








## Original Research

# Translation, cross-cultural adaptation, and measurement properties of the Back pain knowledge and beliefs survey (BackS) for the Brazilian population

Leticia Amaral Corrêa <sup>a,\*</sup> , Mark J. Hancock <sup>b</sup>, Stephanie Mathieson <sup>c,d</sup>,  
Leandro Alberto Calazans Nogueira <sup>e,f</sup> , Tatiane da Silva <sup>g</sup> , Bruno Saragiotto <sup>g,h</sup>,  
Louise Acalantis Pereira Pires Fernandes <sup>e</sup>, Ben Darlow <sup>i</sup> , Simon D. French <sup>a</sup> 

<sup>a</sup> Department of Chiropractic and Spinal Pain Research Centre, Faculty of Medicine, Health and Human Sciences, Macquarie University, Sydney, Australia

<sup>b</sup> Department of Health Sciences and Spinal Pain Research Centre, Faculty of Medicine, Health and Human Sciences, Macquarie University, Sydney, Australia

<sup>c</sup> Sydney Musculoskeletal Health, Faculty of Medicine and Health, The University of Sydney, Sydney, Australia

<sup>d</sup> Kolling Institute, Faculty of Medicine and Health, The University of Sydney, Sydney, Australia

<sup>e</sup> Rehabilitation Science Postgraduate Program at Augusto Motta University Centre (UNISUAM), Rio de Janeiro, Brazil

<sup>f</sup> Physiotherapy Department, Federal Institute of Rio de Janeiro (IFRJ), Rio de Janeiro, Brazil

<sup>g</sup> Masters and Doctoral Programs in Physical Therapy, Universidade Cidade de São Paulo (UNICID), Brazil

<sup>h</sup> Discipline of Physiotherapy, Graduate School of Health, University of Technology Sydney, Ultimo, Australia

<sup>i</sup> Department of Primary Health Care and General Practice, University of Otago Wellington, New Zealand



## ARTICLE INFO

## Keywords:

Low back pain  
Measurement properties  
Patient-reported outcome measures  
Psychometrics  
Questionnaire translation

## ABSTRACT

**Background:** Low back pain (LBP) is a highly prevalent and disabling health condition worldwide. A Patient-Reported Outcome Measure (PROM) to assess people's knowledge and beliefs about LBP was recently developed in Australia, but a Brazilian-Portuguese translation is not yet available. The lack of adequate cross-cultural adaptation of questionnaires is a barrier to developing LBP research and clinical practice in different cultures. **Objective:** To translate, cross-culturally adapt, and test the measurement properties of the Back pain Knowledge and Beliefs Survey (BackS) to allow its use with Portuguese-speaking Brazilians with LBP (BackS-BR). **Methods:** A forward and backward translation was performed, and measurement properties of the BackS-BR were assessed following the COSMIN guidelines. Pilot testing was performed to assess content validity and online surveys were undertaken to assess other measurement properties. Structural validity was evaluated by confirmatory factor analysis (CFA) and cross-cultural validity by multigroup CFA. Construct validity was assessed by correlation between BackS-BR and the Back Beliefs Questionnaire and a positive moderate correlation was expected. Internal consistency was assessed by Cronbach's alpha, reliability by intra-class correlation coefficient, and measurement error by calculating the smallest detectable change (SDC). **Results:** BackS-BR had good content validity and the 2-factors structure was confirmed. Multigroup CFA produced acceptable measurement invariance. Pearson test confirmed our construct validity hypothesis (0.59). Internal consistency and reliability were adequate (>0.70) and SDC was 11.09 for total scale. **Conclusion:** The BackS was successfully translated into Brazilian-Portuguese and proved to have adequate measurement properties. Its use is recommended for research and clinical purposes.

## Introduction

Low back pain (LBP) is a highly prevalent and disabling health condition leading to a large impact worldwide.<sup>1</sup> LBP affects both high-

and low-income countries and it is estimated that up to 84% of the world population will suffer from LBP at some point in their lifetime.<sup>2</sup> In Brazil, LBP is the leading cause of disability contributing to high economic, social, and individual impact.<sup>3</sup> However, guidance for managing LBP in

\* Corresponding author at: Department of Chiropractic, Faculty of Medicine, Health and Human Sciences, Macquarie University, Level 2, 75 Talavera Rd, Macquarie Park, NSW, 2113, Australia.

E-mail address: [leticia.correa@mq.edu.au](mailto:leticia.correa@mq.edu.au) (L.A. Corrêa).

<https://doi.org/10.1016/j.bjpt.2026.101600>

Received 17 November 2024; Received in revised form 7 December 2025; Accepted 10 March 2026

Available online 30 May 2026

1413-3555/© 2026 The Authors. Published by Elsevier España, S.L.U. on behalf of Associação Brasileira de Pesquisa e Pós-Graduação em Fisioterapia. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Brazilians is limited by a lack of literature considering specific cultural aspects.<sup>3</sup>

Recognising LBP as a complex multifactorial condition has highlighted that a biopsychosocial approach is preferred for the management of LBP.<sup>4</sup> Current international guidelines recommend conservative interventions as first-line treatments for LBP, focussing on patient-centred interventions such as self-management strategies, reassurance, and education.<sup>5-8</sup> Patient-centred interventions provide individualised care based on the individual context of the patient. To deliver a patient-centred intervention, healthcare providers should empower

patients with evidence-based knowledge and skills to self-manage their condition.<sup>9,10</sup>

