



Brazilian version of the King's Health Questionnaire: assessment of the structural validity and internal consistency in female urinary incontinence

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Received: 15 January 2022 / Accepted: 3 March 2022
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Abstract

Introduction and hypothesis The use of valid patient-reported outcome measurements is essential in clinical and research settings. The structure of the Brazilian version of the King's Health Questionnaire (Br-KHQ) has not been evaluated. Thus, this study sought to evaluate the structural validity and internal consistency of the multi-item domains of the Br-KHQ in women with urinary incontinence (UI).

Methods A total of 462 Brazilian Portuguese speakers with UI aged 18 years or older were included in this study. Participants answered the Br-KHQ, and a questionnaire containing demographic and personal information. The structure of the Br-KHQ was examined through Exploratory Factor Analysis (EFA) with the implementation of parallel analysis and evaluated using confirmatory factor analysis (CFA). For the latter, several goodness-of-fit indices were considered to evaluate the model fit of the structures tested in this study. Internal consistency was assessed using Cronbach's alpha, composite reliability, and coefficient omega.

Results The EFA showed that the questionnaire has a five-factor structure, i.e., limitations of daily life, personal relationship, emotions, sleep/energy, and severity measures. The CFA demonstrated that this structure presented the most adequate goodness-of-fit indices and the lowest values of Akaike information criterion and Bayesian information criterion, compared with the original and Portuguese structure. High values (>0.70) of internal consistency were found.

Conclusions The Brazilian version of the KHQ is composed of a five-factor structure. Further studies should evaluate other measurement properties of the Br-KHQ to ensure reliable interpretation of this patient-reported outcome measure in clinical practice.

Keywords Patient-reported outcome measures · Pelvic floor disorders · Quality of life · Urinary incontinence · Women's health

Introduction

Urinary incontinence (UI) is a worldwide, common, chronic condition in adult women, with a prevalence of 29% [1]. Usually, UI requires long-term management and has a significant negative impact on health-related quality of life (HR-QoL) and mental health (e.g., poor self-esteem, feelings of frustration, increased anxiety, and development of depression). Also, the adverse effect of UI on women can seriously affect QoL by forcing them to alter their daily (i.e., social, physical, and occupational) and sexual activities [2, 3]. Thus, UI represents a public health problem, with a high cost for individuals and society.

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Over the years, assessing the QoL of patients with UI has become as important as the objective assessment [3, 4]. Thus, the evaluation of QoL using patient-reported outcome measures (PROMs; i.e., questionnaires) in clinics, outpatient environments, inpatient settings, and research constitutes a valuable source of information for health care professionals (i.e., physiotherapists, urogynecologists, nurses, and other health professionals who care for pelvic floor disorders), as well as researchers [5]. Several PROMs have been developed to assess the impact of UI on QoL [3], and one of the most widely used in research is the King's Health Questionnaire (KHQ). The KHQ is a disease-specific, self-administered questionnaire explicitly designed to assess the impact of UI on QoL [2]. It is a simple, acceptable, and reliable measure to use in the clinical setting and a useful research tool in evaluating UI treatment outcomes [6].

It is well known that research performed with PROMs of poor or unknown measurement properties constitutes a waste of resources [5, 7]. Selecting the best PROM for the outcome of interest (e.g., QoL) in a methodologically sound way requires high-quality studies on the measurement properties of relevant PROMs in the target population [5]. In this sense, the recent systematic review by Wuytack et al. [3] showed that the methodological quality of some measurement properties (structural validity, cross-cultural validity, and measurement error) of the KHQ were rated as adequate, doubtful, or not even tested, with the quality rating of the measurement properties rated as indeterminate. Therefore, this report showed the need to study these measures with high methodological quality.

As far as we know, the structural validity of the Brazilian version of the King's Health Questionnaire (Br-KHQ) has not been evaluated [3, 8, 9]. Although there is a previous hypothesis of multidimensionality (i.e., nine-factor structure, including two single-item domains and seven multi-item domains) of the KHQ [2], three recent studies [10–12] showed that the questionnaire has a structure with fewer factors for patients with UI. The Turkish [10] and the Portuguese versions [11] (note: Portuguese version for Portugal) found a structure composed of three factors, and the Polish version [12], four factors. Both studies used the principal component method to extract the structure of the KHQ, which is not the most recommended method for reflective models (i.e., constructs) [5, 13]. Furthermore, none of these studies assessed the validity of the extracted structure using confirmatory factor analysis (CFA), which is one of the accepted methods for evaluating the factor structure of reflective PROMs. Moreover, one issue applying to CFA is that single-item domains cannot be evaluated because of the minimum number of free parameters required to perform the analysis [14].

Thus, the main aim of the present study was to evaluate, using the classical test theory (CTT), the structural validity

and internal consistency of the multi-item domains of the Br-KHQ. Therefore, the study addressed the following research questions:

1. Is the multidimensionality hypothesis of the seven-factor structure of the original questionnaire appropriate for the Br-KHQ?
2. What is the most suitable structure for the Br-KHQ?
3. Is the internal consistency of the most suitable structure of the Br-KHQ acceptable?

Our hypothesis is that the Br-KHQ will not present seven factors equal to the original version [2] based on recent studies [10–12]. We also hypothesized that the most suitable structure would be the one extracted in this study, thus showing excellent goodness-of-fit indices and acceptable internal consistency.

