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ORIGINAL RESEARCH

Psychometric properties of the Brazilian version of the Bournemouth questionnaire for low back pain: validity and reliability

Letícia Bojikian Calixtre[a,*], **Carlos Luques Fonseca**[b], **Bruno Leonardo da Silva Gruninger**[c], **Danilo Harudy Kamonseki**[a,d]

[a] *Physical Therapy Department, Universidade Federal de São Carlos (UFSCar), São Carlos, SP, Brazil*
[b] *Faculdade Anhanguera, Sorocaba, SP, Brazil*
[c] *Faculdade Sudoeste Paulista, Itapetininga, SP, Brazil*
[d] *Universidade Paulista, Sorocaba, SP, Brazil*

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Abstract
Objectives: The Bournemouth Questionnaire is a comprehensive and short form multidimensional instrument developed to evaluate the health status of individuals with low back pain. The objective of this study was to verify the construct validity and the test-retest reliability of the Brazilian version of Bournemouth Questionnaire in individuals with low back pain.
Methods: This is a methodological study that included 65 patients with low back pain. The Brazilian Bournemouth Questionnaire was applied twice, and the test-retest reliability was assessed using intraclass correlation coefficient (ICC), standard error of measurement (SEM), minimum detectable change (MDC), and internal consistency. The construct validity of the Brazilian Bournemouth Questionnaire was assessed using the numeric pain rating scale (NPRS) and also with the following questionnaires: Roland-Morris Questionnaire (RMDQ), Oswestry Disability Index (ODI), and the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36).
Results: The total score of the Brazilian Bournemouth Questionnaire showed ICC of 0.82 (95% CI: 0.72, 0.90), Cronbachś alpha of 0.85, SEM of 5.97, and MDC of 15.54, without evidence of ceiling and floor effects. The total score of the Brazilian Bournemouth Questionnaire was correlated to the NPRS for current (r = 0.64), highest (r = 0.49), and lowest (r = 0.67) pain as well as scores on the RMDQ (r = 0.58), ODI (r = 0.42), and SF-36 (r = −0.58).
Conclusion: The total score of the Brazilian version of the Bournemouth Questionnaire is valid and reliable to be used with patients with low back pain.

* Corresponding author at: Departamento de Fisioterapia, Universidade Federal de São Carlos, Rodovia Washington Luiz, KM 235, São Carlos, SP CEP: 13565-905, Brazil.
E-mail: lecalixtre@gmail.com (L.B. Calixtre).

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Introduction

Low back pain is a common and disabling health condition.[1] The lifetime incidence is about 60% and the first episode incidence in one year ranges from 6.3–15.4%.[2,3] Low back pain is associated with increased economic burden related to work productivity losses, absenteeism, early retirement, and inactivity.[4] The Brazilian healthcare system spent US$ 71.4 million in 2016 for patients with spinal disorders, where low back pain and disk disorders represented 70% of the costs.[5] In the last 30 years, the number of years lived with disability has increased by 79.7%, and it is expected to keep rising according to a previous study.[6]

Low back pain is a complex disorder, which can be influenced by many factors such as cognitive, psychological, social, physical, and lifestyle alterations.[7] These factors may contribute to chronicity, poorer recovery, and prolonged disability.[8] Evaluating low back pain considering all these factors is a difficult and challenging task.[8] Pain intensity, physical functioning health-related quality of life were considered the main core domains to be measured in clinical trials including patients with low back pain.[9]

Assessing disability and functional status using questionnaires and functional scales is important for clinical practice and scientific research. Those tools can measure self-perception of health status in an efficient and low cost manner.[10–12] The literature indicates differences in psychometric properties between original and translated versions of a questionnaire after translation and cultural-adaptation from another language, due to differences in linguistic and cultural contexts.[13,14]

Bolton and Breen[10] in 1999 created the Bournemouth Questionnaire to provide a tool to measure multidimensional health domains of patients with low back pain. Since then, the Bournemouth Questionnaire has been used for scientific research and clinical practice to measure symptoms related to low back pain and to assist treatment planning.[10,15,16] Furthermore, it was linked to many important core sets, such as body function, activities, and participation of the International Classification of Functioning, Disability and Health (ICF).[15]

This questionnaire was developed in English, however, it has already been used as an evaluation tool in different countries such as Germany,[17] Denmark,[18] and Turkey.[19] The version of Bournemouth Questionnaire used to assess neck pain has already been translated into Brazilian Portuguese and its psychometric properties analyzed.[19] The translation and cultural adaptation of the low back pain version of this questionnaire has been recently published,[20] however, its psychometric properties have not been verified in the Brazilian population yet. Therefore, the purpose of this study is to test reliability, standard error of measurement (SEM), the minimum detectable change (MDC), internal consistency, construct validity, and ceiling and floor effects of the Brazilian Bournemouth Questionnaire for low back pain.