Assessing patients' knowledge and beliefs about LBP is a relevant precursor to providing an individualised patient-centred intervention. Patient-reported outcome measures (PROMs) are used to assess a person's perception of their health. People with LBP expect PROMs to be simple, personalised to each individual, and applicable, providing useful information to be applied during the consultation.<sup>11</sup> However, PROMs commonly used to assess knowledge or beliefs about LBP do not incorporate current guideline recommendations for LBP management (e.g.,

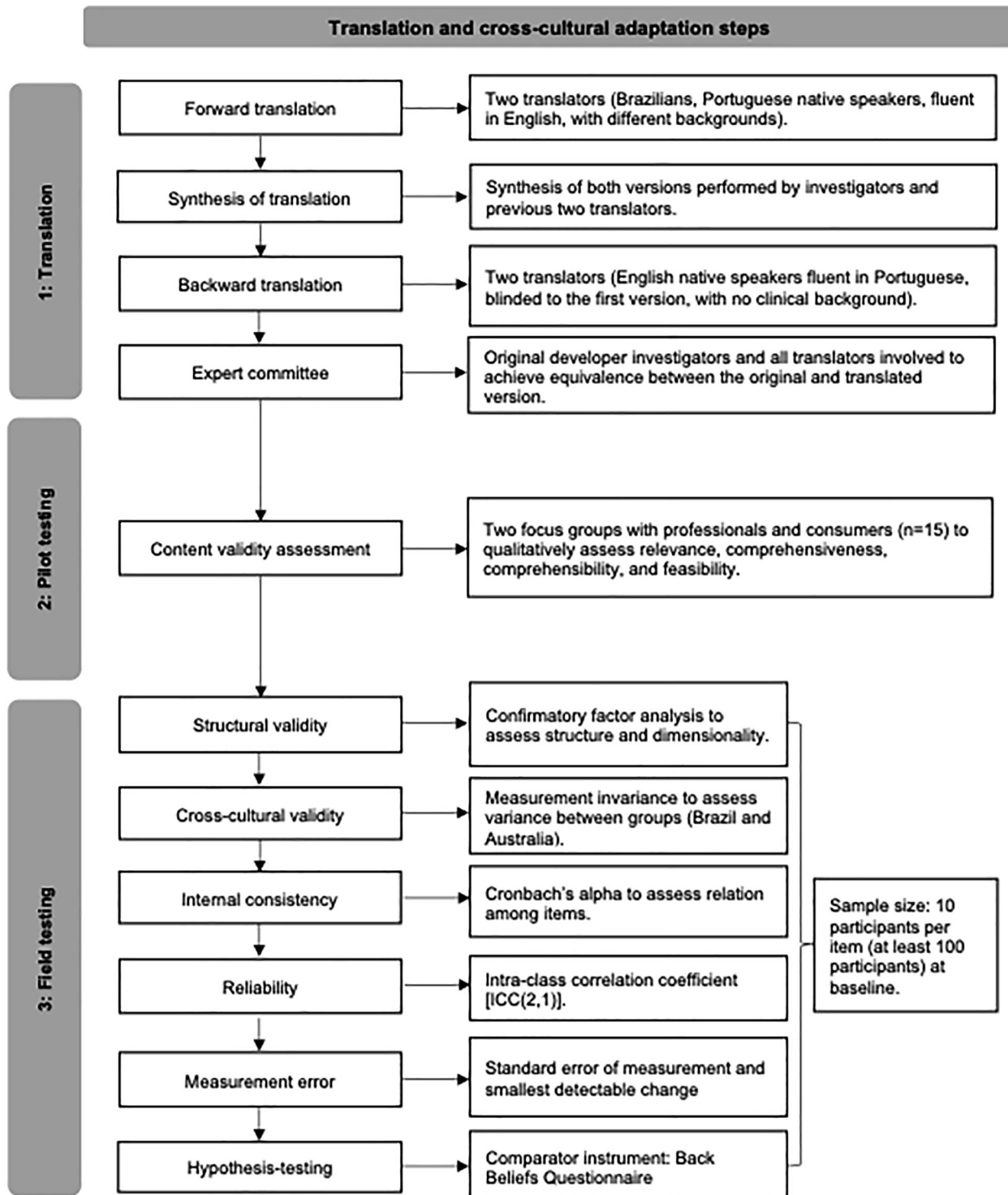


Fig. 1. Translation and cross-cultural adaptation methodology overview flowchart.

Back Belief Questionnaire<sup>12</sup> and Low Back Pain Knowledge questionnaire<sup>13</sup>) and most measurement properties of the Brazilian version of these PROMs were rated as “indeterminate” in a recent systematic review.<sup>14</sup>

Based on the lack of a PROM assessing evidence-based knowledge and beliefs about LBP, a new PROM named Back pain Knowledge and beliefs Survey (BackS) was recently developed in Australia with this purpose.<sup>15</sup> BackS was developed based on current guidelines for management of LBP in addition to key messages for people with LBP identified in a recent Delphi study<sup>16</sup> and involved international experts and consumers with LBP. BackS was found to have adequate measurement properties, which allows it to be used with English-speaking people in Australia.<sup>15</sup> However, there are no validated translations of BackS that allow its use in different countries and languages.

The lack of adequate translation and cross-cultural adaptation of LBP PROMs is a barrier to the development in LBP research and clinical practice in different cultures.<sup>17,18</sup> A Brazilian version of the BackS is necessary to provide a high-quality tool that may guide clinicians and researchers on the topics to be covered in an education intervention, as well as a potential tool to assess the effects of an educational intervention, predict outcomes, and identify subgroups for specific cognitive interventions. This study aims to translate and cross-culturally adapt the BackS to be used by the Portuguese-speaking population in Brazil (BackS-BR) and test its measurement properties (content validity, structural validity, cross-cultural validity, construct validity via hypotheses testing, internal consistency, test-retest reliability, and measurement error).