Materials and methods

Design

This study included measurement properties using cross-sectional data from previous studies. The measurement theories of measuring instruments that are used in this study followed guidelines [5, 15, 16] and are in accordance with the “COnsensus-based Standards for the selection of health Measurement INstruments” (COSMIN) [13], which outlines best practices for conducting systematic reviews of measurement properties of PROMs.

Participants

The sample consists of 794 women from previous studies [17–20], the studies were conducted in accordance with the Declaration of Helsinki, and all participants provided their written informed consent before entering each study. The Human Ethics Committee of the Federal University of São Carlos approved the studies by the registration processes #42677115.5.0000.5504, #0015.0.135.000-08, #50229415.9.0000.5504, and #79893917.1.0000.5504.

Outcomes and data collection

Collected outcome measures used in this study include the Br-KHQ [9], and demographic and personal information. The KHQ consists of two parts and 30 items [2, 9]. The first part is composed of 20 items investigating nine domains with four to five response categories on a Likert scale [2]. There are two single-item questions that address general health perception (GHP) and incontinence impact (II). The following seven multi-item domains are: role, physical, and

social limitations (RL, PL, and SL; 2 items each), personal relationships, and emotions (PR and E; 3 items each), sleep and energy disturbances associated with UI (SE; 2 items), and severity measures for UI (SM; 4 items). The second part is a ten-item Symptom Severity Scale (SSS) that assesses the presence and severity of urinary symptoms. The KHQ is scored by domain, ranging from 0 (best QoL) to 100 (worst QoL). At the same time, the SSS is scored by adding the ten items, thus ranging from 0 (best) to 30 (worst) [2]. The items included in the Br-KHQ and their English version are provided in Table S1 of Supplementary Materials; as well as the algorithm to calculate the scores of each domain of these two versions.

All participants were asked to answer a questionnaire containing demographic and personal information, including age, education, income, marital status, and type of UI (stress, urgency, and mixed). Weight and height were also objectively measured.

Data analysis

Descriptive statistics

Descriptive data summaries are presented using absolute number and percentage or mean and standard deviation. In addition, the response distributions, missing responses, and the correlation matrix are shown for each item of the scale as descriptive data.

Exploratory factor analysis

To examine the factor structure of the Br-KHQ of our sample, an EFA was implemented [5]. Only the multi-item domains were included in this analysis (i.e., the single-item domains GPH and II were not included in the EFA or CFA; as well as the SSS that measures the presence and severity of specific symptoms). The factorability of the data set for EFA was evaluated based on Bartlett's test of sphericity based on a criterion of $p < 0.05$, and the Kaiser–Meyer–Olkin (KMO) statistic of sampling adequacy based on a criterion of ≥ 0.80 [16].

Through EFA, the factor structure was explored with the implementation of a polychoric correlation matrix and the minimum rank factor analysis (MRFA) extraction method [21], and the solution for the factors was examined using the direct oblimin (oblique) rotation to ensure independence of the items. We identified the number of factors to be retained through parallel analysis with a random permutation of the observed data. This method is considered robust and reliable [16, 21]. Additionally, a simpler and less accurate approach was used: the Kaiser eigenvalue-over-one criterion [15, 16].

To the best of our knowledge, there is no clear consensus on the criteria for item deletion or retention [15, 16]. Therefore, items with factor loading < 0.32 ; communalities < 0.35 ;

cross-loadings < 0.15 in difference from the highest factor loading among an item will be considered candidates for deletion [15, 16]. It is noteworthy that care has been taken in applying all of these criteria, as EFA is an interactive, multi-step process. Moreover, the highest factor load was used to decide whether an item loaded on a specific factor.

Confirmatory factor analysis

The structural validity of the factor structure extracted during EFA was evaluated using CFA [13]. The CFA was performed with the implementation of a polychoric matrix and the robust diagonally weighted least squares (RDWLS) extraction method [22]. Considering that the Br-KHQ is a Likert-type questionnaire (1 to 4 points), the use of RDWLS is more suitable for ordinal data than other extraction methods (e.g., maximum likelihood) [22]. The model fit of the factor structure was evaluated using several indices: Pearson's Chi-squared test; Chi-squared divided by the degree of freedom (Chi-squared/df ratio; < 3.00 is adequate, < 5.00 is acceptable); the comparative fit index (CFI) and the Tucker–Lewis index (TLI; > 0.90 is acceptable, > 0.95 is excellent); the root mean square error of approximation with the 90% confidence interval (RMSEA; < 0.08 is acceptable, < 0.06 is excellent); and the standardized root mean square residual (SRMR; < 0.08 is acceptable) [16, 23]. Additionally, the Akaike information criterion (AIC) and the Bayesian information criterion (BIC) were considered to compare the structures tested in this study (see the description below), and the lowest value was considered the most appropriate [16, 23]. Factor loads greater than or equal to 0.40 were considered adequate for the domain.