Methods

Subjects

Sixty-five subjects with low back pain, older than 18 years, recruited by verbal or digital invitation, took part in the study. Participants were considered eligible for the study if they had chronic non-specific low back pain (for more than 3 months, according to the International Association for the Study of Pain) and were physically and mentally able to complete the questionnaires. The sample size was based on previous studies.[18,21–28] and in concordance to the literature, which recommended to include at least 50 subjects.[29]

This study was approved by the Human Research Ethics Committee (*Universidade Paulista*, Sorocaba, São Paulo, Brazil, protocol: 35583114.0.0000.5512). All participants received verbal and written explanation of the aims and methodology of the study, and those who agreed to participate signed an informed-consent agreement.

Procedures

The original Bournemouth Questionnaire comprises seven questions, each one representing a different dimension of the low back pain (Table 1).[11,19] Each question of the Bournemouth Questionnaire is scored using an 11-point Numeric Rating Scale, and the final score, obtained by summing the seven topics, ranging from 0 to 70. Higher scores reflect more pain and disability.[10,18]

The Brazilian Bournemouth Questionnaire used in the present study (available as a supplementary material) was applied twice by the same assessor, under similar conditions (self-administered and in a University rehabilitation center), with an interval of 3–8 days between applications. This time interval between completion was considered long enough to prevent recall, but short enough to ensure that clinical change has not occurred, according with the guidelines[29] and based on previous studies.[21,23,30,31] To monitor significant changes in pain intensity during this period, an 11-point Numeric Pain Rating Scale (NPRS) was used on both occasions to assess the intensity of current, maximum, and minimum low back pain in the past 24 h. Test–retest reliability of the NPRS, using intraclass correlation coefficient (ICC), has been previously reported to between 0.63 and 0.96.[32,33]

The additional following questionnaires were also completed in the first evaluation session to assess validation of the questionnaire:

Roland morris disability questionnaire (RMDQ)

The RMDQ is a self-report questionnaire that quantifies the level of disability experienced by a person with low back pain. It consists of 24 items related to normal activities of daily living: physical ability/activity, sleep/rest, psychosocial, household management, eating, and pain frequency. Each answer is scored 0 or 1, so total score ranges from 0 to 24, with a higher score indicating higher disability.[33] Test-retest reliability of the Brazilian version of the RMDQ showed an ICC of 0.95.[33]

Oswestry disability index (ODI)

The ODI has been developed to assess pain-related disability in people with low back pain. This instrument consists of a 10-item questionnaire which assesses the impact of LBP on various functional activities. The items are divided into three domains: Pain, Physical Functioning, and Social Activities.[34] Each item can receive a value from 0 to 5, total score ranges from 0 to 100, and higher scores reflect higher

Table 1 Matching of the subscales for the subscales and total score of the Bournemouth Questionnaire, Oswestry Disability Index, Roland Morris Disability Questionnaire, and SF-36 questionnaires.

Bournemouth Questionnaire	ODI	SF-36	RMDQ	NPRS
Pain (Question 1)	Pain (Question 1)	Pain (Questions 7 and 8)	Total Score	Current Pain Maximum Pain Minimum Pain
Physical Function (Question 2)	Physical Function (Questions 2–7)	Physical Functioning (Questions 3a-3 j)	Total Score	Current Pain Maximum Pain Minimum Pain
Social Activity (Question 3)	Social Activities (Questions 8–10)	Social Function (Questions 6 and 10)		
Anxiety (Question 4)		Energy/fatigue (Questions 9a, 9e, 9 g and 9i) Emotional Well Being (Questions 9b, 9c, 9d, 9f and 9 h) Role limitations due to emotional problems (Questions 5a-c)		
Depression (Question 5)		Emotional Well Being (Questions 9b, 9c, 9d, 9f and 9 h) Energy/fatigue (Questions 9a, 9e, 9 g and 9i) Role limitations due to emotional problems (Questions 5a-c) Total Score (Questions 1-11d)		
Work-related fear avoidance (Question 6)		Role limitations due to physical health (Questions 4a-d)		
Pain locus of control (Question 7)		General health (Questions 1 and 11a-d)		Current Pain Maximum Pain Minimum Pain
Total Score	Total Score	Total Score	Total Score	

disability. The test-retest reliability of the Brazilian version of the ODI showed an ICC of 0.99.[34]

