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Original Article

Psychometric Properties of the Turkish Version of the Breathlessness Catastrophizing Scale in Patients with Chronic Obstructive Pulmonary Disease

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Abstract

OBJECTIVE: To examine the validity and reliability of the Turkish version of the Breathlessness Catastrophizing Scale (BCS) in patients with chronic obstructive pulmonary disease (COPD).

MATERIAL AND METHODS: Seventy patients with COPD (55 male/15 female, mean age: 68.7±7.3 years, FEV1%: 45.4±19.5) were included in this methodological study. Internal consistency was measured using Cronbach's α, and intra-rater reliability was assessed using the intraclass correlation coefficient (ICC). Correlations between the BCS and Modified Medical Research Council Dyspnea Scale (mMRCS), COPD Assessment Test (CAT), Hospital Anxiety and Depression Scale (HADS), Breathlessness Beliefs Questionnaire (BBQ), and St. the George Respiratory Questionnaire (SGRQ) scores were assessed for convergent validity. Known-group comparisons were performed according to COPD stage and dyspnea severity using the independent sample t-test.

RESULTS: Internal consistency was excellent (Cronbach's α=0.941), and the ICC for reliability was 0.955. The BCS score was correlated with the mMRCS (r=0.745), CAT (r=0.652), HADS anxiety (r=0.556) and depression (r=0.588), the BBQ (r=-0.567), and SGRQ (r=0.550-0.634) scores ($P < 0.05$). The BCS score was higher in patients with advanced COPD ($P = 0.003$) and those with severe dyspnea ($P < 0.001$).

CONCLUSION: The Turkish version of the BCS is a valid and reliable tool for evaluating catastrophic dyspnea in patients with COPD.

KEYWORDS: Catastrophizing, chronic obstructive pulmonary disease, dyspnea, reliability, validity

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a preventable and treatable condition characterized by a chronic inflammatory response in the airways and lung parenchyma to harmful particles and gases, resulting in progressive and persistent airway restriction.[1] The high morbidity and mortality rates associated with COPD, which is the third leading cause of death worldwide, make it a top public health concern.[2]

Shortness of breath, which significantly limits everyday activities, is the most common symptom of COPD and is a rather terrifying experience for many patients. This symptom is a significant indicator of exercise intolerance, poor quality of life, and even mortality.[3] According to previous studies, certain emotional and cognitive processes can influence how a person behaves, particularly regarding the sensation of shortness of breath. These processes can alter how a person perceives dyspnea, in addition to depression and anxiety.[4-7] These specific cognitive processes have been studied using different definitions, such as the formation of negative perceptions about shortness of breath, the fear of experiencing breathlessness, or catastrophizing shortness of breath.[4,5]

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Catastrophizing is characterized by an increase in people's threat values toward such situations and the impression that they are out of control. It is an exaggerated negative cognitive orientation toward destructive stimuli and experiences.[8] It encompasses negative emotional patterns such as magnification, despair, and an intense focus on damaging inputs. Patients who overreact to their shortness of breath are prone to developing an excessive sensitivity to fear of it, which may lead them to refrain from engaging in activities that might trigger it.[9,10] It is hypothesized that dyspnea-specific negative affectivity, such as breathlessness catastrophizing, contributes to increased dyspnea perception beyond the effects of general anxiety levels.[11]

There are limited options in the literature for determining the extent to which patients with COPD experience dyspnea. The Interpretation of Breathing Problems Questionnaire, which was created for patients with COPD, is hardly utilized because it is challenging to complete in a clinical environment.[12] The Breathlessness Beliefs Questionnaire (BBQ), which was developed later, evaluates patients' kinesiophobia rather than providing information about catastrophizing.[13] The Breathlessness Catastrophizing Scale (BCS), a version of the Pain Catastrophizing Scale (PCS)[8], is the standard for the evaluation of catastrophizing among patients with chronic pain, was created.[14] This newly constructed scale has been described as having additional benefits for therapeutic use and demonstrating the direct experiential aspects of catastrophization. The characterization of catastrophic thought in the scale is not limited to increased anxiety, morbidity, or death; each item requires a single quantitative rating. The BCS was found to have high convergent validity, reliability, and sensitivity to changes in the evaluation of dyspnea catastrophization in patients with COPD.[14] To the best of our knowledge, no study has examined the psychometric features of the Turkish version of the BCS in patients with COPD. Therefore, we aimed to investigate the reliability and construct validity of the Turkish version of the BCS in patients with COPD.

