



Psychometric Validation of the LBP-BSTv2 for Assessing Maladaptive Beliefs in Patients With Non-Specific Low Back Pain

Christophe Demoulin, PT, PhD^{1,2,3}, Thibault Desjardins, PT, FOMT⁴, Irène Salamun, MD⁵, Michael Norberg, MD⁶,
Violaine Foltz, MD⁷, Florian Bailly, MD⁷, Laurent Pitance, PT, PhD³, Jean-François Kaux, MD, PhD^{1,2},
Romain Artico, PT, PhD^{4,8,9}

¹Department of Physical Activity and Rehabilitation Sciences, University of Liège, Liège, Belgium

²Department of Physical Medicine and Rehabilitation, University Hospital Centre of Liège, Liège, Belgium

³Faculty of Motor Sciences, Université Catholique de Louvain-La-Neuve, Louvain-la-Neuve, Belgium

⁴Scientific Committee, OMT France (French Orthopaedic Manual Therapy Organization), Paris, France

⁵Interdisciplinary Algology Center, University Hospital Centre of Liège Liège, Belgium

⁶Physical Medicine and Rehabilitation, University Hospital of Lausanne, Lausanne, Switzerland

⁷Rheumatology Department, Pitié-Salpêtrière Hospital, Assistance Publique-Hôpitaux de Paris (AP-HP), Paris, France

⁸CIAMS (UR 4532), Université Paris-Saclay, Orsay, France

⁹Department of Physiotherapy, Faculty of Medicine, Université Paris-Saclay, Le Kremlin-Bicêtre, France

Objective: To assess maladaptive beliefs about low back pain (LBP), valid and reliable measurement tools are required. Although some tools exist to assess them, the Low Back Pain-related Beliefs Screening Tool (LBP-BST) was developed in order to explore all different categories of misbeliefs in individuals chronic low back pain (CLBP). This study aimed to evaluate the main psychometric properties of both the short and long versions of the revised LBP-BSTv2.

Methods: A total of 108 patients with CLBP completed the LBP-BSTv2 to assess its potential floor/ceiling effects, internal consistency, and construct validity. The latter was evaluated by comparing scores with the Back Beliefs Questionnaire (BBQ). Test-retest reliability was assessed in 47 of the participants one week later.

Results: No floor or ceiling effects were observed. The short and long versions of the LBP-BSTv2 showed strong construct validity, with significant correlations with BBQ scores. Internal consistency was acceptable to good (Cronbach's alpha: 0.77–0.84), and test-retest reliability was high (intraclass correlation coefficient: 0.76–0.81).

Conclusion: The LBP-BSTv2 is a valid and reliable tool for assessing maladaptive beliefs in patients with CLBP. Its integration into clinical practice could help healthcare professionals identify and address unhelpful beliefs that may hinder rehabilitation. Further research is needed to confirm its usefulness in tracking changes over time and guiding individualized interventions and to study other psychometric properties such as responsiveness.

Keywords: Low back pain, Health knowledge, Psychometrics, Surveys and questionnaires, Rehabilitation

Received: March 28, 2025

Revised: January 12, 2026

Accepted: February 5, 2026

Correspondence:

Romain Artico
Department of Physiotherapy, Faculty
of Medicine, Université Paris-Saclay, 63
Rue Gabriel Péri, Le Kremlin-Bicêtre
94270, France.
Tel: +33 1 49 59 67 67
Fax: +33 1 49 59 67 00
E-mail: [romain.artico@universite-
paris-saclay.fr](mailto:romain.artico@universite-paris-saclay.fr)

INTRODUCTION

Low back pain (LBP) is one of the leading causes of disability worldwide, with a significant socioeconomic burden due to its high prevalence and recurrent nature [1]. While most cases of chronic low back pain (CLBP) are benign and self-limiting, many patients develop chronic symptoms, partly influenced by maladaptive beliefs and behaviors [2-4]. Negative beliefs about LBP, such as the perception that pain signifies severe damage or that movement should be avoided, have been linked to increased disability, reduced physical activity, and poorer rehabilitation outcomes [5,6]. Addressing these beliefs is therefore essential in clinical practice to improve patient adherence to rehabilitation programs and promote functional recovery [7].