The structure extracted by EFA (i.e., the Brazilian structure) was compared with the original structure [2] with seven-factor and with the Portuguese structure [11] with three-factor. The Turkish [10] and Polish [12] structures were not tested because the items of each domain of these constructs could not be defined. The evaluation of the structures involved checking the quality of the goodness-of-fit indices. In addition, the standardized residual covariance matrix and the modification indices of the structures were verified. Thus, theoretical decisions could be made on item deletion or retention based on the standardized residual covariance matrix and the modification indices, to identify which items of the structure extracted by EFA would be more likely to represent the Br-KHQ concepts [16, 23].

Internal consistency

Internal consistency of the final structure score was evaluated using Cronbach's alpha (α) [5], the composite reliability (CR) [24] and coefficient omega (i.e., hierarchical omega;

McDonald's ω_h) [25]; higher values (> 0.70) were indicative of acceptable internal consistency.

Finally, all analyses were performed using the software R v4.1.1 [26] using “*psych*” v2.1.6 [27] and “*lavaan*” v0.6-9 [14] packages.

Results

Characteristics of respondents

Among the 794 study participants, 20 had missing responses, corresponding to 2.5% of the entire sample, and 312 ticked the response option not applicable to one or more items of the PR domain. Therefore, these individuals were excluded. Thus, in the end, 462 participants provided data that were used in the analysis. The women had a mean age of 41.2 years (SD 16.1) and had a mean BMI of 26.9 (SD 5.6) kg/m². The complete characteristics of the participants are presented in Table 1. In addition, the descriptive data and response distribution of the items are shown in Table S2 and S3 of Supplementary Materials, as well as the distribution

Table 1 Demographic and social characteristic of the sample, $N = 462$

	Mean (SD) or n (%)
Age (years)	41.2 (16.1)
Weight (kg) ^a	69.1 (13.7)
Height (m) ^a	1.62 (0.07)
Body mass index (kg/m ²) ^a	26.9 (5.6)
Education, $n = 330$	
No school education	4 (1)
Secondary	27 (8)
High school	183 (55)
University	116 (35)
Income (month; US\$), $n = 226$	
<\$150	7 (3)
>\$150 <\$400	36 (16)
>\$500	63 (28)
>\$1,000 <\$2,000	66 (29)
\$2,000 <\$4,000	43 (19)
>\$4,000	9 (5)
Marital status, $n = 265$	
Single	123 (46)
Married/stable union	142 (54)
Type of urinary incontinence	
Stress	253 (55)
Urgency	202 (44)
Mixed	164 (35)

SD standard deviation

^aObjectively measured

of responses for each item after removing the single-item domains (GHP and II), missing data, and non-applicable responses from the PR domain in Table S4 of Supplementary Materials. Finally, the correlation matrix for each item of the questionnaire is presented in Table S5 of Supplementary Materials.

Exploratory factor analysis

The data set met the assumptions to proceed with the EFA. The Bartlett's test of sphericity yielded significant results, Chi-squared (153) = 7,655.50, $p < 0.001$, and the KMO test yielded a statistic of 0.83 (ranging from 0.56 to 0.97 between items). The parallel analysis (robust approach; Fig. 1, left panel) that determined the number of factors to be extracted showed support for a five-factor structure. The Kaiser eigenvalue-over-one criterion method (the most simple and most common approach; Fig. 1, right panel) showed that the data contain four factors with eigenvalues greater than 1 (note: the fifth factor was borderline close to 1).

The factor loads and communalities for the 18 items of the questionnaire are shown in Table 2. The five-factor structure accounts for 74% of the total variance. In general, the items had factor loadings ranging from 0.52 to 0.96 and communalities ranging from 0.36 to 0.92—all above the pre-specified criteria. The exceptions were item 4d, which presented cross-loading < 0.15 in difference from the highest factor loading, and item 8b, which demonstrated low values of communality (0.22). As previously mentioned, EFA is an interactive and multi-step process. Therefore, the entire analysis was redone without item 4d, then without item 8b, and finally without both items. The same results of a construct with a five-factor structure were confirmed in this analysis (data not shown). Thus, the structure without items 4d and 8b extracted by EFA was used in the following analyses.

Confirmatory factor analysis

The goodness-of-fit indices for all structures assessed in the study are shown in Table 3. Fit indices of the structure extracted by EFA (see the Brazilian structure in Table 3) demonstrated excellent fit on all indices. Inspection of the standardized residual covariance matrix and the modification indices of this model showed slight within-item error. In this sense, any modification in the structure would improve neither model fit nor factor loadings. The parameter estimates of the Brazilian structure had moderate to high factor loadings (i.e., > 0.50) for all items (Fig. 2). The factor loadings (i.e., standardized coefficients) and associated data of the Brazilian structure are presented in Table S6 of Supplementary Materials.