## Methods

### Study design and ethics

A translation and cross-cultural adaptation study was performed following the Guidelines for the Process of Cross-Cultural Adaptation of Self-Report Measures<sup>19</sup> and the Consensus based Standards for the selection of health Measurement Instruments (COSMIN) recommendations for assessment of measurement properties in translation studies.<sup>20</sup> Measurement properties were assessed based on COSMIN taxonomy and criteria.<sup>21-23</sup> Research Ethics Committees in Australia (Macquarie University, HREC#520231572051785) and Brazil (Augusto Motta University Centre, HREC#73645723.0.0000.5235) approved the study. The protocol was prospectively registered on Open Science Framework (<https://osf.io/ypb82>). Informed consent was obtained from all participants prior to data collection. Fig. 1 presents an overview of each step of this study.

### Back pain knowledge and beliefs survey (BackS)

The BackS is a contemporary PROM to assess people’s knowledge and beliefs about LBP, developed in Australia by some investigators of this translation study.<sup>15</sup> The original Australian version of the BackS (Supplementary Material 1) includes 20 items related to LBP prognosis, diagnosis, imaging, staying active, and treatment. Items were generated from extensive literature review, a previous Delphi study,<sup>16</sup> and by consulting global LBP research and clinician leaders and people with lived experience of LBP. Each item is scored from 1 to 5 on a Likert-scale from “strongly disagree” to “strongly agree”, where higher scores indicate higher level of evidence-based knowledge. The original Australian BackS had 2-factors and is a valid and reliable PROM.<sup>15</sup> Factor 1, named “biomedical”, includes 9 items scoring from 9 to 45 and factor 2, named “self-care”, includes 11 items scored from 11 to 55. Total score ranges from 20 to 100. BackS is freely available for clinical and non-commercial research use, but requires a licence. Licensing is available at [Spinal Pain Research Centre](https://www.spinalpainresearchcentre.com).

### Translation and cross-cultural adaptation

A recommended multistep approach<sup>19</sup> was performed, consisting of: translation, synthesis of translation, back translation, and expert committee review. The translation aimed to retain the same concepts of the original version. BackS was translated independently from English into Portuguese by two Brazilians fluent in English, of which only one had a clinical background. Investigators and translators performed a synthesis of the two translations and no major differences were found between translations. Then, the synthesised version was backward translated to English by two independent English native speakers fluent in Portuguese, both blinded to the original version and with no clinical background. An expert committee, including investigators and translators, compared the forward and backward translations, the synthesised version, and the original BackS, aimed to review for language equivalence (semantic, idiomatic, experiential, and conceptual) between the original and the Brazilian version. The committee found no major difference among translations. Minor differences were addressed by discussion and a few terms were highlighted to be discussed during focus groups to make sure the concepts in translation were equivalent to the original version (i.e., “flare-up”, “bed rest”, “likely to”). The prefinal version of BackS-BR was successfully developed and a full report of translation and cross-cultural adaptation is presented in Supplementary Material 2.

### Pilot testing

The prefinal BackS-BR was qualitatively tested in a pilot study to assess its content validity (relevance, comprehensiveness, comprehensibility) and feasibility. We used convenience sampling, and participants were identified via social media and community advertisements. Two focus groups were performed including both consumers (Brazilian adults who self-reported LBP anytime in the previous 12 months), and healthcare professionals (clinicians or researchers with experience with LBP patients/research in the previous 12 months). Based on COSMIN recommendations, we aimed to include at least 7 consumers and 7 healthcare professionals.<sup>20</sup>

Focus groups were conducted in a hybrid mode (online and in person) by two skilled investigators (1 male and 1 female, both physical therapists with more than 6 years of clinical and research experience, and previous experience conducting focus groups). Each focus group lasted around 60 minutes and was recorded and transcribed using Microsoft Teams® software. The moderators started each focus group by presenting an overview about the study in plain language, suitable for a non-specialist audience. Participants were then asked to complete the prefinal BackS-BR online (via LimeSurvey®) using the think-aloud method and each item was discussed within the group until a consensus was reached. The understanding about the questionnaire instructions, items, and responses, plus identification of unfamiliar words and suggestion of missing content, were discussed based on a guide developed by the COSMIN group (Supplementary Material 3).<sup>24</sup> Suggestions for rewording items were discussed among participants and considered when at least 20% of the participants agreed the change would improve understanding. After the BackS-BR was modified based on input from participants in the focus groups and qualitative assessment by the investigators, an experienced Brazilian Portuguese language teacher reviewed the final version for any grammatical error.

