CFI value must be greater than 0.90, which was confirmed in this study (0.944), indicating a good fit to the model. RMSEA values measure the discrepancy or error of fit of the matrix of the sample under study and the population covariance matrix, and, in this study, they also showed a good fit (RMSEA = 0.053; p = 0.11). Values below 0.05 indicate a good fit; however, values below 0.08 are also accepted for large samples.

Table 4

Fit indices of the model under analysis and the independent model - QGBEP-R

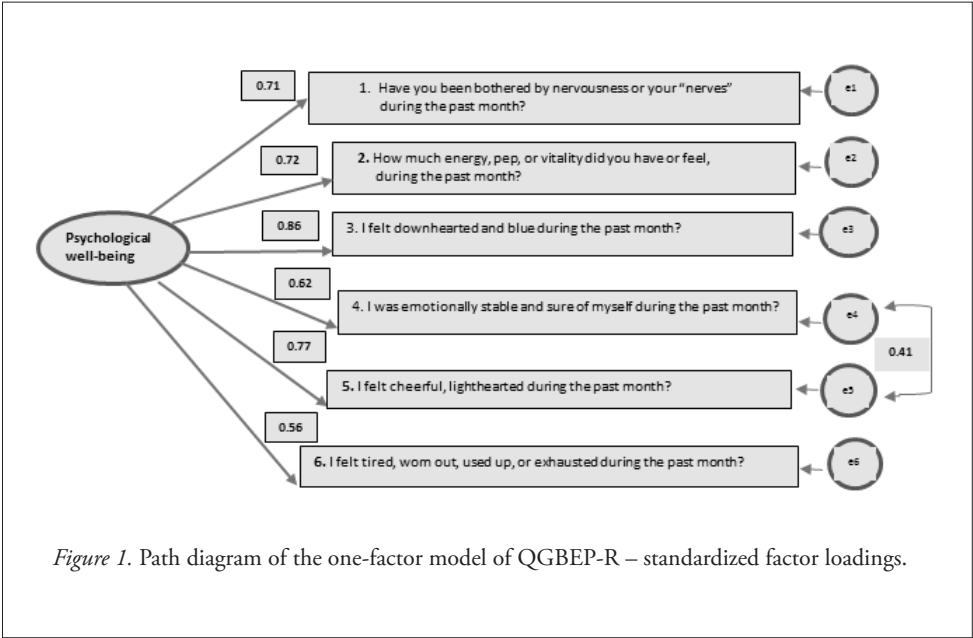| Models	χ^2	χ^2/df	p	CFI	RMSEA	p
Model (study)	14.685	1.836	<0.01	0.992	0.053	<0.01
Independent model	803.076	53.538	<0.01	0.000	0.333	<0.01

Note. χ^2/df = Chi-square/degrees of freedom; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation; Model: df = 8; no. of parameters = 19

The factor loading of each item on the dimension or factor Psychological well-being can be shown using path diagrams, where arrows indicate the type of correlation between the variables. In the QGBEP-R model diagram, the standardized factor loadings and the ellipses represent latent variables, whereas the rectangles represent the analyzed variables.

Factor validity is assessed using standardized factor loadings (λi). Figure 1 shows the factor loadings and all of them had statistical signif-

icance in their dimension, with variations in magnitude (λ = 0.56 to λ = 0.86). All items had a standardized loading above 0.5 ($\lambda \geq 0.50$), which indicates an acceptable value. Thus, it can be assumed that the one-factor model of psychological well-being has factor validity (Marôco, 2010).

The path diagram (Figure 1) shows the results for the measurement model of the questionnaire under analysis, with six items (observed variables), which is a one-factor model.

Figure 1. Path diagram of the one-factor model of QGBEP-R – standardized factor loadings.

Revista de Enfermagem Referência - IV - n.º 18 -2018

Adaptation and validation of the Psychological General Well-Being Index: confirmatory factor analysis of the short version

14

Standardized factor loading (λ) was above the reference value (λ ≥ 0.5) and statistically significant, which can also be seen in the low score of standard error in the estimated parameters, with only item 6 scoring a high value: standardized coefficient = 0.572; standard error = 0.064; critical value = 8.963. Statistical significance requires a critical value above 2.58, which was found in this analysis (Table 5).