To assess maladaptive beliefs in LBP, several self-reported questionnaires have been developed, such as the Back Beliefs Questionnaire (BBQ) [8] and the Fear-Avoidance Beliefs Questionnaire (FABQ) [9]. However, many of these tools have limitations, including a narrow focus on biomedical beliefs or inadequate assessment of multidimensional cognitive factors influencing pain perception [10]. The Low Back Pain-related Beliefs Screening Tool (LBP-BST) was developed after several steps (literature review, Delphi process involving an international and multidisciplinary group of experts, etc.) to comprehensively evaluate patients' beliefs and attitudes toward LBP about the meaning of pain, precautions to take, repercussions/consequences, evolution, physical activities, self-efficacy treatment, imaging, modulating factors and professional activities [11]. After several months of use of the LBP-BST during which a few comments were raised by some users (patients and clinicians), a revised version (LBP-BSTv2) has been adapted to improve its clinical applicability. Therefore, this study aimed to evaluate the main psychometric properties (validity, reliability but also floor/ceiling effects) of the LBP-BSTv2, in a population of patients with CLBP. By confirming its psychometric qualities, this study seeks to support the use of the LBP-BSTv2 as a relevant screening tool for identifying maladaptive beliefs in clinical and research settings.

METHODS

Participants

This study included patients with CLBP. Participants were recruited in Belgium, France, and Switzerland from hospitals, spine clinics, physiotherapy and medical practices, as well as through personal networks.

Eligibility criteria

Participants were eligible if they were French-speaking adults aged 18–80 years with a physician-established diagnosis of CLBP, defined as pain between the costal margin and the gluteal folds persisting for ≥ 3 months and compatible with usual daily activities (ability to read and complete self-report questionnaires).

Exclusion criteria

We excluded any participant with a physician-identified specific spinal disorder, including but not limited to: vertebral fracture, malignancy, spinal infection (e.g., spondylodiscitis), inflammatory spondyloarthropathy, cauda equina syndrome, severe or progressive neurological deficit, symptomatic spinal stenosis, spondylolisthesis with neurological compromise, or other specific structural causes judged to explain the pain presentation. Additional exclusions were: radiculopathy (with clinical signs consistent with nerve root involvement), associated fibromyalgia, recent lumbar spine surgery (within the past 12 months), subacute or acute low back pain (symptom duration < 3 months), and inability to read or understand the questionnaire.

Screening procedure

All candidates underwent clinical triage by a physician (history, examination, red-flag screening). Imaging (X-ray/magnetic resonance imaging) and neurophysiological tests (nerve conduction studies and electromyography) were not performed systematically and were obtained only when clinically indicated to confirm or rule out specific etiologies; any confirmed specific diagnosis led to exclusion.

All the participants were informed of the objective of the project and consented to their participation. The study was approved by the Ethics Committee of the University Hospital Centre of Liège (Approval number: 2018307).

Experimental protocol

Participants completed a battery of self-reported questionnaires to assess demographic information, pain levels, disability, and beliefs regarding LBP. Some of them were invited to fill out again some questionnaires some days later for the test-retest analysis.

Administered questionnaires

General information questionnaire

Collected data on age, sex, employment status (retired, unem-

ployed, disability, student, active/inactive), highest education level obtained, pain duration and disability related to pain, current treatment for LBP.

Numeric pain rating scale

A 0–10 scale measuring current pain intensity and mean pain intensity over the past seven days.

Oswestry Disability Index

Assesses LBP-related functional disability through 10 items, each scored from 0 to 5. The total score is converted into a 0%–100% scale, with higher values indicating greater disability [12].

LBP-BSTv2

This questionnaire ([Supplementary Material S1](#)) was developed in French. In contrast to the original LBP-BST [13], the modified version includes impersonal phrasing (“A back problem...” instead of “Your back problem...”), revised work-related items to accommodate unemployed participants, and a modified scoring system from Likert 1–4 to 0–3, where 0 indicates no maladaptive beliefs. Items 4, 8, 9, 18, 19, and 20 were reverse scored. If items were left unanswered, scores were recalculated proportionally to the number of completed items for managing missing data in the Roland–Morris Disability Questionnaire [14]. The short version (SV) includes the first 10 items (score range: 0–30) and the long version (LV, 20-item) includes 10 additional items (score range: 0–60) instead of 15 in the original version.

BBQ

Measures beliefs about LBP through 14 items rated from 1 to 5, with higher scores indicating fewer negative beliefs [8,15]. As suggested the five items (4, 5, 7, 9, 11) were excluded from scoring to get a final score ranging from 9 to 45, with higher values reflecting more positive beliefs.

Data and psychometric analysis

Construct validity

Construct validity was assessed through correlation analysis between LBP-BSTv2 and BBQ scores to examine convergent validity.

Reliability

To examine the reproducibility of the LBP-BSTv2, a subgroup of participants (n=47) was invited to complete the LBP-BSTv2 questionnaire again one week later. Additionally, they were

asked whether they had received any care over the past seven days that could have influenced their beliefs. Subgroup reliability by numeric pain rating scale severity was not performed because the test–retest sample size did not allow adequately powered per-stratum intraclass correlation coefficient (ICC) estimates.