Short form health survey 36 (SF-36)

The SF-36 is an assessment tool that quantifies quality of life. It is composed of 36 topics divided into eight domains: Physical Functioning, Role Physical, Bodily Pain, General Health, Vitality, Social Functioning, Role Emotional, and Mental Health. The final score is between 0 and 100, with higher score reflecting better quality of life.[35] The test-retest reliability of the Brazilian version of the SF-36 showed Pearson correlation coefficients between 0.44 to 0.83.[35]

Statistical analysis

Descriptive statistics (mean and standard deviation (SD)) were calculated for continuous data. Data normality was verified by the Shapiro-Wilkś test. The variables that did not present normal distribution ($p > 0.05$) were analyzed by non-parametric tests. Statistical tests were done by the Statistical Package for the Social Sciences version 18 software (SPSS Inc, Chicago, IL), using a significance level of 5%.

Reliability

Test-retest reliability was used to verify if repeated measures obtained in two different occasions provided similar results for the Brazilian Bournemouth Questionnaire. Test-retest reliability (reproducibility) was evaluated using $ICC_{(3,1)}$ with values interpreted as follows: 0.40, poor; 0.40 to 0.75, moderate; 0.75 to 0.90, substantial; and 0.90, excellent reliability.[36] Reliability was calculated for each question and for the total score obtained on the Brazilian Bournemouth Questionnaire and for the NPRS.

The SEM provides a value for random measurement error in the same unit as the measurement itself. It quantifies the in-subject variability and reflects the amount of measurement error for any test occasion (between-day reliability). This type of reliability is more clinically applicable than ICC.[24,25] The MDC estimates the smallest amount of change between two measures that can be detected objectively as true change outside of the measurement error. This calculation helps clinicians to make decisions as to whether the change score in individual performance represents real change. The MDC is frequently used to detect the effectiveness of an intervention, considering an important

Table 2 Total and subscale scores of the Brazilian Bournemouth Questionnaire and pain scores.

Brazilian Bournemouth Questionnaire	Mean ± SD		ICC (95%CI)
	First evaluation	Second evaluation	
1- Pain Intensity	4.64 ± 2.45	4.37 ± 2.30	0.72 (0.57, 0.82)
2 - Functional Status	3.20 ± 2.64	2.54 ± 2.30	0.67 (0.50, 0.80)
3 - Social Activities	2.20 ± 2.44	1.78 ± 2.38	0.58 (0.39, 0.72)
4 - Anxiety	5.16 ± 3.45	4.95 ± 3.28	0.81 (0.70, 0.88)
5 – Depression	3.28 ± 3.02	2.88 ± 3.02	0.84 (0.75, 0.90)
6 - Work-related fear avoidance	5.27 ± 3.35	4.86 ± 3.44	0.79 (0.66, 0.87)
7 - Pain Locus of Control	3.18 ± 2.84	2.84 ± 2.66	0.68 (0.52, 0.80)
Total Score	26.96 ± 14.65	24.23 ± 13.42	0.82 (0.72, 0.90)
Numeric Pain Rating Scale			
Current Pain	3.27 ± 2.48	3.42 ± 2.56	0.82 (0.71, 0.89)
Maximum Pain	4.93 ± 2.56	4.89 ± 2.66	0.73 (0.58, 0.83)
Minimum Pain	2.05 ± 2.39	2.03 ± 2.24	0.75 (0.62, 0.85)

Abbreviations: SD, Standard Deviation; ICC, Intraclass Correlation Coefficient; CI, Confidence Interval.

outcome.[24,25] SEM and MDC were calculated on Microsoft Excel by the following formulas: SEM = SD $\sqrt{1}$ - ICC, and MDC90 = SEM x $\sqrt{2} \times 1.64$.[37,38]

Internal consistency

The internal consistency is the level of correlation between the questions that comprise a questionnaire, thus measuring the same construct, to verify the homogeneity of the questionnaire.[39] Internal consistency (homogeneity) was evaluated using Cronbach's alpha, which was considered adequate between 0.70 and 0.95.[29]

Construct validity

The validity of a measurement tool refers to the degree to which an instrument measures what is intended to measure.[39,40] The construct validity is the degree to which the scores of the measurement tool is consistent with a hypothesis, based on the assumption that the instrument measures the construct to be measured.[39] The hypothesis of this study is that the Bournemouth Questionnaire has significant positive association with pain and disability and negative association with quality of life. The magnitude of these correlations was expected to be at least moderate ($r > 0.39$).[41,42] Each question and the total score of the Bournemouth subscale were correlated to validated tools that measure the same construct for the population with low back pain. Table 1 shows the matching of the various subscales on the ODI, SF-36, RMDQ, and NPRS with the seven subscales on the Bournemouth questionnaire for low back pain.