MATERIAL AND METHODS

Permission and Ethics

The scale was requested from its author for Turkish adaptation, and permission was obtained for its use. All participants provided written informed consent after receiving an explanation of the study's objectives and procedures. The study protocol was approved by the İzmir Katip Çelebi University Non-invasive Research Ethics Board (decision number: 0071, permission date: 23.02.2023). The study was conducted in accordance with the ethical standards of the 1964 Declaration of Helsinki.

Main Points

- Multidimensional evaluation of dyspnea sensations in patients with chronic obstructive pulmonary disease (COPD) is critical.
- A catastrophizing breathlessness could affect patients' activity participation.
- The Breathlessness Catastrophizing Scale showed good psychometric properties in Turkish patients with COPD.

Participants and Procedures

This methodological study was conducted between May 2023 and November 2023. The study included patients with COPD who were followed up at the İzmir Dr. Suat Seren Chest Diseases and Surgery Training and Research Hospital.

The minimum sample size for validity and reliability studies is recommended to be between two and 20 people per item.[15] The BCS comprises 13 items; thus, the sample size was predicted to be between 26 and 260. Furthermore, it is proposed that a minimum of 21 participants were necessary to achieve an estimated intraclass correlation coefficient (ICC) value of ≥0.9.[16] The study was completed with 70 patients, who were reached in the time allocated for the study.

The inclusion criteria were: COPD diagnosis according to the diagnostic criteria established by the Global Initiative for Obstructive Lung Disease (GOLD)[1], age >18 years, no medication changes in the last three weeks, and ability to read and comprehend Turkish. The exclusion criteria were: having COPD exacerbation in the previous month, refusal to participate in the survey, failing to understand the questionnaire or other assessment methods, and not filling out the questionnaire properly.[17,18]

The translation of the BCS was performed in accordance with the guideline.[19] Face-to-face interviews were used by the same researcher to collect data. Additionally, the BBQ, the Hospital Anxiety Depression Scale (HADS), the St. George's Quality of Life Questionnaire (SGRQ), the COPD Assessment Test (CAT), and the Modified Medical Research Council Scale (mMRC) were administered to the patients on the same day for validity analysis. The second assessment identified 30 patients using a simple random sampling method with an envelope containing patient numbers,[20] and the measurements were performed seven days later for intra-rater reliability analysis.

Measurements

Sociodemographic characteristics (age, gender, education), physical measurements (body weight, height), and clinical data (disease duration, smoking habits, cigarette consumption, emergency admissions, and hospitalization in the last year) were recorded in the data form. Lung function was measured using a portable spirometer (Cosmed Pony FX, Rome, Italy) following the ATS guidelines.[21] The GOLD spirometric classification was employed to assess the disease's severity.[1]

Breathlessness Catastrophizing Scale

The BCS was developed from the PCS.[8] Participants are asked to score "the extent to which they have these thoughts and feelings when they experience breathlessness" on a 13-item scale.[14] Each item was rated on a scale of 0 to 4, with the options being "(0) not at all, (1) mild, (2) moderate, (3) a lot, and (4) always". The total score ranged from 0 to 52. A score of 0 indicates that shortness of breath is not perceived as catastrophic.

Breathlessness Beliefs Questionnaire

The BBQ includes 11 items that measure two dimensions of breathlessness beliefs: somatic focus and activity avoidance. Each item is scored 1-5 points. The total score ranged from 11 to 55. Low scores indicate no beliefs about dyspnea or dyspnea-related kinesiophobia. High BBQ-SF indicate the perception that the patient's illness is more dangerous. High BBQ-AA represent the patient's conviction that engaging in physical activity or exercising until one feels out of breath should be avoided since doing so may worsen their condition. Turkish validity and reliability of the scale were determined by Gurses et al.[18]

