Original paper

Chronic Respiratory Disease

Chronic Respiratory Disease
2018, Vol. 15(2) 114–122

DOI: 10.1177/1479972317715551
journals.sagepub.com/home/crd
SAGE

Reliability and validity of the Chinese version of the Breathlessness Beliefs Questionnaire

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Abstract

The aim of this article is to evaluate the reliability and validity of the Chinese version of the Breathlessness Beliefs Questionnaire (BBQ) for use among patients with respiratory diseases in China. The BBQ is an instrument for assessing specific dyspnoea-related fears and may have predictive value for chronic obstructive pulmonary disease outcomes beyond general anxiety measures. This instrument has not previously been translated into Chinese or tested in mainland China. This was a cross-sectional validation study with a 1-week test of reproducibility. A total of 252 Chinese patients with respiratory diseases recruited from pulmonary outpatient and inpatient departments completed the BBQ. Demographic characteristics, pulmonary function and degree of dyspnoea were also measured. Cronbach's α was 0.82 for the total BBQ score; 0.72 for the somatic focus subscale and 0.73 for the activity avoidance subscale. Test–retest reliability was satisfactory, with intraclass correlation coefficient scores for the BBQ overall and for each subscale ranging from 0.96 to 0.98 ($p < 0.001$). After exploratory factor analyses, the Chinese version of the BBQ was found to be similar to the original Dutch version. The Chinese version of the BBQ is a reliable tool to assess dyspnoea-related fear in patients with respiratory diseases in mainland China.

Keywords

Dyspnoea, breathlessness, beliefs, anxiety, respiratory diseases

Date received: 4 March 2017; accepted: 9 March 2017

Introduction

Dyspnoea is a prominent symptom of respiratory diseases, such as chronic obstructive pulmonary disease (COPD), asthma and interstitial lung disease (ILD),[1–3] and it is associated with reduced physical activity.[4,5] Low levels of physical activity are generally observed in patients with respiratory diseases,[6,7] and these low levels of activity have been shown to be an independent predictor of mortality in patients with COPD.[8] In clinical practice, patients with respiratory diseases often avoid dyspnoea-eliciting activities. Because of a long-term lack of activity, there is a decline in the functioning of the patient's body, and muscle strength is weakened,[9–12] leading to further increases in the

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level of dyspnoea, forming a vicious circle: Dyspnoea leads to a decrease in activity, which aggravates dyspnoea,[13,14] thereby accelerating the disease progression[15] and affecting the patient's daily functional performance. Hence, it is important to increase the physical activity level of patients with respiratory diseases.

A growing body of research has found significant associations between physical activity and dyspnoea severity, degree of airflow limitation, exercise capacity, muscle function, comorbidities, systemic inflammation, anxiety, self-efficacy for physical activity, weather and lack of intrinsic motivation.[16–21] Recently, several researchers have investigated the role of patients' beliefs about breathlessness, such as fear of inducing breathlessness with physical activity, among those with COPD and asthma.[22–25] Pulmonary rehabilitation programmes are the main intervention for improving these factors to increase the level of physical activity. However, a study conducted in Ireland showed that pulmonary rehabilitation increased exercise capacity but not daily physical activity among patients with COPD,[26] indicating that alternate measures may be necessary to realize behavioural change. Aguilaniu and Roche[27] suggested taking measures to intervene in patients' motivations to improve physical activity levels in COPD. Therefore, a scale aimed at assessing patients' motivations for avoiding activity is necessary.

The Breathlessness Beliefs Questionnaire (BBQ) was developed to measure patients' beliefs about breathlessness in relation to harmfulness and to undertaking physical activity.[24] The BBQ is a Dutch-language quantitative survey developed based on a 17-item questionnaire – the Tampa Scale for Kinesiophobia[28] – for use among those with respiratory diseases.[24] The BBQ comprises 11 items on two subscales: somatic focus and activity avoidance. The items include the patient's beliefs about the harmfulness of dyspnoea and about whether activity should be avoided.[24] Initial quantitative testing of the BBQ showed good performance properties in terms of Cronbach's α coefficient for the total questionnaire, and the questionnaire was also demonstrated to have good construct validity.[24] The instrument has been used as an outcome in a clinical study examining the association between anxiety, breathlessness beliefs and dyspnoea in a pulmonary rehabilitation programme.[25]

In China, respiratory disease is the third leading cause of death in rural areas and the fourth leading cause of death in urban areas.[29] Little previous work has focused on dysfunctional beliefs related to dyspnoea in mainland China. Because of the distinctiveness of the lifestyle and cultural background of respiratory patients in mainland China, the aim of this study was to translate the Dutch version of the BBQ into Chinese and to test its reliability and validity among Chinese patients with respiratory diseases in mainland China.