### Field testing

A cross-sectional study was then performed to assess the measurement properties of the BackS-BR. We recruited participants across Brazil from primary care clinics and universities, and through social media and community advertisements. The eligibility criteria were confirmed through self-reported online questions. People with self-reported LBP in the previous 12 months were included if they were 18 years or older and

were Brazilian-Portuguese native speakers. Participants who self-reported cognitive impairment or illiteracy were excluded. Based on COSMIN recommendation, we aimed to recruit 10 participants per item, therefore, a total of 200 participants.<sup>20,25</sup>

Participants completed an online survey (LimeSurvey®) where all items were mandatory. The survey included the eligibility checklist, demographic, and clinical data (e.g., age, sex, education level, pain intensity, disability), the BackS-BR, and the Brazilian version of the Back Beliefs Questionnaire (BBQ),<sup>26</sup> which was used as a comparator instrument for construct validity assessment. The BBQ was developed to assess beliefs related to LBP consequences and includes 14 items with responses scored on a 5-point Likert scale of agreement with each item. Total score ranges from 9 to 45 and lower scores indicate more pessimistic beliefs regarding the consequence of LBP. As both the BackS-BR and BBQ Brazilian version questionnaires measure different domains of the constructs, we hypothesised that a positive moderate correlation between 0.40 and 0.79 would be presented between BackS and BBQ. To assess reliability, consenting participants were contacted again one week later to complete the follow-up survey.

#### Data analysis

Demographic and clinical data were presented descriptively and focus group discussions were analysed qualitatively based on notes from two moderators. Continuous variables were reported as means and standard deviations (SD), and categorical variables were reported as absolute values and percentage. Data distribution was verified using the Shapiro-Wilk test. Statistical analyses were performed using Stata, version 17 (Stata Corporation, College Station, TX, USA).

#### Structural validity

Structural validity was assessed using Confirmatory Factor Analysis (CFA) to evaluate fit index levels of the 2-factor structure, found in the development sample from Australia.<sup>15</sup> Models analysed in this study were all estimated using maximum likelihood. Models adjusted for modification of indices and alternative structures (e.g., bi-factor, second order) were tested to achieve the best-fit considering the Comparative Fit Index (CFI >0.90), Tucker-Lewis Index (TLI >0.90), Root Mean Square Error of Approximation (RMSEA <0.06), and/or Standardized Root Mean Residuals (SRMR <0.08).<sup>22,23,27</sup> The Bayesian Information Criterion (BIC) was also used for the selection of the most appropriate model, in which the lowest BIC values represent the most adequate factor structure.<sup>28,29</sup>

#### Cross-cultural validity

Multigroup CFA was performed to investigate measurement invariance between the English and Portuguese BackS versions by using the data collected in this study in Brazil and from our original BackS development study in Australia.<sup>15</sup> This analysis assessed configural, metric, and scalar invariance compared consecutively. We considered  $\Delta CFI \leq 0.01$ ,  $\Delta RMSEA \leq 0.015$ , and  $\Delta SRMR \leq 0.015$  as signs of invariance.<sup>30-32</sup> If the multigroup CFA results fit in these criteria, then group differences in mean scores can be interpreted as real differences not due to participants attributing different meanings in different countries.

#### Internal consistency

Cronbach's alpha ( $\alpha$ ) was used to assess the degree of the interrelatedness among items considering the PROM as a whole and each unidimensional subscale separately. Cronbach's  $\alpha \geq 0.70$  was acceptable.<sup>23</sup>

#### Test-retest reliability

Reliability examined agreement between baseline and one-week follow-up (based on agreement, two-way, random-effect model, and single measurements), and was analysed using intra-class correlation coefficient [ICC (2,1)] and their 95% confidence intervals (CIs).

Participants' stability on the construct of interest between the 2 measurement time points was assessed based on BBQ change from baseline and follow-up using the paired Student T-test. In addition, participants were asked in the follow-up survey if they had received any pain education in the week between baseline and follow-up, and participants who reported receiving pain education were not considered stable. The point estimate of ICC  $\geq 0.70$  was considered acceptable.<sup>23</sup>

#### Measurement error

Smallest Detectable Change (SDC) was calculated by multiplying 1.96 (z-score) by square root of 2 and by the Standard Error of Measurement (SEM) [ $1.96 * \sqrt{2 * SEM_{agreement}}$ ].  $SEM_{agreement}$  was calculated by the square root of the test-retest variance (error). A smaller SEM reflects smaller variability between timepoints and SDC reflects the smallest change within-person likely to be considered a true change, not a measurement error.<sup>33</sup>

#### Construct validity

The BBQ was included as a comparator to assess the construct validity of BackS-BR, as there is no gold standard for PROMs.<sup>20</sup> We investigated construct validity through hypothesis testing, and a positive moderate correlation (Pearson correlation test between 0.40 and 0.79) was expected between BackS-BR and BBQ total scores.

#### Interpretability and feasibility

We assessed interpretability and feasibility by assessing questionnaire completion time, distribution of scores in the study population, floor and ceiling effects, comprehensibility, and ease of administration and score calculation.<sup>21,34</sup> Floor and ceiling effects were reported if more than 15% of the participants received the minimum or maximum possible total score.<sup>22</sup> Items with floor or ceiling effect >75% were considered for removal.

## Results

#### Participants

Participants were included across three different phases of this study (translation, pilot testing, and field testing). Pilot testing included 15 participants [mean age of 38.7 (10.7) years, 6 (40%) females]. Field testing survey included 208 participants [mean age of 44.3 (13.1) years, 140 (67.3%) females]. The majority of the participants (194, 87%) resided in the Southeast region of Brazil, the same region where the study was primarily conducted. However, given that hybrid focus groups and online surveys were performed, this study also included 14 (6.3%) participants from Northeast Brazil, 11 (4.9%) participants from South Brazil, 3 (1.3%) participants from Central-West Brazil, and 1 (0.4%) participant from the North region of Brazil. [Table 1](#) presents demographic and clinical data for participants included in each study phase separately.

