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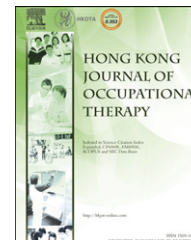
ORIGINAL ARTICLE

Reliability and Validity of the Self-administered Chinese Version of the Shortness of Breath Questionnaire (C-SOBQ) in Patients With Chronic Obstructive Pulmonary Disease

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Summary   *Background*: Dyspnoea is crucial in evaluating patients with chronic obstructive pulmonary disease (COPD). The San Diego Shortness of Breath Questionnaire (UCSD SOBQ) assesses shortness of breath in activities of daily living (ADL). It has been translated into Chinese and used clinically in Hong Kong for many years.
Objective: To investigate the reliability and validity of a self-administered Chinese version of the Shortness of Breath Questionnaire (C-SOBQ) with pictorial enhancement in patients with COPD in Hong Kong.
Methods: A total of 119 patients with COPD were recruited by convenience sampling from seven public clinical settings and two community self-help groups. The C-SOBQ score for each patient was correlated with a set of criterion parameters including age, body mass index (BMI), 6-minute walking distance (6MWD) test, lung function physiological parameters, BODE index, the Modified Medical Research Council Dyspnoea Scale (MMRC Dyspnoea Scale), and the Global Initiative for Chronic Obstructive Lung Disease (GOLD) COPD classifications. For test–retest

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reliability, 22 out of 119 patients were selected and assessed using the C-SOBQ followed by a reassessment within 1 week by the same rater.

Results: The C-SOBQ shows good test—retest reliability with an intra-class correlation coefficient of 0.915 ($p \leqq .05$). It demonstrates significant correlations with the MMRC Dyspnoea Scale, GOLD COPD classifications, BODE index, BMI, and 6MWD. The BODE index, MMRC Dyspnoea Scale, and 6MWD were valid predictors of C-SOBQ total score. A total of 50.4% of patients could be correctly grouped in quartiles of the BODE index using the C-SOBQ.

Conclusion: The C-SOBQ with pictorial enhancement is a valid and reliable instrument which gives precise information about the impact of dyspnoea on functional activities for patients with COPD.

Introduction

Chronic obstructive pulmonary disease (COPD) is a major cause of chronic morbidity and mortality around the world. It is projected that by 2020 it will rank fifth in terms of worldwide burden of disease, according to the World Health Organization (WHO, 2006). In Hong Kong, the prevalence was estimated in 2000 to be 139,000 or 3.5% of the total population (Regional COPD Working Group, 2003). COPD is characterised by airflow limitation that is not fully reversible, is usually progressive, and is associated with an abnormal inflammatory response of the lung (Global Initiative for Chronic Obstructive Lung Disease [GOLD], 2011). The airflow limitation is confirmed by an objective spirometry test. However, such a measure only gives information on one aspect of the disease process: the airflow abnormality in the lungs. This is often inadequate to reflect the multifaceted problems actually caused by the disease. Patients are usually unaware of the pathophysiological changes in their bodies and they only seek medical attention when distressing symptoms such as exertional dyspnoea and exercise limitation begin to appear. Therefore, it is instrumental to directly assess the symptoms of patients in order to understand the impact of the disease process as well as to define outcomes following interventions.

The ATS (2002) defines dyspnoea as a symptom used to characterise a subjective experience of breathing discomfort that consists of qualitatively distinct sensations that vary in intensity. Such subjective experience derives from interactions among multiple physiological, psychological, social, and environmental factors, and may induce secondary physiological and behavioural responses. Experiencing shortness of breath (SOB) and a decline in physical tolerance are often the causes of disability for persons with COPD in performing activities of daily living (ADL) (Chan, Tam, Chan, Ng, & So, 2006; Fong et al., 2001). Eakin, Kaplan, Ries, & Sassi-Dambron (1996) show that self-reported dyspnoea is an important and independent outcome measure of COPD, and it has therefore become an important area of research interest. An accurate assessment reflecting the level of self-reported dyspnoea that the patients are experiencing is essential in clinical practice both for differentiating between patients who have less and those who have more dyspnoea (discriminative), and determining whether their dyspnoea has changed over time and/or as a result of treatment (evaluative). Although many methods are available to evaluate breathlessness in COPD, their effectiveness and clinical utility remain largely unexplored in the respiratory care literature.