The original structure with seven factors also showed excellent fit on all indices. However, an inspection of the

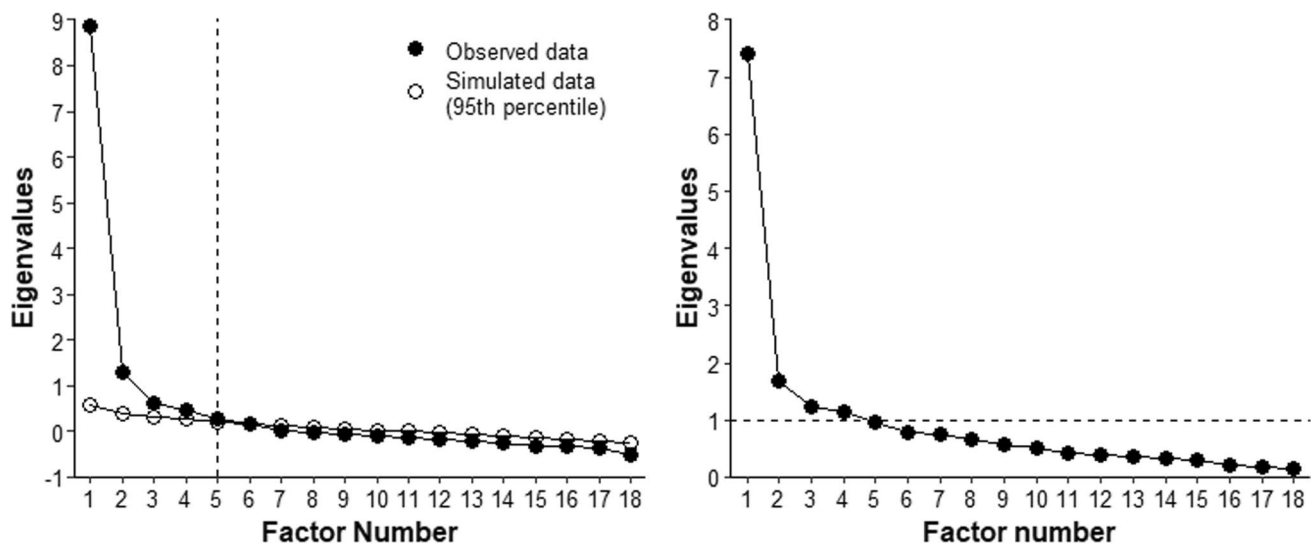


Fig. 1 Parallel analysis (*left panel*) and the Kaiser eigenvalue-over-one (*right panel*). For the parallel analysis, the five-factor structure is shown by the *vertical black dashed line* (of note: factors above the line of the simulated data [95th percentile] indicate the number

of factors in the construct). Scree plot of the Kaiser eigenvalue-over-one criterion is shown by the *horizontal black dashed line* (of note: the four-factor structure is shown by the fourth factor [x-axis] slightly above the dashed line)

modification indices suggests that some items of this structure have high standardized residual covariances with several other items. Thus, covarying within-item error among these items would significantly improve the model fit, although covarying subfactor item errors are not recommended. Furthermore, most of the fit indices of the Portuguese structure were not acceptable, except for CFI and TLI. Comparing AIC and BIC statistics among the structures revealed that the Brazilian structure demonstrated a superior fit (i.e., lower values; Table 3).

Internal consistency

Internal consistency measured using Cronbach's alpha was 0.91 for the total score of the Br-KHQ. The α for each dimension ranged from 0.71 to 0.89 (Table 4). Additionally, we presented other reliability estimates (CR and ω_h) to allow future comparisons with other studies. Those other estimates also presented evidence for strong internal consistency.

The final version of the Br-KHQ is shown in Appendix Table 5; we also presented the new algorithm to calculate the score of each domain.

Discussion

This is, to our knowledge, the first study to examine and evaluate, through EFA and CFA, the factor structure and structural validity of the Br-KHQ in a sample of women with urinary incontinence. Based on EFA, we found that the Br-KHQ has a five-factor structure—limitations of daily life,

personal relationship, emotions, sleep/energy, and severity measures—which accounts for 74% of the total variance. In addition, items 4d and 8b did not meet the retention criteria pre-specified a priori, being excluded from the questionnaire. The CFA showed that the Brazilian structure (i.e., structure extracted by EFA without items 4d and 8b) had an excellent fit on all measured indices. The Br-KHQ also exhibited excellent internal consistency for the whole scale and for each dimension. Therefore, our hypothesis that the Br-KHQ would not present seven factors equal to the original version [2] and that the most suitable structure would be the one extracted in this study, showing excellent goodness-of-fit indices and acceptable internal consistency, was confirmed.

Unlike our study, the exploratory analysis of the factor structure of the Portuguese [11] and Turkish [10] versions showed that the KHQ had a three-factor structure. In contrast, the Polish [12] version showed a structure with four factors. This difference in the number of factors may have occurred because of the extraction method used in the studies, which was the principal component. However, according to COSMIN, this extraction method is not the most frequently recommended method for reflective constructs [5, 13]. In addition, the structures of the Turkish and Polish versions had items loaded in more than one domain (i.e., cross-loading), which made it difficult to distinguish the domains from the constructs and which item constituted each domain. Furthermore, our five-factor structure explained 74% of the total variance of the questionnaire, whereas the Turkish [10], Polish [12],

Table 2 Factor loads and communalities of the exploratory factor analysis assuming five-factor structure and percentage of total variance of each factor (% of variance)

