ORIGINAL ARTICLE

Portuguese Version of the Pain Beliefs and Perceptions Inventory: A Multicenter Validation Study

Luís Filipe Azevedo, MD, PhD[*,†,‡]; Rute Sampaio, PhD[§,¶]; Cláudia Camila Dias, MSc[*,†]; José Romão, MD[**]; Laurinda Lemos, MD, PhD[††]; Luís Agualusa, MD[‡‡]; Sílvia Vaz-Serra, MD[§§]; Teresa Patto, MD[¶¶]; Altamiro Costa-Pereira, MD, PhD[*,†,‡]; José Manuel Castro-Lopes, MD, PhD[‡,§,¶]

*Department of Health Information and Decision Sciences (CIDES), Faculty of Medicine, University of Porto, Porto, ; †CINTESIS – Centre for Health Technology and Services Research, University of Porto, Porto, ; ‡National Observatory of Pain – NOPain (OBSERVDOR), Faculty of Medicine, University of Porto, Porto, ; §Department of Experimental Biology, Faculty of Medicine, University of Porto, Porto, ; ¶IBMC – Institute for Molecular and Cell Biology, University of Porto, Porto, ; **Pain Medicine Unit, Department of Anesthesiology, Porto Hospital Center (Centro Hospitalar do porto, EPE), Porto, ; ††Multidisciplinary Chronic Pain Management Unit and Department of Anesthesiology, Senhora da Oliveira Hospital, Guimaraes (Centro Hospitalar Alto Ave EPE – Guimaraes), Guimaraes, ; ‡‡Pain Medicine Unit, Pedro Hispano Hospital (Unidade Local de Saśde de Matosinhos EPE), Matosinhos, ; §§Pain Medicine Unit, General Hospital, Coimbra University Hospital Centre (Centro Hospitalar e Universitįrio de Coimbra EPE), Coimbra, ; ¶¶Pain Medicine Unit, Santo António dos Capuchos Hospital – Lisboa Central Hospital Centre (Centro Hospitalar Lisboa Central, EPE), Lisboa, Portugal

■ **Abstract**

Background: We aimed to perform the translation, cultural adaptation, and validation of the Pain Beliefs and Perceptions Inventory (PBPI) for the European Portuguese language and chronic pain population.

Methods: This is a longitudinal multicenter validation study. A Portuguese version of the PBPI (PBPI-P) was created through a process of translation, back translation, and expert panel evaluation. The PBPI-P was administered to a total of 122 patients from 13 chronic pain clinics in Portugal, at baseline and after 7 days. Internal consistency and test–retest reliability were assessed by Cronbach's alpha (α) and intraclass correlation coefficient (ICC). Construct (convergent and discriminant) validity was assessed based on a set of previously developed theoretical hypotheses about interrelations between the PBPI-P and other measures. Exploratory and confirmatory factor analyses were performed to test the theoretical structure of the PBPI-P.

Results: The internal consistency and test–retest reliability coefficients for each respective subscale were $\alpha = 0.620$ and ICC = 0.801 for mystery; $\alpha = 0.744$ and ICC = 0.841 for

Address correspondence and reprint requests to: Luís Filipe Azevedo, MD, PhD, Departamento de Ciências da Informação e da Decisão (CIDES), Faculdade de Medicina da Universidade do Porto, Rua Dr. Plácido da Costa, s/n, 4200-319 Porto, Portugal. E-mail: lazevedo@med.up.pt.

Submitted: April 6, 2016; Revised August 22, 2016; Revision accepted: September 4, 2016

DOI. 10.1111/papr.12529

© 2016 World Institute of Pain, 1530-7085/17/$15.00

permanence; $\alpha = 0.778$ and ICC = 0.791 for constancy; and $\alpha = 0.764$ and ICC = 0.881 for self-blame. Exploratory and confirmatory factor analysis revealed a four-factor structure (performance, constancy, self-blame, and mystery) that explained 63% of the variance. The construct validity of the PBPI-P was shown to be adequate, with more than 90% of the previously defined hypotheses regarding interrelations with other measures confirmed.

Conclusion: The PBPI-P has been shown to be adequate and to have excellent reliability, internal consistency, and validity. It may contribute to a better pain assessment and is suitable for research and clinical use. ■

Key Words: chronic pain, pain beliefs and perceptions inventory, reliability, validity, factor analysis

INTRODUCTION

Pain is defined, according to the International Association for the Study of Pain (IASP), as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage"; thus it should be viewed as an inherently subjective and multidimensional phenomenon, which needs to be approached and managed in accordance with the bio-psycho-social model, taking into account not only biological and sensory aspects, but also the functional, psychological, social, and even cultural dimensions.[1–4] Moreover, unlike acute pain, chronic pain (CP), broadly defined by the IASP as "pain which has persisted beyond normal tissue healing time," which "in the absence of other criteria, is taken to be 3 months,"[1] usually does not have any useful or beneficial function and is generally recognized as a major public health problem with very important physical, psychological, and familial consequences.[5–9]

Convictions, beliefs, and perceptions associated with pain are intimately linked to the coping strategies used by individuals. Many beliefs and perceptions about pain have been shown to be maladaptive or associated with maladaptive coping strategies, and these seem to be strongly associated with poor treatment outcomes and poor prognosis, particularly when pain is chronic.[5,10–13] Convictions, beliefs, and perceptions are assumptions, principles, or opinions about our inner or outer worlds that define how we see, interpret, and interact with those realities, changing and shaping the way we understand and respond to everything and everyone around us.[12,14,15] The cognitive–behavioral theory sustains that beliefs, perceptions, and coping strategies have a crucial role in the physical and psychological adjustment of subjects affected by pain, particularly in CP, and are important determinants of the treatment and long-term management strategies and their effectiveness.[5,10–13] Thus, cognitive–behavioral interventions in this context aim to identify and modify maladaptive beliefs and perceptions and to promote and facilitate the implementation of adaptive cognitive or behavioral coping strategies. These interventions have been shown to be effective for improving the physical and psychological functioning of pain patients.[16] Consequently, the existence of suitable instruments allowing the adequate detection and categorization of pain-related beliefs and perceptions is of great significance for the study of pain as a phenomenon and to guide its treatment and management. Indeed, many different questionnaires have been developed and proposed for this purpose.[17] The Pain Beliefs and Perceptions Inventory (PBPI) is one of those instruments, and it has been shown to be comprehensive and easy to use, and to have excellent psychometric properties.[12,13,15]

The PBPI is a self-administered questionnaire composed of 16 items with different statements about common pain-related beliefs and perceptions. The PBPI has been translated and validated into several languages and has been used in several different contexts.[5,10,12,13,18–24] However, a European Portuguese version of this instrument was not yet available.