Data analysis

All participant responses were anonymized and recorded in an Excel file. Statistical analyses were conducted using IBM SPSS Statistics for Windows, version 31.0 (IBM Corp.). Data were presented as means and standard deviations (SDs) for continuous quantitative variables with a normal distribution, and as medians and interquartiles for asymmetric continuous quantitative variables with statistical significance set at $p < 0.05$.

Psychometric properties of the LBP-BSTv2

Floor/ceiling effects

A descriptive analysis was performed by calculating the number of participants who obtained either the minimum or maximum possible score for each item and the total score. A floor/ceiling effect was considered present if at least 15% of participants reached either extreme.

Construct validity (convergent validity)

Spearman's correlation coefficient was used to assess the correlation between LBP-BSTv2 and BBQ scores, with correlation strength interpreted as follows: very weak (0.00–0.19), weak (0.20–0.39), moderate (0.40–0.59), strong (0.60–0.79), and very strong (0.80–1.00).

Internal consistency

Cronbach's alpha coefficient was calculated to assess internal consistency, with values between 0.70 and 0.95 considered satisfactory. Additionally, item-total score correlations were examined using Spearman's correlation test.

Test-retest reproducibility

Reproducibility was assessed by comparing questionnaire responses between test and retest one week apart. Participants completed the full version of LBP-BSTv2 along with an additional question to exclude those who had received any new information that could have changed their beliefs.

Several statistical tests were conducted: The Wilcoxon Signed-Rank Test compared response distributions between test and re-

test. A p -value > 0.05 indicated that distributions were identical. The ICC measured reliability, with values above 0.70 considered satisfactory. The standard error of measurement (SEM) was calculated to determine test precision using the formula:

$$\text{SEM} = \text{SD} \times \sqrt{1 - \text{ICC}},$$

where SD represents the average SD of the first and second tests.

Interpretability of the questionnaire

Minimal detectable change

Minimal detectable change (MDC) was calculated to determine the minimum score difference required between two measurements to be considered a true change. It was computed using the formula:

$$\text{MDC} = \text{SEM} \times 1.96 \times \sqrt{2} [16].$$

Limits of agreement

Limits of agreement (LOA) was determined using the mean and SD of the differences between test and retest scores, following the formula:

$$\text{LOA} = \text{mean difference} \pm 1.96 \times (\text{SD of differences}) [17].$$

RESULTS

Patient recruitment

A total of 108 patients were recruited between November 2022 and April 2023. Most participants were recruited from Belgian university hospitals or international centers in France or Switzerland. The remaining patients were recruited via private physiotherapy clinics or personal networks.

Baseline characteristics of the study population

The study sample consisted of 56.5% female and 43.5% male participants, aged between 21 and 79 years (mean age: 52.5 ± 14.0 years). The 48.1% of participants were professionally active, with most holding a technical secondary diploma (31.5%) or a higher education degree (51.9%).

Regarding pain and disability characteristics, 52.8% had associated pain radiating to the thigh(s) or leg(s).

History of lumbar surgery was reported by 88.9% ($n=96$). At the time of the study, 57.4% of patients were undergoing

treatment: 22.2% individual physiotherapy, 25.9% group rehabilitation, and 9.3% other treatments (while 42.6% reported no current treatment).

Pain intensity and disability scores (Oswestry Disability Index) as well as scores of the beliefs (BBQ, LBP-BSTv2) questionnaires are detailed in [Table 1](#).

Score distribution of the LBP-BSTv2 SV and LV

The mean scores (minimum and maximum values) for both the SV and LV of the LBP-BSTv2 are shown in [Table 1](#).

Item-by-item responses

Detailed item-by-item responses are presented in [Table 2](#).

No participant (0%) strongly agreed with item 5, “Surgery guarantees recovery from back pain,” and no participant strongly disagreed with items 4 (“Physical exercise [e.g., cycling, walking, strength training] is beneficial for treating back pain”) and 20 (“Hyperactivity and/or lack of physical activity can negatively affect the progression of back pain”).

Several items reflecting maladaptive beliefs showed high rates of incorrect responses ($\geq 50\%$). Item 6 revealed problematic beliefs, with 51.9% agreeing and 34.4% strongly agreeing with the statement, “It is important to consult a healthcare professional as soon as back pain increases.” Similarly, item 12 (“The severity of back pain reflects the seriousness of underlying issues [damage, wear and tear, inflammation, etc.]”) had 52.8% agreement. Additionally, item 14 (“Back pain inevitably worsens with age”) had a particularly high agreement rate (58.3%).