#### Pilot testing

Focus group participants were able to easily and clearly understand BackS-BR instructions, items, and response options. BackS-BR presented good content validity by both consumers and healthcare professionals as all focus group participants considered BackS as relevant, comprehensive, and easy to be understood. No major change was required, and no additional items were suggested. A few minor changes were suggested by focus group participants and incorporated to make items better understood by our target population (e.g., adding the word "parcialmente" to response options "discordo" and "concordo" to be aligned with wording usually used in surveys in Brazil; "repouso prolongado na cama" changed to "repouso prolongado deitado" to better reflect the concept from the English term "bed rest"; "radiografia" changed to "raio-x" as is a more popular term used by community in Brazil; "útil" to "benéfico",

**Table 1**  
Demographic and clinical characteristics of included participants.

Characteristics	Translation of BackS		Pilot testing		Field testing	
	Forward (n=2)	Backward (n=2)	Consumers (n=7)	Healthcare professionals (n=8)	Baseline (n=208)	Follow-up (n=128)
Age [years, mean (SD)]	35 (1.41)	41.5 (24.75)	37.1 (4.80)	40.0 (3.2)	44.3 (13.1)	44.9 (13.6)
Sex [female; n (%)]	1 (50%)	0 (0%)	4 (57.1%)	2 (25.0%)	140 (67.3%)	85 (66.4%)
Educational status						
Primary education [n (%)]	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (5.3%)	5 (3.9%)
Secondary education [n (%)]	0 (0%)	1 (50%)	1 (14.3%)	0 (0%)	47 (22.6%)	28 (21.9%)
Tertiary education [n (%)]	2 (100%)	1 (50%)	6 (85.7%)	8 (100%)	150 (72.1%)	95 (74.2%)
Translators' experience with second language [years, mean (SD)]	14 (1.41)	20.5 (4.95)	NA	NA	NA	NA
Professional experience with LBP patients [years, mean (SD)]	NA	NA	NA	15.1 (9.9)	NA	NA
Professional occupation (researcher, clinician, or both)						
Researcher [n (%)]	NA	NA	NA	5 (62.5%)	NA	NA
Clinician [n (%)]	NA	NA	NA	7 (87.5%)	NA	NA
Main occupation						
Physical therapist [n (%)]	1 (50%)	0 (0%)	0 (0%)	5 (62.5%)	NA	NA
Physical educator [n (%)]	0 (0%)	0 (0%)	0 (0%)	3 (37.5%)	NA	NA
Language teacher or Translator [n (%)]	1 (50%)	1 (50%)	1 (14.3%)	0 (0%)	NA	NA
Other [n (%)]	0 (0%)	1 (50%)	6 (85.7%)	0 (0%)	NA	NA
Average pain intensity [NPRS 0-10; mean (SD)]	NA	NA	4.1 (1.2)	NA	5.04 (2.6)	4.6 (2.7)
Disability [RMDQ 0-24; mean (SD)]	NA	NA	5.4 (2.5)	NA	8.01 (5.7)	6.8 (5.7)
Received pain education [yes, n (%)]*	NA	NA	5 (71.4%)	8 (100%)	121 (58.2%)	61 (47.7%)**
BackS (20-items, score range from 20 to 100)	NA	NA	NA	NA	64.04 (10.61)	64.93 (11.39)
Biomedical (9-items, score range from 9 to 45)	NA	NA	NA	NA	21.47 (7.53)	22.63 (7.69)
Self-care (11-items, score range from 11 to 55)	NA	NA	NA	NA	42.57 (5.35)	42.30 (6.12)
BBQ score (14-items, score range from 9 to 45)	NA	NA	NA	NA	28.51 (7.19)	29.50 (7.08)

Abbreviations: BackS, Back pain Knowledge and beliefs Survey; BBQ, Back Beliefs Questionnaire; LBP, Low Back Pain; NA, Not Applicable; NPRS, Numerical Pain Rating Scale; RMDQ, Roland Morris Disability Questionnaire.

\* Pain education from any of the following sources: healthcare professional, websites, university, or others.

\*\* Follow-up question was if pain education was received in the previous week (between baseline and follow up).

“*administrar*” to “*gerenciar*”; “*problema estrutural exato*” to “*problema exato na estrutura da coluna*” to use terms more commonly reported by people with LBP in Brazil). The final version of BackS-BR is presented in Supplementary Material 4. BackS-BR is freely available for clinical and non-commercial research use, but requires a licence. Licensing is available at [Spinal Pain Research Centre](#).

### Field testing

#### Structural validity

The first model tested was a 2-factor structure without adjustments and this model did not provide an ideal fit (CFI = 0.79, TLI = 0.77, RMSEA = 0.08, SRMR = 0.08). A second model was tested by specifying error covariances suggested by modification of indices until no modification of indices higher than 10.000 was suggested and this model produced improved fit (CFI = 0.94, TLI = 0.93, RMSEA = 0.04, SRMR = 0.06) (Supplementary Material 5). Bifactor and second order structures were analysed but did not produce improvement in model fit.

#### Cross-cultural validity

The Goodness-of-fit indexes for the configural, metric, and scalar invariance of the multigroup CFA for the population in Brazil and Australia are presented in Table 2. Differences between configural and metric model suggested adequate measurement invariance, while differences between metric and scalar model suggest partial measurement invariance.

#### Internal consistency

Cronbach's  $\alpha$  was adequate for both factors [Factor 1, biomedical: 0.86; factor 2, self-care: 0.71] and total score (0.84).

#### Test-retest reliability

A total of 201 baseline participants consented to receive the follow-

**Table 2**

Measurement invariance between Brazil (n = 208) and Australia (n = 258) samples.