The multidimensionality of pain and the recognized difficulties associated with its evaluation justify the need for well-developed and adequately validated instruments to support its assessment. Therefore, the aim of this study was to provide a translated and culturally adapted European Portuguese version of the PBPI (PBPI-P) and to assess its applicability, reliability, internal consistency, and validity. In the present article, we report on the results of a multicenter validation study, in 13 chronic pain clinics (CPCs) in Portugal, assessing the construct (convergent and discriminant) and factorial validity of the PBPI-P.

METHODS

The methodological approach used to translate, culturally adapt, and assess the reliability and validity of the PBPI-P has been previously described in detail.[25]

Translation and Cultural Adaptation

The translation and cultural adaptation of the PBPI were undertaken after receiving permission from the

copyright holder and in accordance with the internationally recommended methodology,[26–31] including translation; evaluation of the translation and cultural adaptation by a panel of experts; pilot testing in a sample of the study population; and back translation and assessment of the back translation by the authors of the original version. After completing this process, the Portuguese version of the instrument was used in a validation sample from the study population to assess its reliability and validity.

The translation of the instrument was performed by two independent professional bilingual translators. The independent translations were assessed, reconciled, and culturally adapted item by item by a panel of five clinical experts in pain medicine and three researchers with experience in pain research and questionnaire validation. A preliminary consensus Portuguese version was then applied to a small pilot sample (25 subjects) from the study population (patients from Portuguese pain clinics), to assess the adequacy and understanding of the language and wording, problems with the scales, and time to completion. The revised preliminary Portuguese version of the PBPI was then back-translated to the original language, independently by two professional translators, bilingual but native speakers of the original language of the instrument. The back translation was sent to the author of the original version for their assessment. The proximity with the original version of the instrument was assessed, and all discrepancies and doubts were discussed and resolved by consensus. The final Portuguese version of the PBPI was defined and used in the validation sample to assess its reliability and validity.

Participants

A total of 122 participants were selected from 13 CPCs throughout the country. The inclusion criteria were at least 18 years of age, CP for > 3 months, and willingness to participate in the study and to sign the informed consent. The exclusion criteria were unable to effectively communicate in Portuguese language, unable to read or write, or unable to complete the study questionnaire because of physical or psychiatric handicaps. Participant selection was performed using a consecutive sampling scheme in each of the participating CPCs. A predefined number of patients was planned to be recruited in each CPC, as a function of its size (total number of patients followed) and according to the sample size calculations. Taking into account the primary objectives of the study, sample size calculations were performed aiming to estimate reliability and validity coefficients with a maximum margin of error of ± 0.1 and a confidence level of 95%, for correlation coefficients of ≥ 0.5.[26]

The study protocol was approved by institutional review boards and ethics committees of the participating hospitals.

Instruments

Pain Beliefs and Perceptions Inventory. The PBPI is a self-administered questionnaire composed of 16 items with different statements about common pain-related beliefs and perceptions. In each item, a bipolar Likert scale with four levels (from −2 to +2 and with no zero; anchored to the following descriptors: "strongly disagree," "disagree," "agree," and "strongly agree") is used to assess the degree of agreement with a statement referring to pain-related beliefs or perceptions. Items 3, 9, 12, and 15 were reverse scored. A total score was obtained dividing the total sum by the number of items. Higher scores indicate greater endorsement of the beliefs and perceptions.[12,13,15]

SF-36. The Medical Outcomes Study Short Form 36-Item Health Survey (SF-36) is a general health status questionnaire and a generic health-related quality of life (HRQoL) instrument.[32] This is probably the most widely known and used generic HRQoL instrument in the world, and it has also been culturally adapted and validated for the Portuguese language. This Portuguese version has been extensively used in many different contexts.[32–34] The SF-36 is a self-administered questionnaire composed of 36 items organized in eight HRQoL dimensions and corresponding subscales: Physical Functioning, Role Physical, Bodily Pain, General Health, Vitality, Social Functioning, Role Emotional, and Mental Health. Each subscale is obtained by a weighted average of a set of items (from 2 to 10), and it is measured with a numerical percentage scale from 0 to 100 points, where 0 is the worst health status or HRQoL possible and 100 is the best.[32,35]

Pain Disability Index. The Pain Disability Index (PDI) is a valid and reliable instrument[36–39] to assess CP-related disability, and a Portuguese version is available.[25] It consists of a set of seven items, evaluated using an 11-point numerical rating scale (NRS; from 0 [no disability] to 10 [normal activities have been totally

disrupted by pain]), to assess pain-related disability on family/home responsibilities, recreational activities, social activities, occupation, sexual behavior, self-care activities, and life support activities.[37,39]

Brief Pain Inventory. The Brief Pain Inventory (BPI) is a short and simple questionnaire aiming to measure and assess pain in a multidimensional perspective.[40–43] This instrument has been shown to have excellent psychometric properties[40,42–45] and has been increasingly used in clinical and research contexts. The BPI is composed of 15 items aiming to assess the presence, intensity, location, and functional interference of pain, as well as the therapeutic strategies used and the patient self-assessed treatment effectiveness. It contains an item with a dichotomous scale for the presence of pain; an item to indicate the location of pain using a human body diagram; a pain intensity scale composed of four pain intensity items (maximum, minimum, on average, and right now) measured with an 11-point NRS (from 0 [no pain] to 10 [the worst pain possible]); an item asking to indicate the therapeutic strategies used by the subject; an item with a percentage NRS (from 0% to 100%) to measure the self-assessed pain treatment effectiveness; and, finally, a pain interference scale, composed of seven items measured on an 11-point NRS (from 0 [no interference] to 10 [extreme interference]), assessing the subject's pain-related interference regarding general activities, mood, walking ability, normal work, relations with other people, sleep, and enjoyment of life. The quality and relevance of this instrument is evidenced by the existence of translations and validation studies in more than 10 different languages, including a Portuguese version,[25] and by the fact that it has been recommended by the most relevant international consensus groups and guidelines about pain measurement and pain outcome definitions for clinical and epidemiological research.[44,46–48]

Data Collection Methods

Data collection forms included a few basic clinical questions to be completed by the attending physician, and a set of self-completion questionnaires for the patient. The latter included some general and sociodemographic questions and the Portuguese versions of the questionnaires (PBPI, SF-36, PDI, and BPI). After 7 days, a similar data collection package (retest) was given to each participant to be completed and sent back by prepaid mail. All participating patients were previously informed about the study objectives and all the selection and data collection procedures; all their questions regarding the study were properly answered, and finally, they signed an informed consent form.