Original dimensions	Item	Factor loading and new dimension names					Com
		Limitations of daily life	Personal relationship	Emotions	Sleep/energy	Severity measures	
RL	3a	0.80	0.08	-0.21	0.04	0.22	0.83
RL	3b	0.89	-0.04	0.10	0.01	0.03	0.89
PL	4a	0.54	0.09	0.09	-0.05	0.17	0.53
PL	4b	0.86	0.10	0.01	0.10	-0.08	0.86
SL	4c	0.89	-0.06	0.15	-0.03	0.02	0.88
SL	4d	0.51	<u>0.42</u>	0.05	0.00	0.01	0.71
PR	5a	0.03	0.92	-0.06	0.02	0.07	0.88
PR	5b	-0.03	0.88	0.07	0.04	0.06	0.89
PR	5c	0.13	0.66	0.37	-0.03	-0.23	0.84
E	6a	0.09	0.20	0.64	0.03	0.19	0.84
E	6b	0.23	0.09	0.61	0.11	0.15	0.84
E	6c	0.07	0.17	0.62	0.09	0.21	0.81
SE	7a	0.23	-0.14	0.07	0.75	-0.08	0.68
SE	7b	-0.10	0.08	-0.02	0.96	0.06	0.92
SM	8a	0.14	0.09	0.00	-0.10	0.52	0.36
SM	8b	0.34	0.07	-0.29	0.22	0.05	0.22
SM	8c	0.08	0.05	0.05	0.00	0.71	0.62
SM	8d	0.05	-0.02	0.17	0.14	0.76	0.82
Percentage of variance		25	16	12	10	11	

The factorial loads in bold indicate which factor each item initially loaded

The underlined values indicate cross-loadings < 0.15 in difference from the highest factor loading among an item

The factor loads and communalities in italics indicate values below the pre-specified criterion (i.e., factor loading < 0.32; communalities < 0.35)

The factor solution was rotated using Oblimin (oblique) rotation as correlations between factors were expected

Com communalities, *RL* role limitations, *PL* physical limitations, *SL* social limitations, *PR* personal relationship, *E* emotions, *SE* sleep/energy, *SM* severity measures

Table 3 Adjustment indices of adequacy of the confirmatory factor analysis

Fit indices	Structures		
	Brazilian	Original	Portuguese
Chi-squared	167.987	274.737	927.564
df	94	114	132
Chi-squared/df ratio	1.787	2.410	7.027
CFI	0.993	0.985	0.928
TLI	0.991	0.980	0.916
RMSEA [90% CI]	0.041 [0.031; 0.051]	0.055 [0.047; 0.064]	0.114 [0.107; 0.121]
SRMR	0.039	0.051	0.106
AIC	15,557.900	17,477.780	18,264.510
BIC	15,731.590	17,713.510	18,425.790

Brazilian structure: five factors extracted by EFA without items 4d and 8b

Original structure: seven factors with 18 items

Portuguese structure: three factors with 18 items

df degree of freedom, *CFI* comparative fit index, *TLI* Tucker-Lewis index, *RMSEA* root mean square error of approximation, *CI* confidence interval, *SRMR* standardized root mean square residual, *AIC* Akaike information criterion, *BIC* Bayesian information criterion