Hospital Anxiety and Depression Scale

The HADS is a four-point Likert scale, scored between 0 and 3, comprising a total of 14 questions, seven of which examine symptoms of depression and seven of which examine symptoms of anxiety. The lowest and highest possible scores on the two subscales are 0 and 21, respectively. Turkish validity and reliability study of this scale was performed by Aydemir et al.[22]

St. George's Respiratory Questionnaire

The SGRQ is a 50-item disease-specific quality of life questionnaire scored from 0 to 100. Lower scores indicate better quality of life regarding symptoms, activity, and the impact of COPD. Turkish validity and reliability of the scale were established by Polatlı et al.[23]

Modified Medical Research Council Scale

The mMRCS is a one-dimensional tool that rates breathlessness on five levels according to different physical activities. This scale consists of five items, rated from 0 to 4.[24] Participants were asked to indicate the level of activity that caused dyspnea.

Chronic Obstructive Pulmonary Disease Assessment Test

The CAT is an eight-question test that assesses the grade of the disease, symptom severity, and impact on the patient's quality of life. Each question was scored between 0 (no symptoms) and 5 (severe symptoms). The minimum and maximum evaluation scores were 0 and 40 for the perfect and worst health status. Turkish validity and reliability study of this test was performed by Yorgancıoğlu et al.[25]

Statistical Analysis

Statistical analysis was conducted using Statistical Package for the Social Sciences for Windows (version 21.0. Armonk, NY: IBM Corp., The normality of data distribution was assessed using the Shapiro-Wilk test and histogram graphics. Continuous variables were presented as mean (standard deviation) or median (25-75 interquartile range), whereas categorical variables were presented as numbers and percentages (%).

Construct validity was examined through factor analysis, convergent, and known-group validity. To identify the factor structure of the BCS, principal components explanatory factor analysis was applied, considering an explanatory rate of at least 60%.[26] The adequacy of sample size was determined using the Kaiser-Meyer-Olkin test (coefficient: 0.914), and Bartlett's test of sphericity revealed a *P* value of 0.001, indicating that the data distribution was suitable for factor analysis.

Reliability was assessed using Cronbach's α coefficient to measure internal consistency, with a value of at least 0.70 indicating adequate internal consistency.[27] The intra-rater reliability of the BCS was calculated at a 95% confidence interval (CI) using the ICC model (the two-way random effects and absolute agreement methods), where an ICC >0.90 indicated excellent reliability.[28]

Validity was analyzed using Pearson's correlation coefficients between the BCS and the other measures (BBQ, HADS, SGRQ, CAT, and mMRCS scores). The coefficients were reported as follows: (±0.10 to ±0.39), weak correlation; (±0.40 to ±0.69), moderate correlation; (±0.70 to ±0.89), strong correlation; and (±0.90 to ±1.00), very strong correlation.[29] Known-group validity was analyzed with COPD stage and dyspnea severity according to the mMRCS using the independent samples t-test. By determining the percentage of individuals who achieved the lowest or highest possible score on the BCS, floor and ceiling effects were investigated. Statistical significance was set at $P < 0.05$ for all analyses.

RESULTS

This study included a total of 70 patients with COPD. The characteristics of the patients are presented in Table 1, and the outcome measures are presented in Table 2. Principal component analysis indicated that the scale had a unifactorial structure, and the factor loadings varied between 0.638 and 0.848 (Table 3). The internal consistency of the BCS was excellent (Cronbach's α coefficient=0.941). The Cronbach's if item-deleted coefficients ranged from 0.934 to 0.941 (Table 3). The intra-rater reliability was excellent. The ICC was 0.955 at a 95% CI for the total score, ranging from 0.744 to 0.958 for each item (Table 3).

The BCS score was strongly correlated with the mMRCS (r=0.745) and moderately correlated with the CAT (r=0.652), the HADS anxiety (r=0.556) and depression (r=0.588), the SGRQ symptoms (r=0.550), activity (r=0.578), impact (r=0.558), and the total score (r=0.634), the BBQ activity avoidance (r=-0.468) somatic focus (r=-0.474) and the total (r=-0.567) scores ($P < 0.05$) (Table 4).