Methods

Design, participants and setting

This was a cross-sectional study. A convenience sample of 252 patients with respiratory diseases was recruited from the pulmonary outpatient and inpatient departments of Peking Union Medical College Hospital in Beijing from March 2014 to January 2015.

Criteria for inclusion were as follows: (1) patients with COPD, asthma or ILD diagnosed by respiratory physicians based on their medical history and current symptoms; (2) aged 18 years or older; (3) able to read and write Chinese; (4) not affected by any other conditions that could influence daily performance (e.g. musculoskeletal, neurological or rheumatic diseases with functional impairment etc.) and (5) no history of tuberculosis, lung volume reduction surgery or pneumonectomy.

Measurements

Demographic characteristics and clinical data were collected using an original questionnaire, which included questions on age, sex, body mass index, marital status, education and occupation.

Breathlessness Beliefs Questionnaire. The BBQ comprises 11 items measuring two dimensions of breathlessness beliefs: somatic focus (BBQ-SF, 5 items) and activity avoidance (BBQ-AA, 6 items). Questionnaire respondents indicate to what extent they agree with the items on a five-point scale from 'strongly disagree' (scored 1) to 'strongly agree' (scored 5). Higher scores on the BBQ-SF reflect beliefs that their disease is more harmful. Higher scores on the BBQ-AA reflect beliefs that physical activity/exercise eliciting breathlessness should be avoided, because it might make the patient's disease worse.

The BBQ was translated into Chinese (cBBQ) using forward and back-translation with reconciliation by a panel of experts.[30] The translation process[31,32] was as follows: (1) Forward translation: Two translators (a bilingual PhD student who is a nursing professor and a bilingual master's student)

independently translated the BBQ from English into Chinese. (2) Reconciliation: The two translators met and reached a consensus on a draft of the cBBQ that reflected the literal and conceptual content of the original questionnaire. (3) Review by expert panel: The forward translation was reviewed by a bilingual expert panel composed of three members: a respiratory nursing manager, a respiratory physician and a nursing education expert with experience in instrument development. This panel identified and resolved inadequate expressions as well as discrepancies between the forward translation and the original questionnaire. (4) Back-translation: A native medical English expert who had not seen the original English version of the BBQ performed the back-translation of the Chinese version into English. (5) Pretesting: The researcher administered the translated questionnaire to five patients with respiratory diseases to identify semantic or comprehension difficulties. Finally, the back-translated BBQ was sent to the original developer of the instrument for comments to confirm that any change made in the instrument was consistent with its original intent.

The cross-cultural adaption process was conducted by an expert panel, which included a physician, a nursing professor and a clinical nursing expert. The final version of the cBBQ was sent to the expert panel who were informed about the concepts involved and the instrument's purpose. They were asked to rate each item on a five-point Likert-type scale ranging from 1 ('strongly disagree') to 5 ('strongly agree') and to give their opinions on the cultural equivalency of the cBBQ and the appropriateness of the language translation.

The modified Medical Research Council Dyspnoea Scale. The modified Medical Research Council (mMRC) was also employed to assess the patient's breathlessness during physical activity on a five-point scale, with higher grades on the scale indicating more serious dyspnoea.

Pulmonary function testing. Pulmonary function tests were done at the time of recruitment. Spirometry was performed using a standardized protocol based on American Thoracic Society guidelines. Forced vital capacity (FVC) and forced expiratory volume in one second (FEV_1) were measured in a seated position. The best FVC and FEV_1 values were selected by professionals from three efforts.