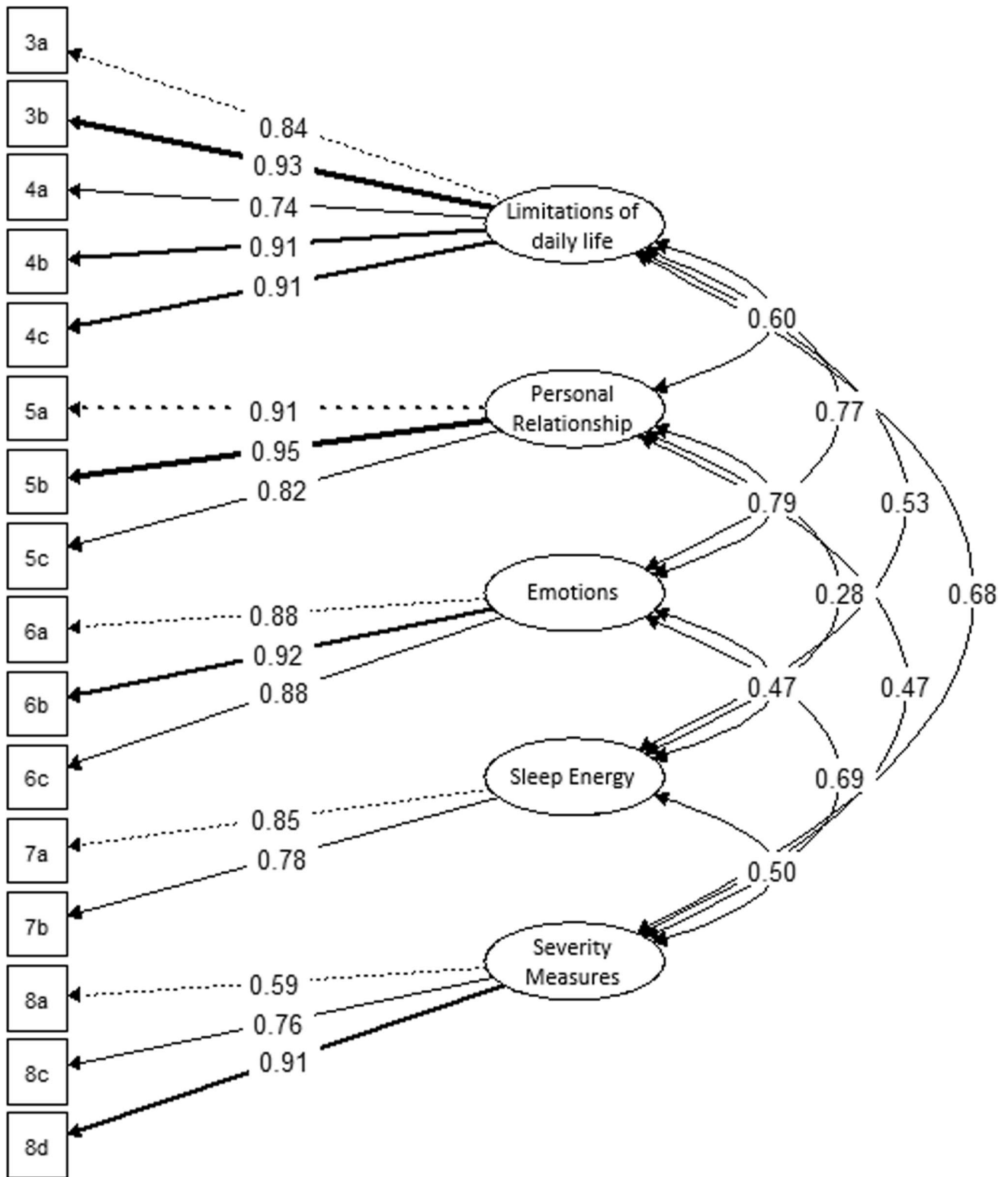


Fig. 2 Correlations between latent variables and factor loadings for each item of the final structure with five factors of the Brazilian version of King's Health Questionnaire. Latent variables are represented

by ellipses; measured variables are represented by squares; error is not shown but was specified for all variables (see Table S6 of Supplementary Materials)

and Portuguese [11] versions of the KHQ explained only 64%, 66%, and 68% of the total variance.

Regarding structural validity, we used the CFA, one of the accepted methods for evaluating the factor structure of reflective PROMs such as Br-KHQ [5, 13]. Thus, to our knowledge, no study has conducted CFA to assess the validity of the KHQ structure of patients with UI, except for that by Homma and Uemura [28], who tested a short-form of the KHQ with a second-order factor structure in patients with overactive bladder; even so, this study had a different objective and population than ours. The CFA results evaluated using the goodness-of-fit indices showed that the Brazilian structure presented better fit indices (i.e., Chi-squared/df < 3.00, CFI > 0.95, TLI > 0.95, RMSEA < 0.06, SRMR < 0.08, and lower values of AIC and BIC) than the original and Portuguese structure (see Table 3). Even the original structure showing optimal fit indices—except for AIC and BIC—by checking the standardized residual covariance matrix and the modification indices, some items had high standardized residual covariances with several other items, suggesting that the structure has some problems.

The internal consistency among the KHQ (i.e., original, Turkish, Portuguese, and Polish) versions was similar to that found in this study (α ranged between 0.71 and 0.89; see Table 4). In addition, the original [2] version had an internal consistency ranging between 0.72 and 0.89, the Turkish [10] ranged between 0.68 and 0.83, the Portuguese [11] ranged between 0.72 and 0.91, and the Polish [12] had an overall Cronbach's alpha of 0.93. Thus, all of them were considered excellent. Besides the α , we also presented the composite reliability and coefficient omega, which allows future comparisons with other studies.

Strengths and limitations

The strengths of the present study are the use of an adequate sample size to analyze structural validity; use of data analysis according to the COSMIN consensus [13]; and use of a polychoric correlation matrix in polytomous

Table 4 Internal consistency of the Brazilian version of the King's Health Questionnaire dimensions

	Limitations of daily life	Personal relationship	Emotions	Sleep/energy	Severity measures
α	0.89	0.83	0.87	0.72	0.71
CR	0.94	0.92	0.92	0.80	0.81
ω_h	0.89	0.86	0.87	0.72	0.74

α Cronbach's alpha, CR composite reliability, ω_h coefficient omega

data [21, 22]. Additionally, there were only a small number of missing values in the dataset, which means that the response rate was high. However, there are some limitations to this study. First, we collected data from a convenience sample through the voluntary participation. Thus, these participants may limit the generalizability of the results; another limitation is that voluntary participation hardly provides the assessment of a large proportion of women with worse QoL due to more severe UI, such as those observed in tertiary centers. However, we still included a very diverse sample, composed of subjects with QoL scores ranging from 0 (best) to 100 (worst) and, therefore, the study has wide external validity. In addition, in this study, we only included women with UI, which limits the use of this validated structure for male patients. These limitations notwithstanding, our study contributes to research in pelvic floor health owing to the high methodological quality and the validation of the KHQ structure in a population of women with UI.

Future directions

Finally, future studies should evaluate other measurement properties of the Br-KHQ, such as cross-cultural validity/measurement invariance, reliability, measurement error, criterion validity, hypothesis testing for construct validity, and responsiveness [13]. We also suggest that future studies should apply item response Theory to obtain item-level information for each dimension of the KHQ and thus refine the questionnaire, leaving only those items that measure the lower end to the upper end of the QoL continuum (i.e., the entire latent trait of QoL) [29]. Furthermore, we recommend that the KHQ structure validated in this study should be tested in other languages using CFA and that the use of polychoric correlation matrix and coherent extraction methods for ordinal data should be considered [3, 21, 22, 30].