Known group analyses showed that the BCS score was higher in patients with advanced stage ($P = 0.003$) and severe dyspnea ($P < 0.001$) (Table 5). No floor or ceiling effects were observed for the BCS. One participant (1.4%) earned the lowest score of zero, while 2 people (2.9%) earned the highest score of 52.

DISCUSSION

In the present study, an exploration into the intra-rater reliability, internal consistency, construct validity (including convergent and known group analysis), as well as ceiling and floor effects, was conducted on the Turkish version of the BCS among patients with COPD. The findings indicated that the scale exhibited both validity and reliability. Minimal adaptation was deemed necessary, and all constituent items were in congruence with the Turkish demographics.

Table 1. Characteristics of patients

Variables (n = 70)	Mean (SD) or Median (25-75 IQR)	Minimum-maximum
Age (years)	68.1 (7.3)	52-80
Body mass index (kg/m^2)	26.2 (5.2)	17.2-39.8
Disease duration (years)	13.3 (9.3)	1-50
Consumption of cigarette (*P* *years)	47.3 (36.1)	0-180
Pulmonary function test		
FEV1 (%)	45.4 (19.5)	20-86
FVC (%)	61.5 (16.1)	29-85
FEV1/FVC	54.5 (13.7)	36-68
Emergency admission (n/last year)	1 (0-2)	0-12
Hospitalization (n/last year)	0 (0-1)	0-8
	n (%)	
Male gender	55 (78.6)	
Education		
Primary school	46 (65.7)	
Secondary school	10 (14.3)	
High school	9 (12.9)	
University	5 (7.1)	
Smoking habits		
Smoker	16 (22.9)	
Ex-smoker	50 (71.4)	
Never smoked	4 (5.7)	
COPD severity		
Stage 1	3 (4.3)	
Stage 2	22 (31.4)	
Stage 3	28 (40.0)	
Stage 4	17 (24.3)	

Data are expressed as mean (standard deviation), median (25-75 interquartile range), or n (percentage).
SD: standard deviation, IQR: interquartile range, FEV1: forced expiratory volume in the first second, FVC: forced vital capacity, COPD: chronic obstructive pulmonary disease

Originally developed by Solomon et al.[14] As a derivative of the PCS, the BCS has been demonstrated to be valid and reliable within COPD cohorts. Notably, no translations were performed into other languages. Consistent with the original study,[13] the Turkish version of the BCS exhibited a unifactorial structure and robust internal consistency. Factor loadings ranged from 0.638 to 0.848 across items, with the 12th item exhibiting the lowest loading. Furthermore, the deletion of this item yielded a Cronbach's α value of 0.941. Remarkably, patient interviews revealed notable challenges in comprehension of the 12th item, which were likely attributed to the advanced mean age and limited educational background of the participants. Therefore, practitioners are advised to exercise particular discretion when administering this medication in clinical settings.

Our investigation revealed some intra-rater reliability disparities compared with the original study.[14] Notably, while the ICC values in the original study ranged from 0.69 to 0.86, our analysis yielded values ranging from 0.744 to 0.958. We propose that this variance may stem from the different time intervals between the two measurements. Our measurements were separated by a seven-day interval, whereas in the original study, measurements were taken before and after pulmonary rehabilitation (PR). Furthermore, our observed breathlessness-catastrophizing scores exceeded those reported in the study that developed the BCS (26.64 vs. 18.25).[14] In the aforementioned study, item 5 garnered the lowest score, while item 8 received the highest. The heightened scores observed in our study may be ascribed to the comparatively older demographic with whom we collaborated. Additionally, supplemental oxygen therapy is known to mitigate hypoxia associated with COPD, thereby alleviating dyspnea symptoms by stimulating receptors in the upper airways.[30] Consequently, it is plausible that the patients in the original study, who were hospitalized and received oxygen support, exhibited lower symptomatology compared with our outpatient cohort.