The key requirements of the self-reported assessment tool should be: (a) a patient-reported outcome; (b) multi-dimensional, but simple to use; (c) responsive to therapy with the ability to detect change; and (d) an established minimal clinically important difference (Cullen & Rodak, 2002; Mahler, 2006). The University of California San Diego Shortness of Breath Questionnaire (UCSD SOBQ) is a self-administered questionnaire developed primarily as a screening evaluation for rehabilitation programme to assess the self-reported dyspnoea associated with specific ADL (Eakin, Resnikoff, & Prewitt, 1998). It meets all the above requirements and, in addition, its broader coverage of items in ADL and its wider gradation (0—120) may offer advantages over other, similar instruments (Eakin et al., 1998; Kupferberg, Kaplan, Slymen, & Ries, 2005).

The aims of this study were: to develop a self-administered Chinese SOBQ with pictorial enhancement (C-SOBQ); to investigate its test—retest reliability and criterion-related and discriminative validities; and to improve the clinical application of the instrument in local communities, especially among the illiterate, and across populations of different languages and cultures (such as Chinese not of Guangzhou origin, Caucasians, and so on). The study primarily intended to establish the instrument's reliability and validity.

Methods

Participants

This was a cross-sectional study employing a convenience sample of 115 patients suffering from COPD of various severities and whose medical conditions were stable. They were recruited from five public hospitals, two outpatient clinics, and two community COPD self-help groups. Patients with different disease severities were staged according to the GOLD guidelines (2011). Participants were required to meet the selection criteria: (1) diagnosed with COPD with a ratio of forced expiratory volume in 1 second (FEV_1) to forced vital capacity (FVC) of less than 70%; (2) stable condition (no admissions related to respiratory problem in

the 4 weeks prior to assessment); and (3) no current or recurrent symptomatic ischaemic heart disease, lung cancer, known psychiatric illness, active tuberculosis, uncontrolled insulin-dependent diabetes mellitus, and active exacerbation of COPD. Twenty-two out of the 115 patients were randomly recruited from the seven clinical settings for test–retest reliability purposes and were assessed by the C-SOBQ followed by a reassessment within 1 week by the same rater.

Design

To establish test–retest reliability, all patients were assessed using the C-SOBQ followed by a reassessment within 1 week by the same rater. The first and second sets of scores were then analysed. To establish criterion-related validity, the C-SOBQ was correlated with seven criterion parameters in four domains: (1) physical parameter in terms of age and body mass index (BMI); (2) exercise capacity by the 6-minute walking distance (6MWD) test; (3) physiological parameters by means of lung function impairment as measured by spirometry in terms of FEV_1, FVC, the ratio of FEV_1 and FVC (FEV_1/FVC), and the predicted values of FEV_1 and FVC; and (4) the impairment level of COPD in terms of the GOLD classification and score on the Modified Medical Research Council Dyspnoea Scale (MMRC Dyspnoea Scale). The C-SOBQ scores of the 115 participants were used to predict the GOLD COPD classification, the MMRC Dyspnoea Scale score, and the BODE index by means of discriminative analysis. The parameters were collected from the medical records of each selected patient within a 1-month interval. If those were not available, assessments were conducted by occupational therapy students under the direct supervision of registered occupational therapists.

Instruments

C- SOBQ (Appendix I)
The UCSD SOBQ is a valid and reliable instrument for assessing the impact of dyspnoea on ADL for patients with different lung diseases (Eakin et al., 1998). The C-SOBQ was translated from the UCSD SOBQ with the author's permission. It contains 24 items rated using a scoring scale from 0–5. The C-SOBQ is a self-administered questionnaire which asks patients to indicate the severity of their shortness of breath on a six-point scale (where 0 = not at all and 5 = maximal or unable to do because of breathlessness) during 21 different ADL associated with varying levels of exertion. Three additional questions about limitations because of shortness of breath, fear of harm from overexertion, and fear of shortness of breath are included to make up the total of 24 items.

The content validity of the instrument, instructions and testing procedures of the C-SOBQ were verified by a panel comprised of one expert from Hong Kong Polytechnic University and nine occupational therapists with intensive experience of working with COPD patients in public hospitals.

The 24 items were presented to the participants using picture cards representing the specific tasks of ADL. The cards were illustrated in black-and-white cartoon style in order to accommodate patients with decreased visual sensitivity to colour contrast. Six A4-sized scoring cards printed with different dyspnoea scores (0–5) were also placed on a desk in front of the participant. The ADL picture cards were then given one by one and the patient asked to score the subjective dyspnoea level of each specific ADL activity by placing the presented ADL picture card on one of the corresponding scoring cards. Patients' response should be for an average day during the past week. If patients did not routinely perform the activity, they were asked to estimate the degree of shortness of breath anticipated. The C-SOBQ was scored by summing responses across all 24 items to form a total score ranging from 0 to 120.