Conclusions

The present study showed that the Br-KHQ is composed of a structure of five factors: limitations of daily life, personal relationship, emotions, sleep/energy, and severity measures. Despite evaluating only structural validity and internal consistency, this study is the first to report a valid structure of the KHQ. Further studies should evaluate other measurement properties of Br-KHQ, to ensure reliable interpretation of this PROM in clinical practice, as well as to assess cross-cultural validity/measurement invariance to ensure comparability with other countries.

Appendix

Table 5 New dimension names, new item names, response option of each item and new algorithm to calculate the score for each domain of the Brazilian version of the King's Health Questionnaire

Item	Brazilian Portuguese	English
	<i>Percepção geral da saúde</i>	<i>General health perception</i>
1	Como você avaliaria sua saúde hoje? Resposta: muito boa; boa; normal; ruim; muito ruim Score = ((score to Q1 - 1) / 4) × 100	How would you describe your health at the present? Response: very good; good; fair; poor; very poor
	<i>Impacto da Incontinência</i>	<i>Incontinence impact</i>
2	Quanto você acha que seu problema de bexiga atrapalha sua vida? Resposta: Não; Um pouco; Mais ou menos; Muito Score = ((Score to Q2 - 1) / 3) × 100	How much do you think your bladder problem affects your life? Response: not at all; a little; moderately; a lot
	<i>Limitações de vida diária</i>	<i>Limitations of daily life</i>
3a	Com que intensidade seu problema de bexiga atrapalha suas tarefas de casa (ex., limpar, lavar, cozinhar, etc.) Resposta: nenhuma; um pouco; mais ou menos; muito	Does your bladder problem affect your household tasks? (e.g., cleaning, shopping, etc.) Response: not at all; slightly; moderately; a lot
3b	Com que intensidade seu problema de bexiga atrapalha seu trabalho, ou suas atividades diárias normais fora de casa como: fazer compra, levar filho à escola, etc.? Resposta: nenhuma; um pouco; mais ou menos; muito	Does your bladder problem affect your job, or your normal daily activities outside the home? Response: not at all; slightly; moderately; a lot
3c	Seu problema de bexiga atrapalha suas atividades físicas como: fazer caminhada, correr, fazer algum esporte, etc.? Resposta: não; um pouco; mais ou menos; muito	Does your bladder problem affect your physical activities (e.g., going for a walk, running, sport, gym, etc.)? Response: not at all; slightly; moderately; a lot.
3d	Seu problema de bexiga atrapalha quando você quer fazer uma viagem? Resposta: não; um pouco; mais ou menos; muito	Does your bladder problem affect your ability to travel? Response: not at all; slightly; moderately; a lot
3e	Seu problema de bexiga atrapalha quando você vai a igreja, reunião, festa? Resposta: não; um pouco; mais ou menos; muito Score = (((Score to Q3a + Q3b + Q3c + Q3d + Q3e) - 5) / 15) × 100	Does your bladder problem limit your social life? Response: not at all; slightly; moderately; a lot
	<i>Relações pessoais</i>	<i>Personal relationship</i>
4a	Seu problema de bexiga atrapalha sua vida sexual? Resposta: não se aplica; nenhuma; um pouco; mais ou menos; muito	Does your bladder problem affect your relationship with your partner? Response: not applicable; not at all; slightly; moderately; a lot
4b	Seu problema de bexiga atrapalha sua vida com seu companheiro? Resposta: não se aplica; nenhuma; um pouco; mais ou menos; muito	Does your bladder problem affect your sex life? Response: not applicable; not at all; slightly; moderately; a lot
4c	Seu problema de bexiga incomoda seus familiares? Resposta: não se aplica; nenhuma; um pouco; mais ou menos; muito If score to Q4a + Q4b + Q4c ≥ 3 Score = (((Score to Q4a + Q4b + Q4c) - 3) / 9) × 100 If one of Q4a, Q4b and Q4c = 0 Score = (((Score to Q4a + Q4b + Q4c) - 2) / 6) × 10 If two of Q4a, Q4b, and Q4c = 0 Score = (((Score to Q4a + Q4b + Q4c) - 1) / 3) × 100 If Q4a + Q4b + Q4c = 0, treat as missing value (Not applicable)	Does your bladder problem affect your family life? Response: not applicable; not at all; slightly; moderately; a lot
	<i>Emoções</i>	<i>Emotions</i>
5a	Você fica deprimida com seu problema de bexiga? Resposta: não; um pouco; mais ou menos; muito	Does your bladder problem make you feel depressed? Response: not at all; slightly; moderately; a lot
5b	Você fica ansiosa ou nervosa com seu problema de bexiga? Resposta: não; um pouco; mais ou menos; muito	Does your bladder problem make you feel anxious or nervous? Response: not at all; slightly; moderately; a lot
5c	Você fica mal com você mesma por causa do seu problema de bexiga? Resposta: não; um pouco; mais ou menos; muito	Does your bladder problem make you feel bad about yourself? Response: not at all; slightly; moderately; a lot

Table 5 (continued)