To evaluate the validity of the Turkish version of the assessment tools, we integrated the CAT, which is frequently employed in everyday practice to evaluate and measure the effects of COPD symptoms on patients' health state.[31] It has been reported that an increased CAT score is associated with dyspnea.[32] In our

Table 2. Outcome measures of the patients

Variables (n = 70)	Mean (SD)	Minimum-maximum
Breathlessness Catastrophizing Scale (0-52)	26.6 (14.7)	0-52
Breathlessness Belief Questionnaire		
Activity avoidance (6-30)	17.5 (2.6)	12-24
Somatic focus (5-25)	14.2 (2.7)	10-20
Total (11-55)	31.7 (4.3)	22-43
COPD Assessment Test (0-40)	19.7 (9.8)	2-40
mMRC Dyspnea Scale (0-4)	2.2 (1.3)	0-4
Hospital Anxiety and Depression Scale		
Anxiety (0-21)	6.32 (4.7)	0-18
Depression (0-21)	6.45 (4.7)	0-18
St. George's Respiratory Questionnaire		
Symptom (0-100)	49.1 (23.6)	0-97.5
Activity (0-100)	67.7 (29.1)	0-100
Impact (0-100)	37.9 (23.6)	0-81.4
Total (0-100)	49.4 (23.5)	0.9-88.1

Data are expressed as mean (standard deviation).
SD: standard deviation, mMRC: Modified Medical Research Council, COPD: chronic obstructive pulmonary disease

Table 3. Intra-rater reliability, Cronbach's α values if item deleted, and factor loadings for each item in the Turkish version of the Breathlessness Catastrophizing Scale

Item	Mean (SD)	ICC (95% CI)	Internal consistency (Cronbach's α if item deleted)	Factor loadings
1	2.1 (1.4)	0.844 (0.676-0.925)	0.940	0.641
2	2.1 (1.3)	0.847 (0.679-0.927)	0.939	0.675
3	2.2 (1.5)	0.958 (0.912-0.980)	0.939	0.648
4	2.6 (1.3)	0.856 (0.699-0.931)	0.935	0.774
5	1.9 (1.4)	0.744 (0.456-0.878)	0.934	0.829
6	2.3 (1.5)	0.822 (0.628-0.915)	0.934	0.815
7	1.6 (1.6)	0.832 (0.650-0.919)	0.937	0.745
8	2.1 (1.5)	0.861 (0.706-0.934)	0.937	0.717
9	2.2 (1.6)	0.906 (0.797-0.956)	0.936	0.776
10	1.8 (1.6)	0.805 (0.595-0.907)	0.934	0.848
11	1.9 (1.5)	0.834 (0.654-0.920)	0.935	0.815
12	1.9 (1.6)	0.913 (0.815-0.959)	0.941	0.638
13	2.9 (1.4)	0.919 (0.831-0.962)	0.935	0.794
Total	26.6 (14.7)	0.955 (0.906-0.975)	-	-

Cronbach's α=0.941.
SD: standard deviation, CI: confidence interval, ICC: intraclass correlation coefficient

study, we predicted that the severity of breathlessness may be related to the severity of the disease perceived by patients, and our results confirmed this relationship.

Previous studies have shown that the sensation of breathlessness is associated with anxiety and depression.[14,18,33] These typical symptoms are linked to a higher risk of death in COPD patients.[33] For this reason, we included psychological symptom assessment in our study due to its importance in COPD clinics using HADS, which are used more frequently in routine practice. Employing the HADS, we explored the interplay between breathlessness catastrophizing and anxiety/depression, given the frequent co-occurrence of psychological comorbidities in dyspneic patients, characterized by prevalent fear, anxiety, and depression.[34] Furthermore, we opted for the BBQ scale, which was tailored to assess patients' maladaptive cognitions regarding dyspnea and validated for use in patients with COPD.[18] Our study indicated that there was a moderate relationship between breathlessness catastrophizing and BBQ scores. Our results confirmed the hypothesis that patients who experience catastrophic shortness

Table 4. Validity analysis

Variables (n = 70)	The Breathlessness Catastrophizing Scale	
	r (95% CI)	*P**
Breathlessness Belief Questionnaire		
Activity avoidance	-0.468 (-0.688, -0.208)	0.001
Somatic focus	-0.482 (-0.676, -0.238)	0.001
Total	-0.567 (-0.751, -0.343)	<0.001
mMRC Dyspnea Scale	0.745 (0.538, 0.826)	<0.001
COPD Assessment Test	0.652 (0.479, 0.850)	<0.001
Hospital Anxiety and Depression Scale		
Anxiety	0.556 (0.382, 0.763)	<0.001
Depression	0.588 (0.381, 0.781)	<0.001
St. George's Respiratory Questionnaire		
Symptom	0.550 (0.331, 0.732)	<0.001
Activity	0.578 (0.317, 0.745)	<0.001
Impact	0.558 (0.386, 0.712)	<0.001
Total	0.634 (0.445, 0.780)	<0.001