Pearson or Spearman correlation coefficients (R) with 95% confidence intervals were calculated to examine the relationship of the Brazilian Bournemouth Questionnaire, with the other tools (NPRS, RMDQ, ODI, and SF-36). Correlation coefficients between 0.0 and 0.10 were defined as negligible, 0.10 to 0.39 as weak, 0.40 to 0.69 as moderate, 0.70 to 0.89 as strong, and 0.90–1.00 as very strong.[22,24,43] The level of significance was set at 0.05 for all statistical analyses.

Interpretability

Potential floor and ceiling effects were measured by verifying the distribution of answers across the Brazilian Bournemouth Questionnaire scores. The percent of patients that scored the lowest or the highest values at the Brazilian Bournemouth Questionnaire were calculated. Ceiling and floor effects were present if more than 15% of the total sample achieved the lowest or highest possible total score.[29] When the floor or ceiling effects are present, that may indicate limited content validity and reduced sensitivity to distinguish individuals with the lowest or the highest scores.[29]

Results

Data were collected from 26 women and 39 men with low back pain. Their mean ± SD age was 40.36 ±17.85 and symptoms duration 9.28 ±12.2 years. They were recruited in three different health centers in Brazil, and their educational level varied from elementary school (8 subjects), high school (23 subjects), college (27 subjects), and post-graduation (7 subjects). Six participants did not come back for the second evaluation, so reliability was determined using data of 59 patients, while validity was determined for total sample using the data collected on the first evaluation. Total scores for the Bournemouth Questionnaire and SF-36, as well as the NPRS scales were considered parametric according to the Shapiro-Wilkś test. The remaining variables were considered non-parametric.

Test-retest reliability

Summary and reliability data for the Brazilian Bournemouth Questionnaire and NPRS for current, maximum, and minimum pain, are provided in Table 2. The reliability for the total score of the Brazilian Bournemouth Questionnaire was strong ($ICC_{3,1}$ = 0.82; 95%CI: 0.72, 0.90). However, reliability for four of the seven individual scores was considered moderate with ICC values under 0.70 but above 0.58. Pain

Table 3 Correlation between the scores on the Brazilian Bournemouth Questionnaire and corresponding items on the Oswestry Disability Index.

Brazilian Bournemouth Questionnaire	Oswestry Disability Index		
	Variable	r-value	p-value
Pain	Pain	0.153	0.242
Physical Function	Physical Function	0.358	0.005
Social Activities	Social Activities	0.440	0.001
Total Score	Total Score	0.426	0.001

Table 4 Correlation between the scores on the Brazilian Bournemouth Questionnaire and SF-36.

Brazilian Bournemouth Questionnaire	SF-36		
	Variable	r-value	p-value
1 - Pain	Pain	−0.529	0.001
2 - Physical Function	Physical Functioning	−0.317	0.014
3 - Social Activity	Social Function	−0.563	0.001
	Energy/fatigue	−0.347	0.005
4 - Anxiety	Emotional Well Being	−0.396	0.001
	Role limitations due to emotional problems	−0.207	0.101
5 - Depression	Emotional Well Being	−0.386	0.002
	Energy/fatigue	−0.370	0.003
	Role limitations due to emotional problems	−0.143	0.260
	Total Score	−0.493	0.001
6 - Work-related fear avoidance	Role limitations due to physical health	−0.496	0.001
7 - Pain locus of control	General health	−0.037	0.796
Total Score	Total Score	−0.586	0.001

did not show significant change between days, and the ICC varied from 0.73 to 0.82, showing substantial reliability. SEM of the Brazilian Bournemouth Questionnaire was 5.97 points and the MDC was 16.54 points.

Internal consistency

The Brazilian version of the Bournemouth Questionnaire for low back pain showed a Cronbach α of 0.85, indicating acceptable consistency between the subscales (questions 1–7).