Item	Brazilian Portuguese	English
	Score = (((Score to Q5a + Q5b + Q5c) - 3) / 9) × 100.	
	Sono/energia	Sleep/energy
6a	Seu problema de bexiga atrapalha seu sono? Resposta: não; às vezes; várias vezes; sempre	Does your bladder problem affect your sleep? Response: never; sometimes; often; all the time
6b	Você se sente desgastada ou cansada? Resposta: não; às vezes; várias vezes; sempre Score = (((Score to Q6a + Q6b) - 2) / 6) × 100	Does your bladder problem make you feel worn out and tired? Response: never; sometimes; often; all the time
	Medidas de gravidade	Severity measures
	Algumas situações abaixo acontecem com você? Se tiver o quanto?	Do you do any of the following? If so how much?
7a	Você usa algum tipo de protetor higiênico como: fralda, forro, absorvente tipo Modess para manter-se seca? Resposta: não; às vezes; várias vezes; sempre	Wear pads to keep dry? Response: never; sometimes; often; all the time
7b	Você precisa trocar sua roupa íntima (calcinha), quando fica molhadas? Resposta: não; às vezes; várias vezes; sempre	Change your underclothes because they get wet? Response: never; sometimes; often; all the time
7c	Você se preocupa em estar cheirando urina? Resposta: não; às vezes; várias vezes; sempre Score = (((Score to Q7a + Q7b + Q7c) - 3) / 9) × 100	Worry in case you smell? Response: never; sometimes; often; all the time
	Escala de sintomas	Symptom severity scale
	Gostaríamos de saber quais são os seus problemas de bexiga e quanto eles afetam você. Escolha da lista abaixo APENAS AQUELES PROBLEMAS que você tem no momento. Quanto eles afetam você?	We would like to know what your bladder problems are and how much they affect you? From the list below choose only those problems that you have at present. Leave out those that don't apply to you
-	Frequência: você vai muitas vezes ao banheiro? Resposta: um pouco; mais ou menos; muito	Frequency: going to the toilet very often Response: a little; moderately; a lot.
-	Noctúria: você levanta a noite para urinar? Resposta: um pouco; mais ou menos; muito	Nocturia: getting up at night to pass urine Response: a little; moderately; a lot
-	Urgência: você tem vontade forte de urinar e muito difícil de controlar? Resposta: um pouco; mais ou menos; muito	Urgency: a strong and difficult to control desire to pass urine Response: a little; moderately; a lot
-	Bexiga hiperativa: você perde urina quando você tem muita vontade de urinar? Resposta: um pouco; mais ou menos; muito	Urge incontinence: urinary leakage associated with a strong desire to pass urine Response: a little; moderately; a lot
-	Incontinência urinária de esforço: você perde urina com atividades físicas como: tossir, espirrar, correr? Resposta: um pouco; mais ou menos; muito	Stress incontinence: urinary leakage with physical activity: e.g., coughing, running Response: a little; moderately; a lot
-	Enurese noturna: você molha a cama à noite? Resposta: um pouco; mais ou menos; muito	Nocturnal enuresis: wetting the bed at night Response: a little; moderately; a lot
-	Incontinência no intercuro sexual: Você perde urina durante a relação sexual? Resposta: um pouco; mais ou menos; muito	Intercourse incontinence: urinary leakage with sexual intercourse Response: a little; moderately; a lot
-	Infecções frequentes: você tem muitas infecções urinárias? Resposta: um pouco; mais ou menos; muito	Waterworks infections Response: a little; moderately; a lot
-	Dor na bexiga: você tem dor na bexiga? Resposta: um pouco; mais ou menos; muito	Bladder pain Response: a little; moderately; a lot
-	Outros: você tem algum outro problema relacionado a sua bexiga? Resposta: um pouco; mais ou menos; muito	Other (please specify) Response: a little; moderately; a lot
	Score = i1 + i2 + i3 + i4 + i5 + i6 + i7 + i8 + i9 + i10	

Scores of each domain range from 0 (best QoL) to 100 (worst QoL). Although the score of the symptom severity scale ranging from 0 (best) to 30 (worst)

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1007/s00192-022-05189-3>.

Acknowledgements The authors gratefully acknowledge the efforts of our participants.

Financial disclaimer None.

Author contributions L.A. Brusaca: conceptualization, methodology, statistical analysis and interpretation of data, writing (original draft preparation, review, and editing), critical revision of the manuscript for important intellectual content, final approval of the version to be published; A.P.R. Rocha: conceptualization, acquisition of data, writing (review and editing), critical revision of the manuscript for important intellectual content, final approval of the version to be published; L. Cardozo: writing (review and editing), critical revision of the manuscript for important intellectual content, final approval of the version to be published; A.B. Oliveira: writing (review and editing), critical revision of the manuscript for important intellectual content, project administration, final approval of the version to be published; P. Driusso: conceptualization, acquisition of data, writing (review and editing), critical revision of the manuscript for important intellectual content, project administration, final approval of the version to be published.

Funding This study was supported by the São Paulo Research Foundation (FAPESP; grant number 2019/25140-6).

Declarations

Ethics of approval statement The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Human Ethics Committee of the Federal University of São Carlos (registration process #42677115.5.0000.5504, #0015.0.135.000-08, #50229415.9.0000.5504, and #79893917.1.0000.5504).

Conflicts of interest The authors declare no conflicts of interest.

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