Statistical Analysis and Assessment of Reliability and Validity

A descriptive analysis of the general characteristics of the sample was performed. Continuous variables were summarized using the mean and standard deviation (SD). Categorical variables were described using absolute (n) and relative frequencies (%) for each category.

Summary statistics were presented for each item and subscale, including the proportion of missing data and the proportions of scores in the extremes of the scales, to assess the ceiling and floor effects.[26,49]

The assessment of the psychometric validity of the PBPI-P followed the internationally recommended standards[26,49–51] and included assessments of applicability, quality of the translation and cultural adaptation, test–retest reliability, internal consistency, factorial validity, and construct (convergent and discriminant) validity.

The applicability and quality of the translation and cultural adaptation of the PBPI-P were assessed, as previously described, by a panel of experts and a pilot sample, including a set of standardized questions regarding the time for completion of the questionnaire and difficulties, problems, and necessary adaptations needed in the Portuguese version of the instrument.

The assessments of the internal consistency and test–retest reliability were performed according to available recommendations.[26,49] Analysis of internal consistency was performed by assessing the Cronbach's alpha statistic, the Cronbach's alpha when the items were deleted, and the item-total correlation. The test–retest reliability was assessed by the estimation of agreement between the baseline and the 7-day assessments, using appropriate statistics (intraclass correlation coefficient).

Assessments of the construct (convergent and discriminant) validity was performed by calculating and evaluating the correlations defined by a set of previously developed theoretical hypotheses about interrelations among scales and/or subscales under study.[26,49] Taking into account the theoretical model on which the PBPI is based, a set of hypotheses were proposed, assuming the existence of significant correlations between the following measures: (1) the subscales of permanence and constancy of the PBPI-P and the eight dimensions of the SF-36, assuming that beliefs and perceptions of

permanence or constancy could be associated with worst health-related quality of life, as measured by SF-36 dimensions; (2) the subscales of permanence and constancy of the PBPI-P and the items and subscales of pain interference and severity of the BPI-P, with stronger correlation for the subscale of constancy,[13] and assuming an association between those beliefs and perceptions and worst scores in the pain interference and severity scales; (3) the subscales of permanence and constancy of the PBPI-P and the pain-related disability items of the PDI-P, with stronger correlation for the subscale of constancy,[13] and assuming an association between those beliefs and perceptions and worst scores in the pain-related disability items; (4) the subscale of mystery and self-blame of the PBPI-P and the dimension of mental health of the SF-36, assuming an association between mystery and self-blame subscales and constructs such as anxiety and/or depression; and (5) the absence of correlation between the mystery and self-blame subscales of the PBPI-P and the items and subscales of pain severity, interference, and disability of the BPI-P and PDI-P, in accordance with findings of previous reports.[12,18–20]

As general practical rules, interpretation of the reliability and correlation coefficients was based, respectively, on the quantitative criteria and qualitative descriptors defined by Landis and Koch[52] and Cohen[53]; interpretation of the Cronbach's alpha measures was based on recommendations by Nunnally and Bernstein.[49,54]

Factorial validity was assessed by the definition and evaluation of the factor structure of the instrument using methods of exploratory and confirmatory factor analysis.[26,53,55–57]

Models of exploratory factor analysis were defined using principal components analysis for factor extraction.[26,53,55–57] Selection of the number of factors to retain took into account Kaiser's criterion (eigenvalues larger than one), graphical analysis of the scree plot, and a criterion based on the total variance explained (at least above 50%). To improve interpretation of factors, orthogonal varimax rotations were applied.

Confirmatory factor analysis was performed using structural equation models (SEMs), with parameter estimation based on maximum likelihood methods and with the use of the AMOS 22.0® software program (IBM Corp., Armonk, NY, USA).[55–57] The definition of the structural models to be tested took into account the factor structure of the instruments initially defined by the authors of the original version of the PBPI (three-factor structure)[12,15] and a most recent and consensual structure obtained by several other authors (four-factor structure).[13,18,20] Point estimates of model parameters, results of significance tests for each parameter, global tests of model fit, and global model fit statistics were used for the evaluation of the SEM. To allow model comparison and to assess SEM quality and model fitting, a set of criteria were used, based on multiple indexes, statistics, and measures of model fit: (1) value of the chi-square statistic, as a measure of overall model fit; (2) chi-square test of model fit; (3) ratio between the chi-square statistic and the number of degrees of freedom; (4) goodness-of-fit index (GFI); (5) Bentler–Bonett normed fit index (NFI); (6) comparative fit index (CFI); (7) relative fit index (RFI); and (8) root-mean-square error of approximation (RMSEA) and its respective 90% confidence interval.[55–57]

For all hypothesis tests, a significance level of $\alpha = 0.05$ was defined. The statistical analysis was performed using the software program SPSS version 22.0® (IBM Corp.).

RESULTS

Preliminary results of the assessments of applicability, quality of the translation and cultural adaptation, test–retest reliability, and internal consistency of the PBPI-P have been previously reported in Portuguese[25] and are briefly reviewed in the ensuing section to set the stage for the presentation of results of the factorial and construct (convergent and discriminant) validity of the instrument.

Applicability, Quality of the Translation, and Cultural Adaptation

Assessment and reconciliation of translations and cultural adaptation of the PBPI-P were performed by a panel of eight experts, taking into account the specifics of the European Portuguese language and the particular characteristics of CP patients. Consensus among all panel members was reached for all items. A pilot test of the preliminary version of the PBPI-P was then performed on a sample of 25 subjects from the target population. Confirmation of the applicability of the instrument and the quality of the translation and cultural adaptation was obtained; a median of time to completion of 5 minutes was observed (with a 25th percentile of 4 minutes and a 75th percentile of 10 minutes). Finally, the assessment of the back

translations was performed by the author of the original version of the PBPI (Dr. David A. Williams).[13,15] Only one issue was raised regarding the translation of item 6 and the eventual risk of this loading in the permanence subscale of the four-factor solution of the PBPI, instead of the constancy subscale where it should load. We analyzed this issue and concluded that it was caused by a misinterpretation of the back translation. We re-assessed item 6, and we checked that it rightly loaded in the constancy subscale of the four-factor solution, as expected (see Results in the "Factor Analysis" section and Table 2).