Construct validity

The results for the construct validity analysis are shown on Tables 3, 4, and 5. The questions related to Physical function and Social activities of the Bournemouth Questionnaire showed correlation to the corresponding items of the Oswestry Disability Index (Table 3), but only Social activities and total score were positive and moderately correlated (r = 0.440). Total score from both questionnaires were also positive and moderately correlated (r = 0.426).

The questions related to Pain, Social activity, Depression, and Work-related fear avoidance of the Bournemouth Questionnaire showed moderate negative correlation (r > −0.39)

Table 5 Correlation between the scores on the Brazilian Bournemouth subscales and the Roland Morris Disability Questionnaire and Numeric Pain Rating Scale.

Brazilian Bournemouth Questionnaire	RMDQ		Numeric Pain Rating Scale					
			Current Pain		Maximum Pain		Minimum Pain	
	r-value	p-value	r-value	p-value	r-value	p-value	r-value	p-value
Pain	0.343	0.007	0.668	0.001	0.828	0.001	0.516	0.001
Physical Function	0.472	0.001	0.733	0.001	0.556	0.001	0.616	0.001
Pain locus of control	0.192	0.125	0.300	0.015	0.267	0.031	0.344	0.005
Total Score	0.583	0.001	0.644	0.001	0.496	0.001	0.674	0.001

RMDQ- Rolland-Morris Disability Questionnaire.

with the corresponding subscale of the SF-36 (Table 4). However, the Pain locus of control did not have a positive correlation with the similar domain on the SF-36 (General health). Also, Physical function question had weak (r = −0.317) correlation with the Physical functioning domain from SF-36. Once again, total score from both questionnaires were moderately correlated (r = −0.586).

The physical function question of the Brazilian Bournemouth Questionnaire was moderately correlated (r = 0.472) with the total score of the RMDQ (Table 5). Questions related to pain, physical function, and total score of the Brazilian Bournemouth Questionnaire were also positively moderately correlated (r > 0.39) with the scores on the NPRS (Table 5). The Pain Locus of control question was weakly positively non-significant correlated with the RMDQ (r = 0.192) and weakly positively significant correlated with the scores on the NPRS (r > 0.267). Finally, the total score on the Brazilian Bournemouth Questionnaire was positively moderately correlated with scores on both the RMDQ and NPRS.

Interpretability

Floor and ceiling effects were not present since the scores 0 or 70 on the questionnaire were not achieved by any participant. The majority of participants scored between 25 and 30 points.

Discussion

The purpose of this study was to assess the measurement properties of the Brazilian version of the Bournemouth Questionnaire. The subscales and the total score showed acceptable test-retest between-days reliability and construct validity according to other important tools that measure pain, disability, and quality of life in individuals with low back pain. This study also provided values for SEM and MDC for this questionnaire, which can be useful for future studies and clinical practice.

The total score of the Brazilian version of the Bournemouth Questionnaire showed a substantial test-retest reliability (ICC = 0.82). Those results are similar to those from other versions of Bournemouth Questionnaire: The original (ICC = 0.95),[10] the Turkish (ICC = 0.96),[19] the Danish (ICC = 0.96),[18] and the German (ICC = 0.99)[17] versions showed excellent test-retest reliability. The higher ICC shown by those studies might be due to the shorter interval between applications for test-rest reliability. The test-retest of these versions was performed with a time interval of 2 h,[17,18] 2 days[19] or in the same day.[10] The short time interval between application was considered a study limitation by one of these studies.[17]

The internal consistency of the total score of the Brazilian version of the Bournemouth Questionnaire was classified as appropriate and similar with other versions (Cronbach's alpha of 0.85). The original version showed a Cronbach's alpha of 0.87,[10] the Turkish version of 0.91,[19] Danish version of 0.89,[18] and the German of 0.86.[17] Values are considered appropriate when they vary between 0.70 and 0.95.[44]

The results of the present study showed that 5.97 points should be considered to be the random measurement error of applications of the Brazilian version of Bournemouth Questionnaire completed on different days. According to the MDC calculated on the present study, changes larger than 16.54 points should be considered relevant if the measurements are taken on different days. The MDC and SEM weren't calculated for other versions of Bournemouth Questionnaire.