Table 1. Results from pain-related questionnaires ($n=108$)

Questionnaires [min-max]	Mean±SD [min-max]
Age [21-79]	52.5±14.0
Sex (female, %)	56.5
NPRS [0-10] (current pain)	4.41±2.23 [1-10]
NPRS [0-10] (last 7 days)	4.71±2.13 [1-9]
ODI (%)	23.82±14.2 [0-66.7]
BBQ [9-45]	26.53±5.83 [10-45]
Treatment history (%)	
Surgery	88.9
None	42.6
Individual physiotherapy	22.2
Group rehabilitation	25.9
Other treatments	9.3
LBP-BSTv2 short version [0-30]	10.65±4.26 [3-21]
LBP-BSTv2 long version [0-60]	22.17±7.32 [6-39]

min, minimum; max, maximum; NPRS, numeric pain rating scale; ODI, Oswestry Disability Index; BBQ, Back Beliefs Questionnaire; LBP-BSTv2, Low Back Pain-related Beliefs Screening Tool version 2.

Table 2. Item-by-item responses

Item	Strongly agree	Agree	Disagree	Strongly disagree
	%			
1) Pain structural damage (belief) (n=108)	1.9	36.1	39.8	22.2
2) Best to minimize movement (n=107)	0.9	8.3	43.5	46.3
3) Everyday activities are impossible with back pain (n=108)	0.9	20.4	40.7	38.0
4) ^{a)} Exercise helps treat back pain (beneficial) (n=108)	57.4	39.8	2.8	0
5) Surgery guarantees recovery (n=108)	0	10.2	45.4	44.4
6) Worsening pain must see a clinician (n=108)	34.3	51.9	13.0	0.9
7) Imaging always reveals the cause (n=108)	13.9	34.3	33.3	18.5
8) ^{a)} Self-management without medication can reduce pain (n=107)	13.0	48.1	31.5	6.5
9) ^{a)} Distraction/pleasant activities can relieve pain (n=108)	13.0	56.5	24.1	6.5
10) Work should not be done with back pain (n=105)	2.8	8.3	41.7	44.4
11) Back pain is necessarily due to lesion/degeneration/inflammation (n=108)	15.7	44.4	24.1	15.7
12) Pain severity mirrors pathology severity (n=107)	12.0	52.8	26.9	7.4
13) Protect the back by avoiding lifting/bending/carrying (n=108)	16.7	44.4	28.7	10.2
14) Back pain inevitably worsens with age (n=108)	8.3	58.3	26.9	6.5
15) Back pain often from “structure displacement” (n=107)	5.6	32.4	45.4	15.7
16) Only medicines/products relieve pain (n=108)	0.9	5.6	51.9	41.7
17) Medical procedures always improve pain (n=108)	2.8	21.3	47.2	28.7
18) ^{a)} Education about pain factors is beneficial (n=108)	39.8	56.5	2.8	0.9
19) ^{a)} Mood/anxiety/stress can influence pain (n=108)	44.4	46.3	5.6	3.7
20) ^{a)} Overactivity or inactivity can worsen the course (n=108)	38.0	59.3	2.8	0

^{a)}Reverse-scored items in the questionnaire.

Items 11 (“Back pain necessarily indicates damage, wear and tear, or inflammation”) and 13 (“Activities involving lifting, carrying, or forward bending should be avoided to protect the back”) also indicated maladaptive beliefs among a considerable number of participants (both 60% [strong] agreement with the statement).

In contrast, responses to item 4, emphasizing the benefits of physical activity for back pain management, were overwhelmingly appropriate, with 57.4% strongly agreeing and 39.8% agreeing.

Item 10 (“You should not work when you have back pain”) had the highest number of non-responses (n=3).

Floor and ceiling effects

No floor or ceiling effects were observed, and no participants reached the minimum or maximum possible score for either version.

Construct validity

Spearman correlation analyses indicated significant negative correlations between the BBQ and both versions of the LBP-BSTv2 (SV: $\rho=-0.44$; LV: $\rho=-0.45$; both $p<0.001$) suggesting the convergent validity of the questionnaire.

Reliability

Internal consistency

Cronbach's alpha coefficients for the LBP-BSTv2 SV and LV were $\alpha=0.77$ and 0.84 , respectively.

Item-score correlations

Item-total score correlations were statistically significant, with moderate to strong correlations ($0.40-0.70$), except for Item 6, which showed a weaker correlation (<0.30).

Test-retest reproducibility

A total of 47 patients (51.1% female, 48.9% male) participated in the test-retest analysis, with no reports of new interventions that could modify beliefs between assessments. The mean age of this subgroup was 52.3 years, and 48.9% being professionally active.