General Characteristics of the Sample

In the final multicenter validation study, the sample of participants ($N = 122$) had a mean age of 55 years (SD = 15). They were predominantly female (64%), married/joined by civil union (79%), or widowed (12%). Most of them had completed 4 or fewer years of schooling (65%), with only 5% having a higher education degree. Many were retired or on a welfare pension (52%), 8% were unemployed, and 24% had a full-time job. All participants had CP, but the etiology was heterogeneous. The most common diagnostic groups were musculoskeletal and osteoarticular diseases (40%); cancer (16%); postsurgery pain (9%); neuralgias or conditions of the peripheral nervous system (6%); peripheral vascular disease (3%); pain associated with traumatic injuries (2%); and migraine and other chronic headaches (2%).

Item Descriptive Analysis and Missing Data

Summary statistics and missing data for items and subscales of the PBPI-P are briefly reviewed in Table 1. The proportion of missing data was 7% to 9% for the majority of items. There were indications of possible ceiling and/or floor effects in items 5, 7, 9, 10, 11, 13, 15, and 16.

Test–Retest Reliability and Internal Consistency

The analysis of internal consistency and test–retest reliability of the PBPI-P are briefly reviewed in Table 1. Internal consistency was acceptable in all subscales; except for the mystery subscale, where a relatively low Cronbach's alpha ($\alpha = 0.620$) was observed. Test–retest reliability coefficients were substantial for all subscales of the PBPI-P.

Factor Analysis

The results obtained showed five factors with eigenvalues > 1 (Kaiser's criterion). However, the fifth factor had an eigenvalue marginally greater than 1, and the

Table 1. Descriptive Analysis, Internal Consistency, and Reliability of Items and Subscales of the Portuguese Version of the Pain Beliefs and Perceptions Inventory ($N = 122$)

Items	Mean	SD	Floor Effect* (%)	Ceiling Effect† (%)	Missing Values (%)	α	α If Item Deleted	Item-Total Correlation	Test–Retest Reliability ICC (95% CI)
Mystery subscale	0.2	0.9	2	1	7	0.620	—	—	0.801 (0.659–0.884)
1. No known cause	−0.3	1.4	20	11	9	—	0.557	0.389	—
4. Pain is confusing	0.4	1.3	11	18	7	—	0.671	0.228	—
8. Need more info about pain	0.5	1.3	10	17	8	—	0.434	0.549	—
14. Can't make sense of pain	0.3	1.3	9	14	9	—	0.508	0.457	—
Permanence subscale	0.4	0.9	1	4	7	0.744	—	—	0.841 (0.728–0.907)
2. Lost hope for cure	0.4	1.4	10	23	5	—	0.758	0.348	—
5. Pain is here to stay	0.8	1.2	7	29	7	—	0.670	0.597	—
9. Pain is temporary	−0.6	1.4	29	8	6	—	0.690	0.531	—
12. There is a cure	0.2	1.2	11	7	7	—	0.679	0.566	—
15. Will be pain free	−0.6	1.4	29	13	7	—	0.695	0.521	—
Constancy subscale	0.6	0.9	1	7	5	0.778	—	—	0.791 (0.645–0.877)
3. Some pain free periods	−0.2	1.3	16	10	9	—	0.687	0.749	—
6. Pain is continuous	0.4	1.2	5	17	6	—	0.630	0.581	—
10. Wake and sleep with pain	0.6	1.3	7	27	5	—	0.726	0.372	—
16. Varies in intensity	1.1	0.9	2	33	3	—	0.814	0.581	—
Self-blame subscale	−1.1	0.9	29	1	10	0.764	—	—	0.881 (0.788–0.933)
7. Pain is my fault	−1.2	0.9	48	1	7	—	0.719	0.564	—
11. I caused my pain	−1.2	1.1	46	3	9	—	0.603	0.664	—
13. I blame myself	−1.1	1.2	43	2	7	—	0.719	0.568	—
Total mean score	0.1	0.6	—	—	10	0.736	—	—	0.856 (0.758–0.914)

*Percentage of subjects scoring in the minimum of the scale (floor effect).
†Percentage of subjects scoring in the maximum of the scale (ceiling effect).
SD, standard deviation; α, Cronbach's alpha; ICC, intraclass correlation coefficient; CI, confidence interval.

analysis of the scree plot indicated the utilization of only four factors. Consequently, the final factor structure considered only four factors, explaining 63% of the total variance. Rotated loadings of the four-factor solution for the PBPI-P are presented in Table 2. Taking into account the four-factor structure previously described, we observed matches between factor 1 and the subscale permanence, factor 2 and the subscale constancy, factor 3 and the subscale self-blame, and finally factor 4 and the subscale mystery. It is important to notice the existence of relevant cross-loadings in four items (2, 8, 14, and 16).

Confirmatory factor analysis was also carried out, using SEM techniques, and the results are presented in Table 3 and Figure 1. Two alternative theoretical models were tested, based on the PBPI theory and previous reports: (1) the three-factor solution originally described by Williams et al.[12,15]; and (2) the four-factor solution more recently described by several authors.[13,18,20] In Table 3, fit indexes and statistics are presented for the two alternative models evaluated. Taking into account the criteria used to determine model fit and quality, it is possible to observe that, although none of the models has an excellent model fit, the second model with four factors is substantially better than the first. In the four-factor model (model 2), we observed (1) a ratio of chi-square/df lower than 2 and clearly lower than in model 1; (2) the GFI and CFI were just below 0.9 and were clearly larger than those of model 1; (3) the NFI and RFI were larger than those of model 1; and (4) the RMSEA was just above the cutoff of 0.08, but was clearly lower than in model 1. The best model and the only one showing minimally acceptable model fit, given the criteria, was model 2, with four factors, represented and described (structurally and quantitatively) in Figure 1.