Procedure

The study was approved by the Institutional Review Board at the School of Nursing at Peking Union Medical College, and all patients provided informed written consent. The cBBQ, the mMRC and the demographic and clinical questionnaire were administered to each of the patients. Most patients completed the questionnaire by themselves. Several patients were unable to see the words on the instrument clearly because of presbyopia, although they indicated that this condition did not affect their daily activities. In these cases, the researcher read the questionnaire to them item-by-item, and then they filled in the questionnaire by themselves. The survey took about 6–8 min to complete.

Finally, a subgroup of 20 stable patients with COPD were interviewed again at the clinic for 1 week after the initial interview to assess the reproducibility (test–retest reliability) of the cBBQ.

Analysis

IBM SPSS software version 20.0 was used for the statistical analysis. Descriptive statistics were used to summarize the patients' demographic characteristics. For the cBBQ, assessments of reliability and validity as well as explanatory factor analysis were conducted.[33]

Reliability

Internal consistency reliability was assessed using Cronbach's α and corrected item-total correlation. Scores under 0.50 were deemed to reflect poor internal consistency, scores of 0.51–0.69 were considered suspicious, scores of 0.70–0.80 were considered acceptable, scores of 0.81–0.90 were considered good and scores >0.90 indicated excellent internal consistency.[34]

Test–retest reliability was used to reflect the temporal stability of the instrument. This was assessed using the intraclass correlation coefficient (ICC). Scores of 0–0.25 were judged to be very poor, those of 0.26–0.49 were considered poor, those of 0.50–0.69 were considered average, those of 0.70–0.89 were considered strong and those higher than 0.90 were deemed very strong.[35]

Validity

Content validity was assessed using the scale-level content validity index (S-CVI) and the item-level content validity index (I-CVI) by calculating the

Table 1. Characteristics of the participants ($n = 252$).

Characteristics		*n* (%)	Medium	Mean ± *SD*
Age (years)	23–59	121 (48.0)	60	
	60–74	112 (44.4)		
	75–83	19 (7.5)		
Gender	Male	171 (67.9)		
	Female	81 (32.1)		
BMI (kg/cm^2)	16.5–18.4	6 (2.4)		
	18.5–23.9	128 (50.8)		
	24.0–27.9	85 (33.7)		
	28.0–37.9	33 (13.1)		
Marital status	With spouses	234 (92.9)		
	Without spouses	18 (7.1)		
Occupational status	Employed	101 (40.1)		
	Unemployed	151 (59.9)		
Smoking duration			8.5	
Lung function index	FEV_1/FVC	231		55.13 ± 14.39
	FEV_1 (%predicted)	231		61.55 ± 21.71
mMRC	4	23 (9.1)		
	3	38 (15.1)		
	2	96 (38.1)		
	1	68 (27.0)		
	0	27 (10.7)		

BMI: body mass index; mMRC: modified Medical Research Council Dyspnoea Scale; FEV_1: forced expiratory volume in one second; FVC: forced vital capacity; SD: standard deviation.

proportion of items receiving high agreement from all of the experts involved.

The explanatory factor analysis was used to assess construct validity. The suitability of the data for factor analysis was examined using the Kaiser–Meyer–Olkin (KMO) test to measure sampling adequacy and Bartlett's χ^2 test of sphericity. Item-total correlation was applied to further assess the construct validity of the cBBQ. Also, to examine the construct validity of the cBBQ, the Spearman's correlation coefficient was calculated between each item and the BBQ subscale scores as well as between the total cBBQ score and the mMRC grade. The distribution of mean cBBQ scores for each mMRC grade was also compared using one-way analysis of variance.

Two-tailed p values were used in all analyses, and $p < 0.05$ was considered statistically significant.

Results

Demographic and clinical characteristics

Data on 252 participants (including 149 patients with COPD, 85 with asthma and 18 with ILD) were analysed. There were no missing data. Demographic and clinical characteristics of the sample are shown in Table 1.

Thirty-three participants (13.1%) were current smokers, 105 (41.7%) were ex-smokers and 114 (45.2%) were nonsmokers. The majority (178, 70.6%) lived in rural areas, and 121 (48.0%) were poor (income < 3000 RMB per month). Approximately, 70% of the participants were male. Most (80.2%) of the participants had grade 1–3 dyspnoea as assessed by the mMRC.