In the rating scale of the original SOBQ, there were no descriptive wordings for scale points 1–3. However, the panel decided to use descriptive wordings for all five points throughout the study to make the scale clearer and more understandable. They are: 0 = Not at all, 1 = Very mild, 2 = Mild, 3 = Moderate, 4 = Severely, and 5 = Maximally or unable to do because of breathlessness. Face validity was carried out to determine whether the pictorial illustrations precisely represented the corresponding ADL tasks (questions 1–21). A field test of 20 participants with COPD was conducted twice with the prototype C-SOBQ, one of which included descriptive wordings and one which did not. The results did not identify any significant differences in the final scores between the two questionnaires, suggesting that the intended adaptations did not alter the construct of the rating scale.

The COPD stage (Appendix II)
The disease severity of patients was classified into four COPD stages: Stage 1 = Mild, Stage 2 = Moderate, Stage 3 = Severe, and Stage 4 = Very Severe, as according to the GOLD spirometry classification guidelines (GOLD, 2011).

The MMRC Dyspnoea Scale (MMRC) (Appendix III)
The MMRC dyspnoea scale is a measure of disability in patients with COPD and is recognised as a simple discriminative measure of functional dyspnoea levels (Eltayara, Becklake, & Volta, 1996). It is an ordinal five-point scale based on the degree of exertional levels of various physical activities that precipitate dyspnoea. Patients are asked about their perceived breathlessness and classified into the five dyspnoea grades (from 0 = minimal to 4 = maximum) (Mahler & Wells, 1988). The MMRC is also used to construct the BODE index.

The BODE index (Appendix IV)
The BODE index is a tool recently proposed to provide prognostic information about COPD patients (Amorós, Mastous, & Renom-sotorra, 2009; Celli, Cote, & Martin, 2004). It is used to predict COPD mortality. BODE refers to the BMI (B), the degree of airflow obstruction (O), dyspnoea (D), and exercise capacity (E) and is a simple multidimensional 10-point scale in which higher scores indicate a higher risk of death (Callens et al., 2009; Celli et al., 2004). The total score is calculated using four parameters (Appendix II).

The BODE score can be classified into four quartiles and each quartile increase in BODE score is associated with

increased mortality: Quartile 1 = BODE 0–2, Quartile 2 = BODE 3–4, Quartile 3 = BODE 5–6, and Quartile 4 = BODE 7–10 (Celli et al., 2004).

Spirometry lung function test

A spirometry test was conducted according to the American Thoracic Society/European Respiratory Society (ATS/ERS) Standardization Guidelines (Miller, 2005) using a spirometer. It measured the volume of air forcibly exhaled from the point of maximum inspiration (FVC) and the volume of air exhaled during the first second of this manoeuvre (FEV_1). The ratio of these two figures (FEV_1/FVC) was then calculated. The predicted values of FEV_1 and FVC in this study were calculated using the Hong Kong norms of lung function according to the equations for males and females (Ip et al., 2006). In this study, the degree of airflow obstruction from spirometry is also used as a variable to construct the BODE index. Lower limit for normal (LLN) of FEV_1/FVC ratio for males was calculated as: $[0.00932 + (Age \times 1.409 \times 10^{-5}) + (Age^2 \times -3.038 \times 10^{-7}) + (Height \times -4.001 \times 10^{-5})] \times Height^2$, and LLN of FEV1/FVC ratio for females: $[0.01119 + (Age \times -1.062 \times 10^{-5}) + (Age^2 \times -2.046 \times 10^{-8}) + (Height \times -4.900 \times 10^{-5})] \times Height^2$.

6MWD

The self-paced 6MWD is a submaximal exercise test, but it correlates well with the maximal cardiopulmonary exercise test (Carter et al., 2003). It is frequently used to assess the level of exercise capacity of patients suffering from COPD. In this study, the 6MWD was measured by the distance that a patient could walk quickly on a flat hard surface over a period of 6 minutes. Short breaks were allowed if necessary. Pulse rate and oxyhaemoglobin percentage (% SpO_2) were recorded before, during, and after the test. The 6MWD is one of the variables used to construct the BODE index.

BMI

BMI is the weight in kilograms divided by the square of the height in metres. There is an inverse relation between BMI and survival and index values below 21 are associated with an increased risk of death as reported by Celli et al. (2004). The BMI is also used to construct the BODE index.