No significant differences were observed between test and re-test regarding the total LBP-BSTv2 score neither for the SV nor for the LV. Test-retest reliability was good (ICC= 0.76 for SV; 0.81 for LV). The SEM was 1.91 (SV) and 2.87 (LV), yielding MDC, 95% values of 5.3 and 7.95 points, respectively, indicating that changes exceeding these thresholds likely reflect true change. LOA (SV -5.7 to 5.0 ; LV -8.4 to 7.7) and non-significant mean differences ($p=0.40$; $p=0.58$) suggest no systematic bias (Table

3). Given the $n=47$ test-retest cohort, severity-stratified ICCs (mild/moderate/severe) were not computed due to insufficient per-group size; agreement metrics (ICC, SEM, MDC, LOA) showed stable measurement without proportional bias across the observed score range.

DISCUSSION

A more comprehensive understanding of maladaptive beliefs could assist in optimizing therapeutic strategies, fostering self-management, and improving long-term outcomes in those living with CLBP. The objective of this study was to refine and validate a new version of the LBP-BST questionnaire, hereafter referred to as the LBP-BSTv2 which is particularly relevant considering the importance to capture the various kinds of LBP-related maladaptive beliefs highlighted in the literature [10,18-20]. Indeed, CLBP is known to be influenced not only by biomechanical factors but also by a range of psychosocial determinants [3,10]. Misconceptions about LBP—particularly those reinforcing a biomedical rather than a biopsychosocial approach—can exacerbate fear, encourage avoidance behavior, and delay recovery [21]. Given the multifaceted nature of LBP, it is vital to target these belief systems as part of a comprehensive treatment approach. In doing so, we aimed to provide a tool that would help health professionals identify harmful beliefs that contribute to the chronicity of LBP, thereby guiding more effective patient education.

Several questionnaires currently exist to measure LBP-related beliefs, with tools such as the BBQ [8], the FABQ [9] widely employed and the Back-PAQ (Back Pain Attitudes Questionnaire) [22]. While these instruments have proven useful, none covers all dimensions of LBP beliefs to the extent clinicians

and researchers might desire, particularly when attempting to identify nuanced misconceptions that persist in individual patients. The original iteration of the LBP-BST was devised to fill this gap. Its initial psychometric evaluations demonstrated promising convergent validity, satisfactory internal consistency, and acceptable test-retest reliability. However, feedback from patients and healthcare providers underscored the need to make some adaptations which resulted in the development of the LBP-BSTv2. One notable improvement in the revised LBP-BST questionnaire was its enhanced acceptability. In the previous version, certain items were not suitable for individuals who were not currently employed, such as retirees, students, or job seekers. This limitation led to a proportion of missing responses. In the new version, we modified and clarified the items related to professional activities so that all participants could identify a suitable answer. In the current assessment, the proportion of missing responses was extremely low, suggesting that the LBP-BSTv2 is more user-friendly and better tailored to diverse circumstances. This high level of acceptability is crucial for a clinical tool, as response burden and question ambiguity can reduce both patient motivation and the overall accuracy of the data collected [23].

A key strength of this study lies in the heterogeneous composition of the patient sample which were recruited in various centers/contexts as well in Belgium as in France and Switzerland. Most participants were experiencing chronic LBP, reflecting the reality that a significant proportion of patients in clinical settings present with longstanding pain. The diversity in terms of participants' educational levels, professional status, and pain duration makes it more likely that the LBP-BSTv2 can be generalized to multiple subgroups. Ensuring broad applicability is important, as different populations bring varied perceptions of

Table 3. Test-retest reliability of LBP-BSTv2

Version	Test	Retest	p-value	ICC ^{a)} (95% CI)	SEM ^{b)}	MDC ^{c)}	LOA ^{d)}
	Mean±SD						
LBP-BSTv2 SV	11.0±4.1	10.7±3.7	0.40	0.76 (0.60–0.86)	1.91	5.30	-5.7, 5.0
LBP-BSTv2 LV	22.9±6.4	22.6±6.8	0.58	0.81 (0.68–0.89)	2.87	7.95	-8.4, 7.7

LBP-BSTv2, Low Back Pain-related Beliefs Screening Tool version 2; SD, standard deviation.

^{a)}Intraclass correlation coefficient (ICC): index of test-retest reliability (two-way random effects, absolute agreement), reported with 95% confidence interval (CI); values -0.70–0.79=acceptable, 0.80–0.89=good, ≥ 0.90 =excellent. In this sample, ICCs of 0.76 (short version, SV) and 0.81 (long version, LV) indicate good stability.

^{b)}Standard error of measurement (SEM): typical measurement error in scale units; $SEM=SD \times \sqrt{1-ICC}$. Here, $SEM \approx 1.91$ points (SV, range 0–30) and 2.87 points (LV, range 0–60).

^{c)}Minimal detectable change (MDC, 95%): smallest change beyond measurement error with 95% confidence; $MDC_{95}=1.96 \times \sqrt{2} \times SEM$. Thus, $MDC_{95} \approx 5.3$ points (SV) and 7.95 points (LV). Changes larger than these thresholds are likely true changes.