Cross-cultural adaption

During the pretesting, the participants noted that they did not understand the content of the item 5: 'I am afraid that I may accidentally hurt myself'. To clarify the meaning of this item for the participants, after communicating with the original author, the researcher added the following note to item 5: 'eg. Shortness of breath, the decline of lung function'.

During the cross-cultural adaption process, the original author made two comments on the appropriateness of the language translation. First, he noted that the translator (just a native medical English expert performed the back-translation) had consistently used 'physical exercise' where the original version stated 'physically active' or 'physical activity'. He explained that these concepts are related, but they

Table 2. Means (and SDs) for cBBQ subscale scores and total scores (n = 252).

Characteristics	Mean	*SD*
Total score of cBBQ	37.47	6.97
cBBQ-SF	17.50	3.36
cBBQ-AA	19.96	4.73

BBQ: Breathlessness Beliefs Questionnaire; BBQ-SF: BBQ-somatic focus; BBQ-AA: BBQ-activity avoidance; SD: standard deviation.

mean different things: Exercise is comparable to doing sports, which many patients with severe lung disease cannot do, whereas physical activity might also mean things like doing household chores, going shopping and so forth. Activities in this latter category are also taxing for patients with pulmonary diseases. After checking the cBBQ's consistency with the original BBQ with an English expert, we corrected 'physical exercise' in the translated version. Second, the original author also noted that, in the original item 10, '. . . protect my health' meant that patients want to avoid further deterioration in their health. However, the translated version was 'I have to keep healthy'. In Chinese, these two expressions are similar. After communicating with original author on this point, he had no further remarks.

Descriptive statistics of the scale

The BBQ total score was 37.47 (standard deviation (*SD*) = 6.97), and the BBQ-SF and BBQ-AA scores were 17.50 (*SD* = 3.36) and 19.96 (*SD* = 4.73), respectively (Table 2).

Reliability

Internal consistency. The Cronbach's α coefficients for the total BBQ, BBQ-SF and BBQ-AA scores were 0.82, 0.72 and 0.73, respectively.

Test–retest reliability. For the total BBQ, BBQ-SF and BBQ-AA scores, the ICC was greater than 0.90 ($p < 0.001$; Table 3).

Validity

Content validity. For the committee of experts, the S-CVI was 0.97, and the I-CVI ranged from 0.67 to 1.00.

Construct validity. The KMO test score was 0.81, indicating good sampling adequacy, and Bartlett's test of sphericity was significant ($\chi^2 = 706.22$, $p < 0.001$), suggesting that the data were suitable for factor analyses. Table 4 summarizes the results of the exploratory factor analysis, which yielded two factors based on the criteria of eigenvalues >1.00. These two factors overlapped the original questionnaire. The factor loadings of the tested items ranged from 0.46 to 0.81, with the two extracted factors accounting for 34.90% of the total variance.

Table 3. Test-retest reliability of cBBQ in respiratory diseases patients (*n* = 20).

Dimension	Initial scores (mean ± *SD*)	Retest scores (mean ± *SD*)	ICC
cBBQ-AA	17.10 ± 3.84	16.55 ± 3.78	0.963[a]
cBBQ-SF	16.70 ± 3.29	16.55 ± 3.78	0.982[a]
Total score of cBBQ	33.80 ± 5.85	33.10 ± 5.91	0.981[a]

BBQ: Breathlessness Beliefs Questionnaire; BBQ-SF: BBQ-somatic focus; BBQ-AA: BBQ-activity avoidance; ICC: intraclass correlation coefficient; SD: standard deviation.
[a]$p < 0.001$, exceeding the recommended standard of 0.70.