Statistical analysis

Descriptive statistics were used to present the patients' demographic data. The test–retest reliability of the C-SOBQ was determined using the intraclass correlation coefficient (ICC) (two-way mixed effect model) with a 95% confidence interval. A sample size of 22 patients for the test–retest reliability by ICC was determined based on a predicted value of ICC ranged from 0.8 to 0.9 with a 0.05 confidence limit (Walter, Eliasziw, & Donner, 1998). This reports the proportion of variance of an observation because of between-subject variability in the true scores. The ICC ranges between 0.0 and 1.0. The correlation of the C-SOBQ with criterion-related parameters was calculated using Spearman's rank correlation coefficient over the 115 patients. Stepwise multiple linear regression analysis was

also used to analyse the relationships between the variables including the BODE index, COPD classification, MMRC scale, 6MWD, lung function test (FEV_1, FVC, FEV_1/FVC, FEV1% predicted, FVC% predicted) and BMI as a predictor of the C-SOBQ total score. The level of significance was set at $p \leq .05$. To investigate the discriminative ability of the C-SOBQ, discriminate function analysis was used to determine if the C-SOBQ could distinguish categorical dependent variables or groupings of COPD patients. The group memberships of the COPD classification, the MMRC levels, and the quartiles of the BODE index were analysed using the total scores of C-SOBQ as the independent variable. Wilks' lambda is a statistic used in particular in discriminant factor analysis as a measure of class separation. A small (close to 0) value means that the groups are well separated where a large (close to 1) value means that they are poorly separated.

Results

A total of 115 participants were recruited to test the criterion-related and discriminative validities, including 107 males and eight females. The patients were aged 51–89 years with a mean age of 73.92 years. They included patients at GOLD COPD classification Stages I–IV and MMRC scales 0–4. The mean of the patients' lung function impairment in terms of FEV_1/FVC was 48.27% (SD 13.49). The BODE index values ranged from 1 to 10 with a mean of 4.17. The C-SOBQ score ranged from 0 to 99, with an average score of 40.83 units (Table 1).

The ICC obtained in this study was 0.915 ($n = 22$) which indicates good test–retest reliability (Portney & Watkins, 2000).

In terms of functional classification measures, there were significant positive correlations between the total

Table 1 Demographic Characteristics of Patients with COPD.

Characteristics ($n = 115$)	Mean	SD
Age (y)	73.92	9.12
BMI	21.31	3.58
6MWD (m)	317.58	112.23
FEV_1 (L)	0.96	0.46
FVC (L)	1.98	0.66
FEV_1 /FVC (%)	48.27	13.50
FEV_1 % predicted (%)	45.87	20.19
FVC % predicted (%)	68.69	20.61
BODE Index	4.17	2.53
MMRC	1.92	1.01
GOLD COPD Stage	2.80	0.90
C-SOBQ	40.83	26.89

Note. 6MWD = 6-minute walking distance; BMI = body mass index; COPD = chronic obstructive pulmonary disease; C-SOBQ = Chinese version of the Shortness of Breath Questionnaire; FEV_1 = forced expiratory volume in 1 second; FVC = forced vital capacity; FEV_1 % predicted = predicted value of forced expiratory volume in 1 second; FVC % predicted = predicted value of forced vital capacity; GOLD = Global Initiative for Chronic Obstructive Lung Disease; MMRC = Modified Medical Research Council Dyspnoea Scale; SD = standard deviation.

Table 2 Correlation Matrix of C-SOBQ with Other Criterion Parameters.

Criterion-related parameter	Spearman's Rho coefficient
Gold COPD classification	.581*
MMRC	.687*
BODE Index	.762*
Age	−.220
BMI	−.314*
6MWT	−.594*
FEV$_1$	−.630*
FVC	−.416*
FEV$_1$/FVC	−.415*
FEV$_1$ predicted	−.593*
FVC predicted	−.417*

Note. 6MWD = 6-minute walking distance; BMI = body mass index; COPD = chronic obstructive pulmonary disease; C-SOBQ = Chinese version of the Shortness of Breath Questionnaire; FEV$_1$ = forced expiratory volume in 1 second; FVC = forced vital capacity; FEV$_1$ % predicted = predicted value of forced expiratory volume in 1 second; FVC % predicted = predicted value of forced vital capacity; GOLD = Global Initiative for Chronic Obstructive Lung Disease; MMRC = Modified Medical Research Council Dyspnoea Scale.
*$p \leq .01$.

C-SOBQ score and the MMRC scale ($r = .687$), GOLD COPD stage ($r = .581$), and BODE index ($r = .76$) (Table 2). Looking at physiological measures of disease severity, there was a significant negative correlation between the total C-SOBQ score and the FEV$_1$/FVC, FEV$_1$, FVC, and respective predicted values ($r = −.415$ to $−.63$). In terms of measures of physical wellness, significant negative correlations were also found between the C-SOBQ and BMI ($r = −.314$), and 6MWD ($r = −.59$). However, age had no significant correlation with C-SOBQ score.