Measurement invariance	CFI	RMSEA (90%CI)	SRMR	$\Delta$ CFI	$\Delta$ RMSEA	$\Delta$ SRMR
Configural invariance	0.914	0.051 (0.042, 0.059)	0.062	-	-	-
Metric invariance	0.900	0.053 (0.045, 0.061)	0.075	0.01	0.002	0.013
Scalar invariance	0.797	0.073 (0.066, 0.080)	0.090	0.10	0.020	0.015

Abbreviations: CFI, Comparative Fit Index; RMSEA, Root Mean Square Error of Approximation; SRMR, Standardized Root Mean Residuals.

up survey, of which 128 (64.0%) submitted a complete follow-up survey, with a mean of 13 (7.26) days after baseline. There was no statistical difference between baseline and follow-up responses for BackS-BR and BBQ scores ( $p > 0.05$ ). However, 61 (47.7%) of the follow-up responders reported having received pain education between baseline and follow-up from healthcare professional (46 out of 61, 75.4%), websites (19 out of 61, 31.2%), and university (15 out of 61, 24.6%). Therefore, as these participants were considered potentially unstable for the construct of interest, they were excluded from the test-retest reliability analysis. Considering the remaining 67 participants, BackS-BR presented adequate test-retest reliability for Biomedical factor [ICC(2,1) = 0.92 (0.87, 0.95)], Self-care factor [ICC(2,1) = 0.71 (0.57, 0.81)], and total scale [ICC(2,1) = 0.91 (0.85, 0.94)].

#### Measurement error

SEM<sub>agreement</sub> was 2.84 for Biomedical factor, 3.37 for Self-care factor, and 4.00 for total scale. SDC was 7.87 for Biomedical factor, 9.35 for

Self-care factor, and 11.09 for total scale.

#### Construct validity

Correlation between BackS-BR and BBQ confirmed our construct validity hypothesis of a positive moderate correlation (Pearson test = 0.59).

#### Interpretability and feasibility

Participants took a mean of 6 minutes to complete the BackS-BR. Baseline participants had a BackS total mean score of 64.04 (10.61), and a range of 41 to 99. No floor or ceiling effects were found. BackS-BR was reported by participants of focus groups as easy to understand and administrate.

#### Discussion

The original version of BackS was successfully translated and cross-culturally adapted into Brazilian Portuguese following the internationally recommended COSMIN guidelines. BackS-BR has acceptable structural validity, cross-cultural validity, construct validity, internal consistency, test-retest reliability, and measurement error. BackS-BR is easy to comprehend and administer, requiring about 6 minutes to complete. BackS-BR is acceptable and recommended for use in research and clinical practice in Brazil.

Assessing the structure of a PROM and its measurement invariance across countries is a crucial step to ensure the validity of translation versions. Although this analysis is not commonly explored, it is especially relevant when self-reported measurements are used to assess non-observable attributes.<sup>30</sup> The present study confirmed the findings from the original Australian version of BackS about its 2-factor structure after using pre-planned criteria for modification of indices.<sup>15</sup> Measurement invariance analysis was performed to assess the equivalence of BackS between Brazil and Australia, including data from the original study.<sup>15</sup> Our results indicate adequate configural and metric invariance, which means that factors items contribute to the construct similarly across Brazil and Australia groups. Scalar invariance was not fully confirmed in this study; however, some authors argue that adequate metric invariance is sufficient for comparing latent variances across groups.<sup>35</sup> Based on this, a quantitative group comparison is plausible, as factors are suggested to have the same meaning in each group, but differences between groups can be contaminated by differential additive response bias. We recommend future studies to assess BackS cross-cultural validity based on Item Response Theory (IRT) to investigate its Differential Item Functioning (DIF) to add to its evidence.

BackS-BR validity and reliability were confirmed in this study. Our results were similar to the results found in Australia.<sup>15</sup> However, in the Brazilian sample, almost half of the follow-up responders consulted or were exposed to pain education between baseline and follow-up and a smaller sample was included to assess test-retest reliability. The number of people seeking health information online has increased over recent years because of the convenience and coverage of the Internet.<sup>36</sup> Nonetheless, seeking this information may have been a result of participation in the study. The small sample who completed the reliability aspect of the study resulted in the wide confidence interval. One aspect of reliability is measurement error, which a higher SDC was found in BackS-BR compared to the Australian sample<sup>15</sup> and this should be considered when interpreting BackS results between countries.

BackS-BR is the first available translation and cross-cultural adaptation for BackS, providing a tool for clinicians and researchers in Brazil to assess people's knowledge and beliefs about LBP considering current evidence-based recommendations. However, some study limitations need to be addressed. First, although this study included participants across all regions of Brazil (i.e., North, Northeast, Central-West, Southeast, and South), most participants resided in the Southeast region. Given the high cultural diversity among regions in Brazil, further research should be conducted to test the BackS-BR in populations from

different states and municipalities. Also, more than 70% of our participants reported completing tertiary education, and no participants with primary education as the highest level of education were included in our pilot testing. Based on this, our findings may not be generalisable to populations with low levels of education. Considering that only 18.4% of the Brazilian population had completed higher education (tertiary level) in 2022,<sup>37</sup> future studies should assess the validity of BackS-BR content in less educated populations before its implementation within the Brazilian Unified Health System. Also, because it was designed as a cross-sectional study with test-retest and no intervention was applied, we could not assess BackS-BR responsiveness and Minimal Important Change. Future studies should consider these measurement properties to determine BackS-BR's sensitivity to change and determine measurement error interpretation.