To further evaluate the construct validity of the cBBQ, Spearman's correlation coefficients were calculated between each item and each dimension, as shown in Table 5. These correlation coefficients ranged from 0.54 to 0.73. The Spearman's correlation coefficient was also calculated between the total cBBQ score and the mMRC grade, with a resulting *r* value of 0.40 ($p = 0.000$). The mean cBBQ score for each mMRC grade and its differences is presented in Table 6. There were significant differences in the mean cBBQ scores for patients with different levels of dyspnoea ($F = 11.986$, $p = 0.000$). Patients assessed at mMRC grade 3 or 4 had higher mean cBBQ scores than patients did at mMRC grades 0–2, and those at mMRC grade 2 had higher cBBQ scores than those did at mMRC grade 0.

Discussion

The BBQ is an instrument designed to measure dysfunctional beliefs related to breathlessness and physical activities among patients with respiratory diseases. This study was conducted to determine whether the BBQ could be used among Chinese patients with respiratory diseases in mainland China. As suggested by the World Health Organization[31] and the International Society for Pharmacoeconomics and Outcomes Research Task Force on Translation,[32] we translated the BBQ into Chinese using forward and back-translation, cultural adaption and pilot testing. We also examined the reliability and validity of the cBBQ using Cronbach's α coefficient, test–retest

Table 4. Exploratory factor analysis.

Factors	Items	Factor loading	Eigenvalue	Percentage of variance
Activity avoidance	1. I'm afraid that I might make my disease worse if I exercise	0.46	3.84	34.90
	6. The best thing I can do to control my shortness of breath is to avoid unnecessary activity	0.76		
	8. Feeling short of breath lets me know when to stop exercising so that I don't make myself worse	0.81		
	9. It's really not safe for a person with a condition like mine to be physically active	0.67		
	10. I can't do most of the things healthy people do because I have to protect my health	0.62		
	11. No one should have to exercise when he/she is feeling short of breath	0.75		
Somatic focus	2. Whenever I feel short of breath, my body is telling me I have something seriously wrong	0.60	1.40	47.65
	3. My lung disease has put my body at risk for the rest of my life	0.71		
	4. Shortness of breath always means that I'm not getting enough oxygen	0.48		
	5. I am afraid that I may accidentally hurt myself	0.73		
	7. I wouldn't have as much shortness of breath if there weren't something potentially dangerous going on in my body	0.55		

Table 5. Item-total correlations of cBBQ (r_s).

Item	BBQ-AA	BBQ-SF
1	0.62[a]	0.38[a]
2	0.23[a]	0.62[a]
3	0.29[a]	0.68[a]
4	0.28[a]	0.54[a]
5	0.36[a]	0.73[a]
6	0.69[a]	0.23[a]
7	0.38[a]	0.60[a]
8	0.69[a]	0.29[a]
9	0.75[a]	0.36[a]
10	0.72[a]	0.38[a]
11	0.72[a]	0.38[a]

BBQ: Breathlessness Beliefs Questionnaire; BBQ-SF: BBQ-somatic focus; BBQ-AA: BBQ-activity avoidance.
[a]$p < 0.0$.

Table 6. Differences of mean cBBQ scores for each mMRC grade: one-way ANOVA.

mMRC	*n*	BBQ
0(a)	27	32.41 ± 6.66
1(b)	68	35.66 ± 7.33
2(c)	96	37.63 ± 6.31
3(d)	38	40.50 ± 5.53
4(e)	23	43.04 ± 4.90
F	11.986	
P	0.000	
LSD		a < b, c < d, e

BBQ: Breathlessness Beliefs Questionnaire; mMRC: modified Medical Research Council; LSD: least-significant difference ($p < 0.05$); ANOVA: analysis of variance.

reliability, expert review and exploratory factor analysis.

Previously, the original Dutch version of the scale was found to be valid and reliable among 187 patients with respiratory diseases. However, the lifestyles and cultural backgrounds of patients in mainland China are different from those of Dutch patients. The results of the present study suggest that the BBQ can be adapted to Eastern cultures. The cBBQ was found to have good content validity and a reasonable factor structure as well as acceptable internal consistency reliability and high test–retest reliability among patients with respiratory diseases in an outpatient and an inpatient department.