Table 2. Exploratory Factor Analysis of Items of the Portuguese Version of the Pain Beliefs and Perceptions Inventory: Loadings for Each Factor and Each Item in the Model with Four Factors After an Orthogonal Varimax Rotation and Factor Extraction Using Principal Components

	Factors*			
Items	1	2	3	4
Permanence subscale				
2. Lost hope for cure	**0.440**	0.079	0.166	**0.652**
5. Pain is here to stay	**0.774**	−0.018	−0.014	0.259
9. Pain is temporary	**0.712**	0.165	−0.290	−0.058
12. There is a cure	**0.757**	0.172	0.105	−0.078
15. Will be pain free	**0.691**	0.284	0.182	−0.068
Constancy subscale				
3. Some pain free periods	0.124	**0.860**	−0.050	−0.120
6. Pain is continuous	0.182	**0.819**	−0.126	0.095
10. Wake and sleep with pain	0.278	**0.707**	0.025	0.058
16. Varies in intensity	0.289	**0.356**	−0.296	**0.473**
Self-blame subscale				
7. Pain is my fault	0.030	−0.028	**0.759**	−0.161
11. I caused my pain	−0.009	0.020	**0.839**	0.174
13. I blame myself	0.049	−0.058	**0.776**	−0.018
Mystery subscale				
1. No known cause	0.072	−0.121	0.082	**0.811**
4. Pain is confusing	−0.236	0.061	−0.201	**0.668**
8. Need more info about pain	**−0.336**	**0.390**	0.264	**0.464**
14. Can't make sense of pain	−0.148	**0.508**	**0.435**	**0.370**

Bold values indicate loadings greater than 0.3.
*Four factors explaining 63% of the total variance; Kaiser–Meyer–Olkin statistic = 0.638; Bartlett's test of sphericity: $P < 0.001$.

Construct (Convergent and Discriminant) Validity

We took into account the theoretical model on which the PBPI is based and defined a set of previously proposed hypotheses regarding the interrelations between the PBPI-P and other measures (see Methods section). As shown in Table 4, the subscale of constancy of the PBPI-P had, as expected, negative, moderate, and significant correlations with the dimensions vitality, mental health, bodily pain, and general health of the SF-36. The subscale of permanence of the PBPI-P had negative and significant correlations only with the dimensions of vitality and general health. The subscale of constancy of the PBPI-P, but not the subscale of permanence, was moderately but significantly correlated with the subscales of pain severity and pain interference of the BPI-P. There were also moderate correlations between the subscales of constancy and permanence of

Table 3. Confirmatory Factor Analysis Using Structural Equations Models for the Portuguese Version of the Pain Beliefs and Perceptions Inventory: Models Assessed and Their Respective Fit Indexes

	Fit Indexes and Statistics							
Models	χ^2	df	χ^2/GL	GFI	NFI	CFI	ρ	RMSEA [90% CI]
3-Factor model	211.055	101	2.090	0.767	0.560	0.694	0.477	0.109 [0.088–0.129]
4-Factor model	163.299	98	1.666	0.810	0.659	0.818	0.583	0.085 [0.061–0.108]

χ^2, chi-square discrepancy statistic; df, degrees of freedom; χ^2/GL, ratio between the chi-square statistic and the number of degrees of freedom; GFI, goodness-of-fit index; NFI, normed fit index of Bentler–Bonett; CFI, comparative fit index; ρ, relative fit index; RMSEA, root-mean-square error of approximation; CI, confidence interval.

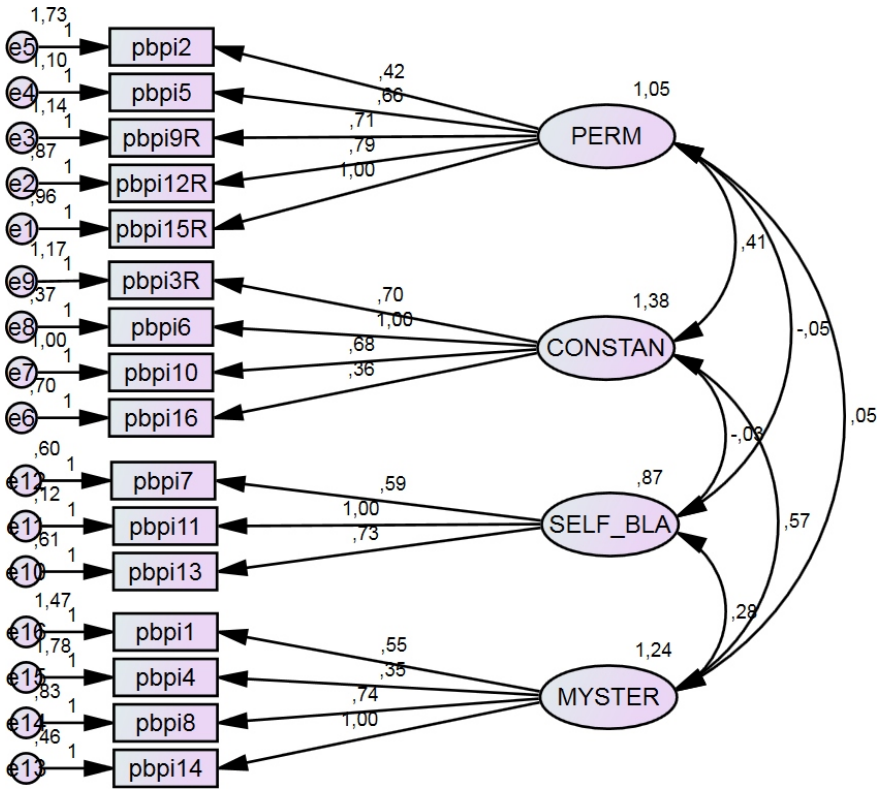

Figure 1. Confirmatory factor analysis using a structural equations model for the Portuguese version of the Pain Beliefs and Perceptions Inventory (PBPI-P). This is a structural and quantitative representation of the four-factor model. PERM, permanency subscale; CONSTAN, constancy subscale; SELF_BLA, self-blame subscale; MYSTER, mystery subscale; e1–e16, error terms; pbpi1–pbpi16, PBPI observed items; R, suffix to indicate reverse scoring items.

the PBPI-P and the items of pain-related disability of the PDI-P. The subscale of mystery of the PBPI-P, and not the subscale of self-blame, was significantly correlated with the mental health dimension of SF-36. Finally, the subscales of mystery and self-blame of the PBPI-P were not correlated with the scales of pain severity, interference, and disability of BPI-P and PDI-P.

DISCUSSION

The aim of the present study was the translation, cultural adaptation for the European Portuguese language, and assessment of the reliability and validity of the PBPI-P, following adequate and internationally recommended guidelines and standards. This is, to the best of our knowledge, the first study to develop and examine the validity and reliability of the PBPI-P for assessing Portuguese patients suffering from CP. The protocol for translation, cultural adaptation, and validation was performed as planned, producing a validated Portuguese version of the PBPI showing excellent psychometric properties, with confirmed test–retest reliability, internal consistency, and adequate factorial and construct validity.