#### Conclusion

The BackS was successfully translated and cross-culturally adapted into Brazilian-Portuguese and proved to have adequate measurement properties. BackS-BR is a valid and reliable PROM easy to understand and administrate, and it is recommended for research and clinical purposes.

#### Declaration of competing interest

None.

#### Acknowledgements

The authors would like to thank Professor Peter Petocz (statistician at Macquarie University), Professor Wieneke Mokkink (founder of the COSMIN initiative), and Guilherme de Arruda (PhD candidate supervised by Professor Wieneke Mokkink) for their consultation and advice on the analysis plan for this manuscript. We also thank the translators Gustavo Telles, Thatiane Oliveira, Phillip Kesler, and Charles Kesler, and all participants involved in this study for their contribution. We acknowledge Mrs Lidia Corrêa (Brazilian Portuguese language teacher) for grammar revision of the BackS-BR final version. This work was supported by an International Macquarie University Research Excellence Scholarship (iMQRES) and Macquarie University Postgraduate Research Fund (PGRF) grant for LC.

#### Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.bjpt.2026.101600](https://doi.org/10.1016/j.bjpt.2026.101600).

#### References

1. Collaborators GBDLBP. Global, regional, and national burden of low back pain, 1990-2020, its attributable risk factors, and projections to 2050: a systematic analysis of the Global Burden of Disease Study 2021. *Lancet Rheumatol.* 2023;5(6): e316–e329. [https://doi.org/10.1016/S2665-9913\(23\)00098-X](https://doi.org/10.1016/S2665-9913(23)00098-X). Jun.
2. Henschke N, Kamper SJ, Maher CG. The epidemiology and economic consequences of pain. *Mayo Clinic Proceed.* 2015;90(1):139–147. <https://doi.org/10.1016/j.mayocp.2014.09.010>. Jan.
3. Ferreira G, Costa LM, Stein A, Hartvigsen J, Buchbinder R, Maher CG. Tackling low back pain in Brazil: a wake-up call. *Br J Phys Therapy.* 2019;23(3):189–195. <https://doi.org/10.1016/j.bjpt.2018.10.001>. May - Jun.
4. Kamper SJ, Apeldoorn AT, Chiarotto A, et al. Multidisciplinary biopsychosocial rehabilitation for chronic low back pain: Cochrane systematic review and meta-analysis. *BMJ.* 2015;350(5):h444. <https://doi.org/10.1136/bmj.h444>, 2015-02-18feb18-h444.
5. Oliveira CB, Maher CG, Pinto RZ, et al. Clinical practice guidelines for the management of non-specific low back pain in primary care: an updated overview. *Eur Spine J.* 2018;27(11):2791–2803. <https://doi.org/10.1007/s00586-018-5673-2>. Nov.
6. National Guideline Centre. *Low Back Pain and Sciatica in Over 16s: Assessment and Management*. London UK: National Institute for Health and Care Excellence; 2016. <https://www.nice.org.uk/guidance/ng59>.