Cronbach's α coefficient for the total BBQ score was 0.81 for the full sample, indicating high internal consistency reliability. This finding was comparable to Cronbach's α for the Dutch population. For the BBQ-SF and BBQ-AA subscales, the Cronbach's α coefficients were 0.62 and 0.81, respectively. Although the Cronbach's α value obtained for BBQ-SF was lower than the 0.79 found for the Dutch population, the results of the present study remain acceptable. Test–retest reliability as assessed with the ICC was also high, indicating the breathlessness beliefs of stable COPD patients were relatively steady.

The results of our present study have also shown that the cBBQ had a good content validity, indicating that the questionnaire can reflect the breathlessness beliefs of patients with respiratory disease. Exploratory statistical analyses were conducted on the full sample to examine the construct validity. The results of these analyses indicated that all the items had factor loadings >0.46, meeting the criterion for significance. The results suggested a two-factor structure consistent with the original Dutch version. The validity of the cBBQ was further supported by the certain relevance between the items and their dimensions.

In addition, moderate correlations between mMRC scores and cBBQ scores indicated that the cBBQ measures a component of dyspnoea. Furthermore, although there were significant differences in mean cBBQ scores among patients with different levels of dyspnoea, it is somewhat interesting that there were no differences observed in beliefs about breathlessness in relation to its harmfulness or about undertaking physical activity between patients at mMRC grades 3–4 and those at grades 1–2. This may be because mMRC grades 3–4 classified patients who perceived serious breathlessness and mMRC grades 1–2 classified patients who perceived moderate breathlessness. This would suggest that higher cBBQ scores are associated with increased reports of dyspnoea. Janssens et al. found that dysfunctional breathlessness beliefs were associated with higher levels of dyspnoea during ergometer exercise but also with a steeper decrease in exercise dyspnoea among patients with COPD during the course of pulmonary rehabilitation – having lower levels of breathlessness beliefs was associated with an increase in exercise dyspnoea.[25] Future research should explore to what extent the cBBQ is suitable for use among other kinds of respiratory patients. Recent evidence suggests that the responsiveness of the Transition Dyspnoea Index to the effects of pulmonary rehabilitation is greater than that of the mMRC.[36] Therefore, further research is also needed to consider other instruments for assessing breathlessness.

Limitations and recommendations

This study has several limitations. First, China is a vast and culturally diverse country with people of 56 ethnicities. This study's findings were based on data from a convenience sample of patients from Peking Union Medical College Hospital, which may not be representative of respiratory patients in mainland China overall. Peking Union Medical College Hospital is one of the largest medical centres in mainland China. The condition of respiratory patients tends to be more serious in general hospitals in mainland China, especially in areas that are poor and rural. Additional studies should be conducted at hospitals at different levels and in different cities in mainland China. Second, considering that dyspnoea is the most important factor affecting patients' dysfunctional beliefs about breathlessness, this study selected only the level of dyspnoea to assess the construct validity of the cBBQ. Because of limitations in terms of time, manpower and funding, it was not possible to include additional indicators to test the validity. However, Janssens found a significant association between anxiety, depression, perceived decreased functionality and BBQ scores[25] and also found the association of breathlessness beliefs with lower exercise capacity (6-min walking capacity) and impairment in daily activities persisted throughout rehabilitation.[25] Future studies should add physical activities, anxiety and depression to further assess the validity of the cBBQ. Third, I used exploratory factor analysis to investigate the structure of the cBBQ, as it was appropriate to first explore the structure of the instrument. Future validation studies should use confirmatory factor analysis to assess the structure of the cBBQ in mainland China.

In this study, I have demonstrated that the cBBQ has satisfactory validity and reliability for use among respiratory patients in mainland China. The findings also indicate that the cBBQ is suitable for examining dysfunctional beliefs about breathlessness and physical activity among respiratory patients.

Acknowledgements

The authors would like to thank Steven De Peuter for assisting with the protocol development. The authors would also like to thank Professor Tao Liang of Peking Union Medical College School of Nursing; Professor Hui Huang of Peking Union Medical Hospital; and Xiaojiu Qi, a clinical nursing expert at Peking Hospital, for their assistance in the cross-cultural adaption process. They would like to thank Shuzhen Meng, Chi Shao and Tao Liu, who were of great assistance in the patient selection and data collection and also thank all the participants who participated in this study.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Supplementary material

Supplementary material for this article is available online.

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