^{d)}Limits of agreement (LOA): Bland-Altman limits (mean difference ± 1.96 SD of differences) indicating where 95% of test-retest differences lie; here -5.7, 5.0 (SV) and -8.4, 7.7 (LV), consistent with no systematic bias (p-values for mean difference: SV $p=0.40$; LV $p=0.58$).

pain and health. By testing the questionnaire in a wide variety of individuals, we sought to create an instrument that would remain valid irrespective of socio-demographic differences a factor other questionnaires sometimes fail to address.

Assessing the questionnaire's validity involved examining how strongly the LBP-BSTv2 correlated with an established measure of LBP-related beliefs, the BBQ [8]. As expected and as far the original version of the LBP-BST, we found significant correlations for both the short and long forms. Because the BBQ was developed several years ago and have been used in many studies as a standard instrument for evaluating negative beliefs in patients with LBP, observing such correlations is an encouraging sign of the convergent validity of the LBP-BSTv2 [15]. Given its more comprehensive scope and its ability to be used in a SV or LV, this new tool could be a good alternative when measuring multidimensional perspective on LBP beliefs is needed.

Internal consistency, as indicated by Cronbach's alpha, was satisfactory to good for both the SV and LV of the LBP-BSTv2, in line with previous findings for the original questionnaire. This result implies a reliable degree of homogeneity across the items, meaning that each dimension of belief assessed by the questionnaire converges with the overall scale. While some debate remains regarding the appropriate range for Cronbach's alpha, excessively high values can indicate redundancy among items [24], our findings suggest that the LBP-BSTv2 items are sufficiently distinct while maintaining coherence, justifying their use within a single measure. Interestingly, specific items assessing the impact of emotional factors on LBP showed somewhat lower correlations with the total score. This may reflect persistent misconceptions about the role of psychological and emotional factors in back pain, as many patients continue to adhere to a predominantly biomedical perspective [10], underestimating how stress or mood disturbances might amplify pain. By retaining items targeting these dimensions, the LBP-BSTv2 ensures that clinicians can identify patients who need additional psychosocial interventions.

Beyond internal consistency, test-retest reliability was evaluated among a subset of participants who completed the questionnaire twice, separated by an interval short enough to mitigate major clinical changes, yet long enough to reduce the likelihood of recall bias [25]. As for the original version, the absence of significant differences between the two sets of scores, along with strong ICCs, confirms the questionnaire's stability over time. This reliability is crucial for using the LBP-BSTv2 to track changes in beliefs throughout extended treatment or

rehabilitation programs. If a patient's scores shift significantly between baseline and follow-up sessions, clinicians can be more confident that these changes reflect genuine belief shifts rather than measurement error. Besides, the MDC calculation suggests that a change of more than 5 and 8 points (respectively for the SV and LV) indicates a true change in a patient's beliefs.

In clinical settings, measuring improvements in LBP-related beliefs can be linked to gains in pain management and functional outcomes [7,26]. Although altering beliefs is not the only determinant of a patient's progress, research increasingly supports that maladaptive cognitions can perpetuate or worsen chronic pain states [3]. A biopsychosocial model, where beliefs, emotions, and behaviors are addressed alongside physiological factors, is therefore pivotal to fostering patient recovery.

Since LBP-related beliefs are often deeply entrenched, effective strategies to modify them must be multifaceted. Group-based educational sessions have proven helpful but may not suffice for everyone [3]. Future work could explore whether one-on-one sessions, possibly integrated with other interventions such as cognitive functional therapy (CFT), might yield greater shifts in maladaptive beliefs compared to group interventions alone [27]. The CFT approach emphasizes the importance of individualized assessment and targeted education to correct misconceptions and maladaptive beliefs as an essential first step toward effective pain management [28]. Recent evidence indicates that individualized CFT interventions can lead to superior reductions in disability by specifically addressing cognitive, emotional, and behavioral barriers in patients with CLBP [29]. Moreover, existing literature also suggests individualized interviews provide opportunities to uncover barriers and misconceptions that standardized group sessions might overlook [20].

The next step could be to try to identify a cut-off for the SV to decide when to submit the patients to the 10 additional items and a cut-off to decide when the patient's misbeliefs is a dominant factor. Translating this questionnaire in English would also be relevant so that it can be used not only in French-speaking countries.

Like many studies, ours is not without limitations. One key concern is the potential for self-selection bias, as participation was voluntary. This could have led to an overrepresentation of individuals who were aware of the importance of exploring beliefs in cases of lower back pain. Well-conducted studies would be needed to examine other psychometric data. Lastly, establishing a clear threshold score to identify individuals with a high risk of detrimental beliefs remains an important objec-

tive. This score would be particularly useful in clinical practice, where it could streamline the decision to proceed with in-depth assessments.