*Pearson correlation analysis, r: correlation coefficient.
CI: confidence interval, mMRC: Modified Medical Research Council, COPD: chronic obstructive pulmonary disease

Table 5. Comparison of known-group validity

Variables (n = 70)	Known-group validity		*P**
Breathlessness Catastrophizing Scale (0-52)	COPD Stage 1-2 (n = 25)	COPD Stage 2-4 (n = 45)	0.003
	20.9 (12.7)	34.1 (10.3)	
	mMRC Score 0-1 (n = 28)	mMRC Score 2-4 (n = 42)	<0.001
	18.5 (11.5)	38.9 (9.6)	

Data are expressed as mean (standard deviation), *independent samples t-test.
mMRC: Modified Medical Research Council Dyspnea Scale, COPD: chronic obstructive pulmonary disease

of breath may have beliefs to avoid movement. Additionally, the SGRQ was utilized to investigate potential associations between dyspnea catastrophizing and quality of life, as fear of breathlessness significantly impacts quality of life.[35] Our findings revealed significant correlations between dyspnea and these measures, affirming the high convergent validity. Moreover, in addition to the original study, we conducted a known group validity analysis to identify elevated dyspnea in patients with severe dyspnea and advanced-stage COPD.

The sensation of breathlessness is multidimensional and has led to the development of various assessment tools. Although single-item rating scales are prevalent for emotional distress arising from recalled or immediate breathlessness episodes, multidimensional assessment tools offer a more comprehensive appraisal, encompassing affective distress.[36] The ATS recommends classifying instruments according to whether they address sensory-perceptual experience, affective distress, or impact on functional or emotional ability, thereby enabling a more sophisticated comprehension of the aspects of dyspnea.[3]

Based on the PCS, the BCS evaluates the emotional repercussions of breathlessness and presents a measure of catastrophic beliefs surrounding dyspnea. Accordingly, we posit that BCS enriches the multidimensional evaluation of dyspnea, providing clinicians diverse perspectives to inform therapeutic interventions.

Several limitations were identified in the present study. First, the lack of comparable literature on BCS in other languages limited our discussion of our results within existing research. Second, the absence of a rehabilitative intervention in our study precluded the assessment of BCS sensitivity to PR programs. Future investigations should consider evaluating the BCS's responsiveness to PR interventions. Third, not including an assessment of physical activity level or daily living activity, which are likely to be associated with breathlessness catastrophizing, can be considered another limitation.

Although dyspnea and its associated evaluations have been extensively examined in respiratory patient populations, further exploration across diverse disease groups is needed. Such initiatives would advance our understanding of dyspnea and its management in a variety of therapeutic settings.

CONCLUSION

In conclusion, our investigation underscores the robust psychometric properties of the Turkish version of the

Breathlessness Coping Scale (BCS) in assessing dyspnea in patients with COPD. Demonstrating a high level of internal consistency, reliability and construct validity, the BCS is a valuable tool for clinical and research domains within Turkish COPD cohorts.

Ethics

Ethics Committee Approval: The study protocol was approved by the İzmir Katip Çelebi University Non-invasive Research Ethics Board (decision number: 0071, permission date: 23.02.2023).

Informed Consent: All participants provided written informed consent after receiving an explanation of the study's objectives and procedures.

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Footnotes

Authorship Contributions

Surgical and Medical Practices: H.Ş., Concept: Ş.D., İ.N., E.F., M.K., Design: Ş.D., İ.N., E.F., M.K., Data Collection or Processing: Ş.D., H.Ş., Analysis or Interpretation: İ.N., Literature Search: Ş.D., İ.N., Writing: Ş.D., İ.N., E.F., M.K.

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