Table 5

Standardized coefficients and significance values of the correlations in the proposed model - correlation between the items and the psychological well-being construct – QGBEP-R

Correlation			Standardized coefficient (λ)	Standard error	Critical value (Z)	*p*
Item 3	<---	F1	0.839	0.064	13.056	***
Item 2	<---	F1	0.757	0.067	11.325	***
Item 5	<---	F1	0.854	0.071	12.021	***
Item 4	<---	F1	0.766	0.078	9.779	***
Item 1	<---	F1	1.000			
Item 6	<---	F1	0.572	0.064	8.963	***

*** ≤ 0.001

The analysis of the standardized factor loadings showed an acceptable value in the item-factor correlation, which allows concluding that the observed variables measure psychological well-being. All values showed statistical significance, which indicates that convergent validity was established (Marôco, 2010). Convergent validity refers to the extent to which the latent variable (psychological well-being) correlates with its items, that is, whether the observed variables (items) converge statistically.

Below are the results of the internal consistency analysis. Table 6 shows the results of the internal consistency analysis of the questionnaire, namely the mean and the variance if item deleted, the corrected item-total correlation, the squared multiple correlation, and Cronbach's alpha if item deleted.

Table 6

Internal consistency of the QGBEP-R - corrected item-total correlation and Cronbach's alpha if item deleted

Items	Mean if item deleted	Variance if item deleted	Corrected item-total correlation	Squared multiple correlation	Cronbach's alpha if item deleted
Item 1 - "Have you been bothered by nervousness or your "nerves" during the past month?"	15.99	15.93	0.64	0.44	0.84
Item 2 - "How much energy, pep, or vitality did you have or feel during the past month?"	15.67	18.10	0.64	0.46	0.83
Item 3 - "I felt downhearted and blue during the past month"	15.48	17.71	0.76	0.59	0.81
Item 4 - "I was emotionally stable and sure of myself during the past month"	15.86	17.24	0.61	0.49	0.84
Item 5 - "I felt cheerful, lighthearted during the past month"	15.76	16.96	0.75	0.63	0.81
Item 6 - "I felt tired, worn out, used up, or exhausted during the past month"	16.04	19.32	0.51	0.29	0.86

The results showed that the QGBEP-R has good internal consistency (Cronbach's alpha = 0.86). These results are consistent with those found by Grossi et al. (2006; Cronbach's alpha = 0.731).

Discussion

This study aimed to adapt and validate the Portuguese version of the PGWB-S: the QGBEP-R. The one-dimensional structure and convergent validity were confirmed. The goodness-of-fit of the tested one-factor model was confirmed because all items had a standardized value greater than 0.5, which is considered an acceptable value (Marôco, 2010). During the validation process, the assumptions of Kline (2011) and Byrne (2013) were met, that is, the model was built based on the observed variables (items) and then the fit indices and item loadings were calculated.

In this study, the authors used statistical analysis to check if the items estimated psychological well-being in a reliable manner and if this construct was one-dimensional, as in the theoretical proposal of the original version's authors (Grossi et al. 2006). The validation of instruments for assessing psychological characteristics is essential both for health research and intervention (Grossi & Compare, 2014). The relevance of this study lies in the fact that it validated the QGBEP-R, which was previously translated and adapted to Portuguese by Rainho et al., (2012). This questionnaire is a one-dimensional measure of psychological well-being and is suitable for completion by higher education students in a short period of time. Its use is very important for monitoring higher education students' psychological well-being and implementing specific interventions for them.

Conclusion

The results obtained in this study confirmed the construct validity and adequate convergent validity of QGBEP-R, pointing to an adequate fit of the one-factor model. QGBEP-R proved to be a reliable and valid tool for measuring higher education students' psy-

chological well-being. As it is a short questionnaire, it also has the advantage of encouraging student participation, thus it can be applied in the schools involved in the PEER-IESS project.

In future studies, test-retest procedures will be performed to verify its stability and the CFA will be replied in other samples of higher education students, given that a limitation of this study was the use of a sample from a single higher education institution in the northern region Portugal. The analysis of the model's factor invariance for both male and female populations is also recommended.

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Revista de Enfermagem Referência - IV - n.º 18 -2018

Adaptation and validation of the Psychological General Well-Being Index: confirmatory factor analysis of the short version

16

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