7. Qaseem A, Wilt TJ, McLean RM, et al. Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline From the American College of Physicians. *Ann Intern Med.* 2017;166(7):514–530. <https://doi.org/10.7326/M16-2367>. Apr 4.
8. Australian Commission on Safety and Quality in Health Care. *Low Back Pain Clinical Care Standard*. Sydney: ACSQHC; 2022.
9. Kongsted A, Ris I, Kjaer P, Hartvigsen J. Self-management at the core of back pain care: 10 key points for clinicians. *Revista Brasileira De Fisioterapia.* 2021;25(4):396–406. <https://doi.org/10.1016/j.bjpt.2021.05.002>.
10. Lin I, Wiles L, Waller R, et al. What does best practice care for musculoskeletal pain look like? Eleven consistent recommendations from high-quality clinical practice guidelines: systematic review. *Br J Sports Med.* 2020;54(2):79–86. <https://doi.org/10.1136/bjsports-2018-099878>. Jan.
11. Ibsen C, Schiøttz-Christensen B, Maribo T, Nielsen CV, Hørder M, Handberg C. Keep it simple<sup>®</sup>: Perspectives of patients with low back pain on how to qualify a patient-centred consultation using patient-reported outcomes. *Musculoskeletal Care.* 2019;17(4):313–326. <https://doi.org/10.1002/msc.1417>, 2019-12-01.
12. Symonds TL, Burton AK, Tillotson KM, Main CJ. Do attitudes and beliefs influence work loss due to low back trouble? *Occupational Med (Oxford, England).* 1996;46(1):25–32. <https://doi.org/10.1093/occmed/46.1.25>. Feb.
13. Maciel SC, Jennings F, Jones A, Natour J. The development and validation of a Low Back Pain Knowledge Questionnaire - LKQ. *Clinics.* 2009;64(12):1167–1175. <https://doi.org/10.1590/S1807-59322009001200006>.
14. Corrêa LA, Mathieson S, Hancock M, et al. Questionnaires assessing knowledge and beliefs about musculoskeletal conditions are potentially suitable for use, but further research is needed. *J Clin Epidemiol.* 2024;172:111398.
15. Correa LA, Hancock M, Mathieson S, et al. Back pain Knowledge and beliefs Survey (BackS): development and assessment of measurement properties. *Br J Sports Med.* 2024;58(23):1426–1433. <https://doi.org/10.1136/bjsports-2024-108364>. Dec 2.
16. French SD, Nielsen M, Hall L, et al. Essential key messages about diagnosis, imaging, and self-care for people with low back pain: a modified Delphi study of consumer and expert opinions. *Pain.* 2019;160(12):2787–2797. <https://doi.org/10.1097/j.pain.0000000000001663>. Dec.
17. Costa LOP, Maher CG, Latimer J. Self-report outcome measures for low back pain: searching for international cross-cultural adaptations. *Spine.* 2007;32(9):1028–1037. <https://doi.org/10.1097/01.brs.0000261024.27926.0f>.
18. Maher CG, Latimer J, Costa LOP. The relevance of cross-cultural adaptation and clinimetrics for physical therapy instruments. *Br J Phys Therapy.* 2007;11(4):245–252. <https://doi.org/10.1590/s1413-35552007000400002>, 2007-08-01.
19. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine.* 2000;25(24):3186–3191. <https://doi.org/10.1097/00007632-200012150-00014>.
20. Mokkink LB, Prinsen CA, Patrick DL, et al. COSMIN Study Design checklist for Patient-reported outcome measurement instruments. Amsterdam, The Netherlands. 2019:1-32.
21. Mokkink LB, Terwee CB, Patrick DL, et al. The COSMIN study reached international consensus on taxonomy, terminology, and definitions of measurement properties for health-related patient-reported outcomes. *J Clin Epidemiol.* 2010;63(7):737–745. <https://doi.org/10.1016/j.jclinepi.2010.02.006>. Jul.
22. Terwee CB, Bot SD, de Boer MR, et al. Quality criteria were proposed for measurement properties of health status questionnaires. *J Clin Epidemiol.* 2007;60(1):34–42. <https://doi.org/10.1016/j.jclinepi.2006.03.012>. Jan.
23. Prinsen CAC, Mokkink LB, Bouter LM, et al. COSMIN guideline for systematic reviews of patient-reported outcome measures. *Qual Life Res.* 2018;27(5):1147–1157. <https://doi.org/10.1007/s11136-018-1798-3>. May.
24. Terwee CB, Prinsen CAC, Chiarotto A, et al. COSMIN methodology for evaluating the content validity of patient-reported outcome measures: a Delphi study. *Qual Life Res.* 2018;27(5):1159–1170. <https://doi.org/10.1007/s11136-018-1829-0>. May.
25. Mokkink LB, de Vet HCW, Prinsen CAC, et al. COSMIN Risk of Bias checklist for systematic reviews of Patient-Reported Outcome Measures. *Qual Life Res.* 2018;27(5):1171–1179. <https://doi.org/10.1007/s11136-017-1765-4>. May.
26. Teixeira LF, Diz JBM, da Silva SLA, et al. Cross-cultural adaptation, validity and reproducibility of the Back Beliefs Questionnaire among older Brazilians with acute low back pain. A cross-sectional study. Article. *Sao Paulo Medical Journal.* 2020;138(4):287–296. <https://doi.org/10.1590/1516-3180.2019.0542.R2.16042020>. Jul-Aug.
27. Brown TA. *Confirmatory factor analysis for applied research*. 2nd edn. The Guilford Press; 2006. ed.
28. Neath AA, Cavanaugh JE. The Bayesian information criterion: background, derivation, and applications. *Wiley Interdiscip Rev.* 2012;4(2):199–203. <https://doi.org/10.1002/wics.199>.
29. Sclove SL. Application of model-selection criteria to some problems in multivariate analysis. *Psychometrika.* 1987;52(3):333–343. <https://doi.org/10.1007/bf02294360>, 1987-09-01.
30. Gregorich SE. Do self-report instruments allow meaningful comparisons across diverse population groups? *Med Care.* 2006;44(3):S78–S94. <https://doi.org/10.1097/01.mlr.0000245454.12228.8f>, 2006-11-01Suppl.
31. Putnick DL, Bornstein MH. Measurement invariance conventions and reporting: the state of the art and future directions for psychological research. *Dev Rev.* 2016;41:71–90. <https://doi.org/10.1016/j.dr.2016.06.004>, 2016-09-01.
32. Chen FF. Sensitivity of Goodness of Fit Indexes to Lack of Measurement Invariance. *Struc Eq Model.* 2007;14(3):464–504. <https://doi.org/10.1080/10705510701301834>.
33. de Vet HCW, Terwee CB, Mokkink LB, Knol DL. *Reliability. Measurement in Medicine: A Practical Guide*. Cambridge University Press; 2011:96–149. *Practical Guides to Biostatistics and Epidemiology*.
34. Gagnier JJ, Lai J, Mokkink LB, Terwee CB. COSMIN reporting guideline for studies on measurement properties of patient-reported outcome measures. *Qual Life Res.* 2021;30(8):2197–2218. <https://doi.org/10.1007/s11136-021-02822-4>. Aug.
35. Vandenberg RJ, Lance CE. A review and synthesis of the measurement invariance literature: suggestions, practices, and recommendations for organizational research. *Org Res Methods.* 2000;3(1):4–70. <https://doi.org/10.1177/109442810031002>.
36. Patel H, Shepherd TA. Online health information-seeking behaviours for low back pain in the United Kingdom: analysis of data from Google trends and the Global Burden of Disease Study, 2004–2019. *Int Health.* 2024. <https://doi.org/10.1093/inthealth/ihae020>, 2024-02-23.
37. IBGE. 2022 Census: proportion of population with complete higher education increases from 6.8% in 2000 to 18.4% in 2022. <https://agenciadenoticias.ibge.gov.br/en/agencia-news/2184-news-agency/news/42748-2022-census-proportion-of-population-with-complete-higher-education-increases-from-6-8-in-2000-to-18-4-in-2022>.