Internal consistency measured by Cronbach's alpha was satisfactory, with estimates perfectly in line with the original (0.65 to 0.80), U.K. English replication (0.80 to 0.89), Chinese (0.60 to 0.76), Australian (0.67 to 0.80), Italian (0.91 to 0.96), and German (0.64 to 0.83) versions of the PBPI.[15,18–20,22,24] Test–retest stability was excellent, with higher estimates than the Italian version (0.73 to 0.81),[22] although no other comparisons could be made, as this was not investigated in other samples.

In the present study, no criterion or standard measure for the measurement of pain beliefs and perceptions was available for comparison; therefore, no direct assessment of the criterion validity of the PBPI-P was performed. As an alternative, taking into account the theoretical model on which the PBPI is based, a set of hypotheses were proposed a priori regarding the interrelations between beliefs, perceptions, quality of life and pain severity, disability, and interference, so as to assess the construct (convergent and discriminant) validity of the PBPI-P. Overall, the observations are mostly in accordance with our previously stated predictions from the theoretical model of the PBPI and, in general, are evidence of the good construct validity of the PBPI-P. Some of the uncertainties detected are common to other studies[12,18–20] and are mainly associated with the subscales of mystery and self-blame, which lack in this case an adequate set of comparative measures.

Table 4. Construct (Convergent and Discriminant) Validity of the PBPI-P: Pearson Correlation Coefficients Between Items and Subscales of the PBPI-P and Dimensions of the SF-36, Items and Subscales of the BPI-P, and Items and Subscales of the PDI-P

	PBPI-P Subscales			
Item	Mystery	Permanence	Constancy	Self-blame
SF-36				
SF-36_D1—Physical functioning	0.000	−0.121	−0.107	0.026
SF-36_D2—Role physical	0.075	−0.176	−0.006	−0.107
SF-36_D3—Role emotional	−0.003	0.002	0.046	−0.089
SF-36_D4—Vitality	−0.113	−0.298*	−0.461*	−0.125
SF-36_D5—Mental health	−0.237†	−0.084	−0.321*	−0.118
SF-36_D6—Social functioning	−0.202	−0.018	−0.154	−0.162
SF-36_D7—Bodily pain	−0.029	−0.201	−0.402*	−0.045
SF-36_D8—General health	−0.236†	−0.293*	−0.241†	−0.159
BPI-P				
BPI_9a—General activity	0.007	0.185	0.413*	0.037
BPI_9b—Mood	0.215	0.037	0.303*	−0.046
BPI_9c—Walking ability	−0.063	0.132	0.170	−0.149
BPI_9d—Normal work	−0.097	0.081	0.282†	−0.015
BPI_9e—Relations with other people	0.025	−0.023	0.256†	0.054
BPI_9f—Sleep	−0.059	0.059	0.243†	−0.090
BPI_9g—Enjoyment of life	0.110	0.287*	0.367*	−0.092
Pain Intensity subscale	0.050	0.197	0.601*	0.119
Pain Interference subscale	−0.013	0.169	0.436*	−0.075
PDI-P				
PDI_1—Family/home responsibilities	−0.022	0.240†	0.270†	0.059
PDI_2—Recreation	−0.041	0.340*	0.296*	0.017
PDI_3—Social activity	0.007	0.270†	0.101	0.144
PDI_4—Occupation	0.088	0.285*	0.271†	−0.004
PDI_5—Sexual behavior	0.049	−0.024	−0.079	0.005
PDI_6—Self-care	−0.086	0.121	0.031	0.001
PDI_7—Life-support activity	0.264†	0.081	0.223†	0.047
Voluntary Activities subscale	0.008	0.230†	0.192	0.076
Obligatory Activities subscale	0.094	0.118	0.142	0.028

*Significant correlation at significance level $P < 0.01$.
†Significant correlation at significance level $P < 0.05$.
PBPI-P, Portuguese version of the Pain Beliefs and Perceptions Inventory; SF-36, Medical Outcomes Study Short Form 36-Item Health Survey; BPI-P, Portuguese version of the Brief Pain Inventory; PDI-P, Portuguese version of the Pain Disability Index.

Regarding the factorial validity of the PBPI-P, the four-factor structure that we found in the present study is not in accordance with the initial three-factor solution described by the authors of the original version[15] and by the authors of the Italian version.[22] Concerning this recent Italian version, the authors explained that the factor analysis should be evaluated with caution because of a set of unique characteristics of the sample. Our four-factor solution is, however, in accordance with most of the empirical reports available.[12,18–20] Furthermore, the four-factor solution is currently considered more consensual and has even been adopted by the authors of the original version, eventually motivating the recommendation of a new set of scoring procedures.[13] Moreover, our observation of several items with relevant cross-loadings has been a finding common to other reports,[5,13] and this may possibly implicate some future changes in the content of the subscales and, eventually, the factor structure of the PBPI.

The study had some major strengths worth noting: first, the rigorous application of a methodological approach following the best internationally recommended standards for the translation, cultural adaptation, and assessment of the reliability and validity of health measurement instruments, and second, the multicenter character and adequate representativeness of the study sample. However, this study also suffered from some limitations that should be taken into account when interpreting our findings. First, some of the items of the instrument had an important proportion of missing data (8% to 9%); this certainly reflects some limitations in the comprehension, verbal, and written communication abilities of some of the participants, particularly the oldest, and the length of the data collection package applied. Second, the joint effect of the items missing data and the somehow limited sample size resulted in a smaller than expected final sample of complete cases; this imposes some limitations and caution in the

interpretation of the exploratory and confirmatory factor analyses and may actually be the main reason why in the confirmatory factor analysis neither of the two models tested had an excellent model fit. Third, the educational level in our sample was somehow lower when compared to other validation samples of this instrument or other pain studies in general; this is, nevertheless, a real reflection of the educational level of elderly populations in Portugal, and consequently something we are unable to modify. Despite this observation, the psychometric characteristics of the instrument were excellent, and we believe this has not interfered with the translation, adaptation, and validation process; however, this fact may have to be taken into account when interpreting our findings and it may eventually affect the generalizability and comparability of our results.

In conclusion, the PBPI-P has been shown to be adequate and to have excellent reliability, internal consistency, and validity. Some questions regarding the construct validity and, particularly, the factor structure of the PBPI remain under discussion, and the present study contributes additional empirical results that hopefully will add to this debate. Adequately translated and validated instruments are expected to be available for all researchers and clinicians caring for pain-suffering patients. Hopefully, they may contribute to a better pain assessment and treatment and may be tools for a truly multidimensional approach in the care for these patients.