The construct validity of the Brazilian version was tested against other tools that were previously used to validate the Bournemouth questionnaire in other languages. ODI, NPRS, and RMDQ were applied as the condition-specific instruments for low back pain while the SF-36 questionnaire was selected as a general and multidimensional instrument. These instruments are widely accepted and used internationally for clinical and research purposes and they are available for the Brazilian Portuguese language. The NPRS was also used to validate some of the domains of the Brazilian version of the Bournemouth questionnaire, which was not used before by previous validation studies of this tool for other languages.

The ODI was previously used to verify construct validity of the original[10] and the German[17] versions. With the original version, the questions regarding Social activity (question 3) and Pain locus of control (question 7) showed moderate positive correlation (r = 0.85 and r = 0.58, respectively) with the ODI.[10] For the German version, the ODI was moderately correlated with total score and almost all questions (r ≥ 0.50), but Pain locus of control (question 7) showed weak correlation (r = 0.24).[17]

The RMDQ was used to validate the Turkish[19] and the Danish[18] versions. The total score of the Turkish version of the Bournemouth Questionnaire was moderately correlated to the RMDQ (r = 0.70)[19] and the question related to Social activity (question 3) of the Danish version of the Bournemouth Questionnaire was also correlated to the RMDQ (r = 0.78).[18]

Finally, the SF-36 was used to validate the Danish,[18] and the German[17] versions of the Bournemouth Questionnaire. All questions of the Danish version were at least moderately correlated (r > 0.49) to the total score of the SF-36.[18] For the German version, all questions but Social activity (question 3) and Pain locus of control (question 7) were moderately correlated (r = 0.30 and r = 0.17, respectively) with the correspondent sub-items of the Bournemouth Questionnaire.[17]

Surprisingly, some individual questions on the Brazilian Bournemouth Questionnaire did not show significant correlation with the correspondent construct tested. The question about Pain intensity (question 1) did not show significant correlation with the ODI Pain subscale, but was significantly correlated to the correspondent SF-36 pain subscale, with RMDQ total score, and with current, maximum, and minimum pain assessed by the NPRS. The items Anxiety (Item 4) and Depression (question 5) of the Brazilian version of Bournemouth did not show significant correlation with the subscale Role limitation due emotional problems from SF-36, but were significantly correlated to Energy/fatigue and Emotional Well Being SF-36 subscales. Also, Depression (question 5) was significant correlated with SF-36 total score. The question related to Pain Locus of control (question 7) of the Brazilian version of Bournemouth did not show significant correlation with General Health of SF-36 and RMDQ total score, but showed weak correlation with current, maximum and minimum pain assessed by the NPRS, not corroborating

with our hypothesis. The lack of moderate correlation with the General health and pain, assessed by SF-36 and NPRS, respectively, might mean that those questions should not be considered individually, but only as a part of the total score. The lack of significant correlation between some questions from the Brazilian version of the Bournemouth Questionnaire might be influenced by the ceiling effect observed in one item of the SF-36, the subscale Role limitations due to emotional problems, where 48% of the total sample achieved maximum score.

Strengths of the study and Implications for research and clinical practice

Although the RMDQ and ODI are the most comprehensively validated measures with respect to responsiveness for low back pain incapacity,[45] the Bournemouth Questionnaire was developed to assess the multidimensional health domains in patients with low back pain, including psychological and social factors.[20] The ODI covers 1 item on pain and 9 items on daily living activities and the RMDQ comprises 24 items that represent daily physical activities and functions that may be affected by low back pain.[46] Moreover, many items of the Brazilian version of the Bournemouth Questionnaire were significantly correlated to both questionnaires on their Brazilian versions.

The Bournemouth Questionnaire can be used to compare groups of people with different characteristics (gender, age, history of the disease, countries, kind of occupation) or to verify the effects of interventions on individuals with low back pain. This study also provided information about MDC and SEM which will assist future researchers and clinicians to interpret patient's change scores and to plan new studies.

Limitations of the study

Some limitations of the present study need to be addressed. The sample size is not in concordance to the COSMIN checklist,[47] which recommends 100 subjects. Moreover, this study did not assess responsiveness of the Brazilian version of Bournemouth Questionnaire. It is recommended for future research studies to investigate all the required psychometric properties.

Conclusion

The total score of the Brazilian Bournemouth Questionnaire is valid according to other important tools that measure pain, disability, and quality of life in individuals with low back pain. Some questions are also valid and could be used independently as well. Furthermore, it is a reliable questionnaire to be used in this population, considering SEM of 5.97 points and MDC of 16.54.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.bjpt.2020.02.003.

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