Limitations

Treatment history

We did not systematically record current pharmacological therapy (e.g., NSAIDs, weak opioids, strong opioids) beyond a coarse indicator of ongoing treatment. Although the LBP-BSTv2 targets beliefs and psychosocial factors that are not expected to be directly determined by short-term analgesic regimens, we cannot exclude indirect influences (e.g., via changes in pain intensity, sleep, or activity) or differential selection into treatments. Future studies should collect detailed pharmacological data and, ideally, stratify or adjust analyses by medication class and intensity, or perform sensitivity analyses to test the robustness of psychometric findings to concurrent pharmacotherapy.

Conclusion

In summary, our findings support the LBP-BSTv2 as an instrument with acceptable validity, reliability, and utility in capturing a broad spectrum of LBP-related beliefs. By refining item content and improving the scoring system, the revised questionnaire appears more accessible to patients and healthcare providers alike. Future research designed to confirm its validity in diverse populations, further study its other clinimetric properties (such as responsiveness) and determine a cut-off will help consolidate the role of the LBP-BSTv2 in clinical and research contexts. Its translation into other languages would also be relevant.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

FUNDING INFORMATION

None.

AUTHOR CONTRIBUTION

Conceptualization: Demoulin C. Formal analysis: Demoulin C. Methodology: Demoulin C. Supervision: Demoulin C, Salamun I, Foltz V. Validation: Demoulin C, Desjardins T, Norberg M, Bailly F, Pitance L, Kaux JF. Project administration: Salamun

I. Investigation: Foltz V. Resources: Bailly F. Writing – original draft: Artico R. Writing – review & editing: Demoulin C, Desjardins T, Pitance L, Kaux JF, Artico R. Approval of final manuscript: all authors.

ACKNOWLEDGMENTS

We would like to thank Dupont Antoine, Mathus Claire for their valuable support and contributions to this work.

SUPPLEMENTARY MATERIALS

Supplementary materials can be found via <https://doi.org/10.5535/arm.250049>.

ORCID

Christophe Demoulin, <https://orcid.org/0000-0002-8280-834X>

Thibault Desjardins, <https://orcid.org/0009-0001-7932-9567>

Irène Salamun, <https://orcid.org/0009-0000-6982-8568>

Michael Norberg, <https://orcid.org/0000-0003-3053-3126>

Violaine Foltz, <https://orcid.org/0000-0003-2097-9239>

Florian Bailly, <https://orcid.org/0000-0003-2787-4309>

Laurent Pitance, <https://orcid.org/0000-0002-5043-8946>

Jean-Francois Kaux, <https://orcid.org/0000-0003-1939-3652>

Romain Artico, <https://orcid.org/0000-0001-5197-2545>

REFERENCES

1. Hartvigsen J, Hancock MJ, Kongsted A, Louw Q, Ferreira ML, Genevay S, et al. What low back pain is and why we need to pay attention. *Lancet* 2018;391:2356-67.
2. Darlow B, Fullen BM, Dean S, Hurley DA, Baxter GD, Dowell A. The association between health care professional attitudes and beliefs and the attitudes and beliefs, clinical management, and outcomes of patients with low back pain: a systematic review. *Eur J Pain* 2012;16:3-17.
3. Demoulin C, Roussel N, Marty M, Mathy C, Genevay S, Henrotin Y, et al. [The maladaptive beliefs of patients with low back pain. A narrative review]. *Rev Med Liege* 2016;71:40-6. French.
4. Nicholas MK, Linton SJ, Watson PJ, Main CJ. Early identification and management of psychological risk factors ("yellow flags") in patients with low back pain: a reappraisal. *Phys Ther* 2011;91:737-53.
5. Vlaeyen JWS, Crombez G, Linton SJ. The fear-avoidance model of pain. *Pain* 2016;157:1588-9.