ACKNOWLEDGEMENTS

We are most grateful to all the patients who agreed to participate in this study for their support, time, and patience. We are also deeply grateful to all members of the Chronic Pain Clinics who worked with us all the way through this project: Hospital São José de Fafe (coordinator: Dr. Laurinda Lemos), Centro Hospitalar de Vila Real/Peso da Régua (coordinator: Dr. Rosário Abrunhosa), Hospital Pedro Hispano (coordinator: Dr. Luís Agualusa), Hospital Geral de Santo António (coordinator: Dr. José Romão), Centro Hospitalar de Vila Nova de Gaia (coordinator: Dr. Carlos Jorge Carvalho), Hospital Distrital de Oliveira de Azeméis (coordinator: Dr. Maria Carlos Cativo), Hospital São Teotónio (coordinator: Dr. Maria do Céu Salgado), Hospital Infante D. Pedro (coordinator: Dr. Maria de Fátima Oliveira), Centro Hospitalar de Coimbra (coordinator: Dr. Sílvia Vaz Serra), Hospital Santo António dos Capuchos (coordinator: Dr. Teresa Vaz Patto), Hospital Fernando da Fonseca (coordinator: Dr. Georgina Coucelo), Hospital Garcia de Orta (coordinator: Dr. Beatriz Craveiro Lopes), and Hospital Central do Funchal (coordinator: Dr. Duarte Correia).

DISCLOSURES

This work was supported by equal unrestricted research grants from the Portuguese Local Offices of Grünenthal, Pfizer, and Janssen-Cilag, as well as by a research grant from the Health Fund of the Oriente/Johnson & Johnson Foundation (Fundo Fundação Oriente/Johnson & Johnson para a Saúde). The sponsors did not participate in the design or conduct of this study; in the collection, management, analysis, or interpretation of data; or in the preparation, review, or approval of the articles or decisions to submit for publication. The authors are fully responsible for the content of the article and further declare that they have no conflict of interests.

AUTHORS' CONTRIBUTIONS

L. F. Azevedo performed study design, data collection, statistical data analysis, article writing, and final revision. R. Sampaio performed article writing and final revision. C. C. Dias performed data collection and data management. J. Romão performed data collection, article writing, and final revision. L. Lemos performed data collection, article writing, and final revision. L. Agualusa performed data collection, article writing, and final revision. S. Vaz-Serra performed data collection, article writing, and final revision. T. Patto performed data collection, article writing, and final revision. A. Costa-Pereira performed coordination, article writing, and final revision. J. M. Castro-Lopes performed coordination, article writing, and final revision.

REFERENCES

1. Merskey HE. Subcommittee on Taxonomy of the International Association for the Study of Pain – "Classification of chronic pain: descriptions of chronic pain syndromes and definitions of pain terms". *Pain*. 1986;24(suppl 1):S1–S226.

2. The International Association for the Study of Pain. *Classification of Chronic Pain*. 2nd ed. (Revised). http://www.iasp-pain.org/PublicationsNews/Content.aspx?ItemNumber=1673 (accessed April 15, 2015)

3. Borrell-Carrio F, Suchman AL, Epstein RM. The biopsychosocial model 25 years later: principles, practice, and scientific inquiry. *Ann Fam Med*. 2004;2:576–582.

4. Verhaak PF, Kerssens JJ, Dekker J, Sorbi MJ, Bensing JM. Prevalence of chronic benign pain disorder among adults: a review of the literature. *Pain*. 1998;77:231–239.

5. Dysvik E, Lindstrom TC, Eikeland OJ, Natvig GK. Health-related quality of life and pain beliefs among people suffering from chronic pain. *Pain Manage Nurs*. 2004;5:66–74.

6. Gerbershagen HU, Lindena G, Korb J, Kramer S. Health-related quality of life in patients with chronic pain. *Schmerz*. 2002;16:271–284.

7. Korff MV, Simon G. The relationship between pain and depression. *Br J Psychiatry*. 1996;168:101–108.

8. Smith AA, Friedemann ML. Perceived family dynamics of persons with chronic pain. *J Adv Nurs*. 1999;30:543–551.

9. Snelling J. The effect of chronic pain on the family unit. *J Adv Nurs*. 1994;19:543–551.

10. Lipchik GL, Milles K, Covington EC. The effects of multidisciplinary pain management treatment on locus of control and pain beliefs in chronic non-terminal pain. *Clin J Pain*. 1993;9:49–57.

11. Stroud MW, Thorn BE, Jensen MP, Boothby JL. The relation between pain beliefs, negative thoughts, and psychosocial functioning in chronic pain patients. *Pain*. 2000;84:347–352.

12. Williams DA, Keefe FJ. Pain beliefs and the use of cognitive-behavioral coping strategies. *Pain*. 1991;46:185–190.

13. Williams DA, Robinson ME, Geisser ME. Pain beliefs: assessment and utility. *Pain*. 1994;59:71–78.

14. Lazarus RS, Folkman S. *Stress, Appraisal, and Coping*. New York, NY: Springer; 1984.

15. Williams DA, Thorn BE. An empirical assessment of pain beliefs. *Pain*. 1989;36:351–358.

16. Turner JA, Jensen MP, Romano JM. Do beliefs, coping, and catastrophizing independently predict functioning in patients with chronic pain? *Pain*. 2000;85:115–125.

17. DeGood DE, Shutty MS. Assessment of pain beliefs, coping and self efficacy. In: Turk DC, Melzack R, eds. *Handbook of Pain Assessment*. London: Guilford Press; 1992:214–234.

18. Herda CA, Siegeris K, Basler HD. The Pain Beliefs and Perceptions Inventory: further evidence for a 4-factor structure. *Pain*. 1994;57:85–90.

19. Morley S, Wilkinson L. The Pain Beliefs and Perceptions Inventory: a British replication. *Pain*. 1995;61:427–433.

20. Strong J, Ashton R, Chant D. The measurement of attitudes towards and beliefs about pain. *Pain*. 1992;48:227–236.

21. Sullivan MJ, Thorn B, Haythornthwaite JA, et al. Theoretical perspectives on the relation between catastrophizing and pain. *Clin J Pain*. 2001;17:52–64.

22. Monticone M, Ferrante S, Ferrari S, et al. The Italian version of the Pain Beliefs and Perceptions Inventory: cross-cultural adaptation, factor analysis, reliability and validity. *Qual Life Res*. 2014;23:1789–1795.

23. Tavoli A, Montazeri A, Roshan R, Tavoli Z, Melyani M. Depression and quality of life in cancer patients with and without pain: the role of pain beliefs. *BMC Cancer*. 2008;8:177.

24. Wong WS, Williams DA, Mak KH, Fielding R. Assessing attitudes toward and beliefs about pain among Chinese patients with chronic pain: validity and reliability of the Chinese version of the Pain Beliefs and Perceptions Inventory (ChPBPI). *J Pain Symptom Manage*. 2011;42:308–318.

25. Azevedo LF, Pereira AC, Dias C, et al. Tradução, adaptação cultural e estudo multicêntrico de validação de instrumentos para rastreio e avaliação do impacto da dor crónica. [Translation, cultural adaptation and multicentric validation study of chronic pain screening and impact assessment instruments]. *Dor*. 2007;15:6–56.

26. Streiner DL, Norman GR. *Health Measurement Scales —A Practical Guide to Their Development and Use*. 2nd ed. New York, NY: Oxford University Press; 1995.

27. Cha ES, Kim KH, Erlen JA. Translation of scales in cross-cultural research: issues and techniques. *J Adv Nurs*. 2007;58:386–395.

28. Corless IB, Nicholas PK, Nokes KM. Issues in cross-cultural quality-of-life research. *J Nurs Scholarsh*. 2001;33:15–20.

29. Eremenco SL, Cella D, Arnold BJ. A comprehensive method for the translation and cross-cultural validation of health status questionnaires. *Eval Health Prof*. 2005;28:212–232.

30. Pena ED. Lost in translation: methodological considerations in cross-cultural research. *Child Dev*. 2007;78:1255–1264.

31. Sperber AD. Translation and validation of study instruments for cross-cultural research. *Gastroenterology*. 2004;126(suppl 1):S124–S128.

32. The RAND Corporation. *36-Item Short Form Survey (SF-36)*. http://www.rand.org/health/surveys_tools/mos/36-item-short-form.html (accessed April 15th, 2015)

33. Ferreira PL. Development of the Portuguese version of MOS SF-36. Part I. Cultural and linguistic adaptation. *Acta Med Port*. 2000;13:55–66.

34. Ferreira PL. Development of the Portuguese version of MOS SF-36. Part II. Validation tests. *Acta Med Port*. 2000;13:119–127.

35. Ware JE Jr, Gandek B. Overview of the SF-36 health survey and the international quality of life assessment (IQOLA) project. *J Clin Epidemiol*. 1998;51:903–912.

36. Chibnall JT, Tait RC. The Pain Disability Index: factor structure and normative data. *Arch Phys Med Rehabil*. 1994;75:1082–1086.

37. Pollard CA. Preliminary validity study of the Pain Disability Index. *Percept Mot Skills*. 1984;59:974.

38. Tait RC, Chibnall JT, Krause S. The Pain Disability Index: psychometric properties. *Pain*. 1990;40:171–182.

39. Tait RC, Pollard CA, Margolis RB, Duckro PN, Krause SJ. The Pain Disability Index: psychometric and validity data. *Arch Phys Med Rehabil*. 1987;68:438–441.

40. Cleeland CS, Gonin R, Hatfield AK, et al. Pain and its treatment in outpatients with metastatic cancer. *N Engl J Med*. 1994;330:592–596.

41. Keller S, Bann CM, Dodd SL, Schein J, Mendoza TR, Cleeland CS. Validity of the brief pain inventory for use in documenting the outcomes of patients with noncancer pain. *Clin J Pain*. 2004;20:309–318.

42. Tan G, Jensen MP, Thornby JI, Shanti BF. Validation of the Brief Pain Inventory for chronic nonmalignant pain. *J Pain*. 2004;5:133–137.

43. Cleeland C. Measurement of pain by subjective report. In: Chapman CR, Loeser JD, eds. *Advances in Pain Research and Therapy*, Vol 12: Issues of Pain Measurement. New York, NY: Raven Press; 1989:391–403.

44. Caraceni A, Cherny N, Fainsinger R, et al. Pain measurement tools and methods in clinical research in palliative care: recommendations of an Expert Working Group of the European Association of Palliative Care. *J Pain Symptom Manage*. 2002;23:239–255.

45. Twycross R, Harcourt J, Bergl S. A survey of pain in patients with advanced cancer. *J Pain Symptom Manage*. 1996;12:273–282.

46. Dworkin RH, Turk DC, Farrar JT, et al. Core outcome measures for chronic pain clinical trials: IMMPACT recommendations. *Pain*. 2005;113:9–19.

47. Turk DC, Dworkin RH, Allen RR, et al. Core outcome domains for chronic pain clinical trials: IMMPACT recommendations. *Pain*. 2003;106:337–345.

48. Turk DC, Dworkin RH, Revicki D, et al. Identifying important outcome domains for chronic pain clinical trials: an IMMPACT survey of people with pain. *Pain*. 2008;137:276–285.

49. Nunnally J, Bernstein I. *Psychometric Theory*. 3rd ed. New York, NY: McGraw-Hill; 1994.

50. Fayers PM, Machin D. *Quality of Life: The Assessment, Analysis, and Interpretation of Patient-Reported Outcomes*. 2nd ed. Hoboken, NJ: John Wiley; 2007.

51. McDowell I. *Measuring Health: A Guide to Rating Scales and Questionnaires*. 3rd ed. New York, NY: Oxford University Press; 2006.

52. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics*. 1977;33:159–174.

53. Cohen J. Differences between correlation coefficients. In: Cohen J, ed. *Statistical Power Analysis for the Behavioral Sciences*. 2nd ed. Hillsdale, NJ: Lawrence Erlbaum Associates; 1988:109–143.

54. McCrae RR, Kurtz JE, Yamagata S, Terracciano A. Internal consistency, retest reliability, and their implications for personality scale validity. *Pers Soc Psychol Rev*. 2011;15:28–50.

55. Brown TA. *Confirmatory Factor Analysis for Applied Research*. New York, NY: Guilford Press; 2006.

56. Kline RB. *Principles and Practice of Structural Equation Modeling*. 2nd ed. New York, NY: Guilford Press; 2005.

57. Thompson B. *Exploratory and Confirmatory Factor Analysis: Understanding Concepts and Applications*. Washington, DC: American Psychological Association; 2004.