6. Bunzli S, Taylor NF, O'Brien P, Wallis JA, Caneiro JP, Woodward-Kron R, et al. Broken machines or active bodies? Part 1. Ways of talking about health and why it matters. *J Orthop Sports Phys Ther* 2023;53:236-8.
7. [Management of patients presenting with non-specific low back pain] [Internet]. Haute Autorité de Santé; 2019 [cited 2022 Oct 6]. French. Available from: https://www.has-sante.fr/jcms/c_2961499/fr/prise-en-charge-du-patient-presentant-une-lombalgie-commune
8. Symonds TL, Burton AK, Tillotson KM, Main CJ. Do attitudes and beliefs influence work loss due to low back trouble? *Occup Med (Lond)* 1996;46:25-32.
9. Waddell G, Newton M, Henderson I, Somerville D, Main CJ. A Fear-Avoidance Beliefs Questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability. *Pain* 1993;52:157-68.
10. Demoulin C, Gabriel L, Nève de Mévergnies O, Henket L, Roussel N, Goubert L, et al. Several low back pain-related misbeliefs are still around in 2020: a cross-sectional survey in Belgium. *Physiother Res Int* 2022;27:e1927.
11. Demoulin C, Duvalon L, Roussel N, Humblet F, Bornheim S, Harry E, et al. [French translation of the Brief Illness Perception Questionnaire adapted for patients with low back pain and evaluation of its psychometric properties]. *Rev Rhum* 2016;83S:A209. French.
12. Vogler D, Paillex R, Norberg M, de Goumoëns P, Cabri J. [Cross-cultural validation of the Oswestry Disability Index in French]. *Ann Readapt Med Phys* 2008;51:379-85. French.
13. Demoulin C, Salamun I, Bertrand J, Mathy C, Roussel N, Genevay S, et al. [Development of the Low Back Pain-Related Beliefs Screening Questionnaire (LBP-BSQ) to identify the presence of maladaptive beliefs in patients with low back pain]. *Kinesither Rev* 2019;19:102-103. French.
14. Kent P, Lauridsen HH. Managing missing scores on the Roland Morris Disability Questionnaire. *Spine (Phila Pa 1976)* 2011;36:1878-84.
15. Dupeyron A, Lanhers C, Bastide S, Alonso S, Toulotte M, Jourdan C, et al. The Back Belief Questionnaire is efficient to assess false beliefs and related fear in low back pain populations: a transcultural adaptation and validation study. *PLoS One* 2017;12:e0186753.
16. de Vet HC, Terwee CB. The minimal detectable change should not replace the minimal important difference. *J Clin Epidemiol* 2010;63:804-5.
17. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. *Lancet* 1986;1:307-10.
18. Bunzli S, Smith A, Schütze R, O'Sullivan P. Beliefs underlying pain-related fear and how they evolve: a qualitative investigation in people with chronic back pain and high pain-related fear. *BMJ Open* 2015;5:e008847.
19. Bunzli S, Smith A, Schütze R, Lin I, O'Sullivan P. Making sense of low back pain and pain-related fear. *J Orthop Sports Phys Ther* 2017;47:628-36.
20. Caneiro JP, Bunzli S, O'Sullivan P. Beliefs about the body and pain: the critical role in musculoskeletal pain management. *Braz J Phys Ther* 2021;25:17-29.
21. O'Sullivan P, Caneiro JP, O'Keeffe M, O'Sullivan K. Unraveling the complexity of low back pain. *J Orthop Sports Phys Ther* 2016;46:932-7.
22. Demoulin C, Halleux V, Darlow B, Martin E, Roussel N, Humblet F, et al. [French translation of the long version of the "Back Pain Attitudes Questionnaire" and evaluation of its psychometric properties]. *Mains Libr* 2017;34:19-26. French.
23. Otero-Ketterer E, Peñacoba-Puente C, Ortega-Santiago R, Galán-Del-Río F, Valera-Calero JA. Consideration of psychosocial factors in acute low back pain by physical therapists. *J Clin Med* 2023;12:3865.
24. Panayides P. Coefficient alpha: interpret with caution. *Eur J Psychol* 2013;9:687-96.
25. Terwee CB, Bot SD, de Boer MR, van der Windt DA, Knol DL, Dekker J, et al. Quality criteria were proposed for measurement properties of health status questionnaires. *J Clin Epidemiol* 2007;60:34-42.
26. Demoulin C, Ostelo R, Knottnerus JA, Smeets RJ. Quebec back pain disability scale was responsive and showed reasonable interpretability after a multidisciplinary treatment. *J Clin Epidemiol* 2010;63:1249-55.
27. Devonshire JJ, Wewege MA, Hansford HJ, Odemis HA, Wand BM, Jones MD, et al. Effectiveness of cognitive functional therapy for reducing pain and disability in chronic low back pain: a systematic review and meta-analysis. *J Orthop Sports Phys Ther* 2023;53:244-85.
28. O'Sullivan PB, Caneiro JP, O'Keeffe M, Smith A, Dankaerts W, Fersum K, et al. Cognitive functional therapy: an integrated behavioral approach for the targeted management of disabling low back pain. *Phys Ther* 2018;98:408-23.
29. O'Keeffe M, O'Sullivan P, Purtill H, Bargary N, O'Sullivan K. Cognitive functional therapy compared with a group-based exercise and education intervention for chronic low back pain: a multicentre randomised controlled trial (RCT). *Br J Sports Med* 2020;54:782-9.