The regression analysis showed (Table 3) that only the BODE index, the MMRC scale, and the 6MWD yielded significant results and predicted the C-SOBQ total score ($B = −0.077$–9.022, standard error (SE) $= 0.018$–2.446, $t = −4.271$–3.689, $p < .05$). The BODE index accounted for 54.8% of the total variance in the C-SOBQ total score. After adding the 6MWD and the MMRC to the regression model, these three factors accounted for 63.0% of the total variance in the C-SOBQ total score. The final regression equation for predicting the SOBQ total score was devised as: C-SOBQ $= 35.040 + 3.104$ (BODE index) $− 0.077$ (6MWD) $+ 9.022$ (MMRC scale).

In terms of the discriminant analysis, for the COPD classification (Table 4), the group mean difference of

C-SOBQ score was the reference for prediction and was statistically significant for the grouping (Wilks' lambda $= .681$, $df = 3$, $p < .001$). For the MMRC levels, the group mean difference of the C-SOBQ score was also shown to be a significant predictor for the MMRC levels grouping (Wilks' lambda $= .518$, $df = 3$, $p < .001$). Finally, for the quartiles of the BODE index, the discriminative validity for the group mean differences of C-SOBQ to BODE index grouping was fair (Wilks' lambda $= .482$, $df = 3$, $p < .001$).

By using the total C-SOBQ score to predict the classification in COPD, MMRC, and BODE index quartiles (Table 5), the results of the discriminant analysis showed that 40.0% of the COPD stage, 41.7% of MMRC levels, and 50.4% of the quartiles of BODE index of the original cases were correctly classified.

Discussion

In this study, the C-SOBQ showed high test–retest reliability, consistent with one previous study on the original version of the questionnaire (Eakin, Sassi-Dambron, & Ries, 1995). The present study also indicated that a self-administered version of the questionnaire with pictorial enhancement did not alter the test–retest reliability of the instrument; furthermore, this approach requires little instruction in administration and so might be usefully applied among the illiterate, and across populations from different languages and cultures.

In terms of the criterion-related validity, the strongest correlation was found between the C-SOBQ and the BODE index, indicating that C-SOBQ has the potential to act as a good evaluation tool to determine COPD mortality. A good correlation was also obtained between the C-SOBQ and MMRC. This could be explained by the fact that both instruments employ similar constructs to measure dyspnoea, with MMRC looking at functional dyspnoea levels and C-SOBQ the dyspnoea levels specifically related to corresponding ADL activities. A moderate correlation was found between the C-SOBQ score and GOLD COPD classification, reflecting that the patient's subjective functional performance is actually correlated with physiological impairment as shown by the spirometry lung function test. In terms of the patient's actual functional performance, a strong correlation was found between the C-SOBQ and the 6MWT. This is not surprising as the 6MWT measures the patient's actual exercise capacity which can be highly limited by dyspnoea. This result is consistent with that found in previous studies of the SOBQ and 6MWT by Eakin et al. (1995). A fair correlation was observed between the C-SOBQ and lung function test, with the result being

Table 3 Prediction of the C-SOBQ Total Score.

	B	SE	t	Sig.	R	R^2
(Constant)	35.040	8.000	4.380	<0.001*	0.794	0.630
BODE Index	3.104	1.165	2.665	0.009*		
6MWD	−0.077	0.180	−4.271	<0.001*		
MMRC Scale	9.022	2.446	3.689	<0.001*		

Note. 6MWD = 6-minute walking distance; C-SOBQ = Chinese version of the Shortness of Breath Questionnaire; MMRC = Modified Medical Research Council Dyspnoea Scale; Sig. = p value; * ≤ 0.001.

Table 4 Prediction of COPD Stage MMRC Level and the Quartiles of the BODE Index by Total Score of C-SOBQ.

	Mean	SD	n
COPD stage			
1	10.43	9.20	7
2	28.00	24.11	39
3	42.97	23.20	39
4	61.83	21.21	30
MMRC			
0	3.40	3.21	5
1	24.63	21.08	41
2	40.38	20.70	34
3	67.39	16.70	28
4	58.43	22.30	7
BODE quartiles			
Q1 (0–2)	19.35	18.32	34
Q2 (3–4)	29.61	19.90	28
Q3 (5–6)	53.30	19.36	27
Q4 (7–10)	68.08	18.11	26

Note. COPD = chronic obstructive pulmonary disease; C-SOBQ = Chinese version of the Shortness of Breath Questionnaire; MMRC = Modified Medical Research Council Dyspnoea Scale; SD = standard deviation.

similar to that of a study by Fong et al. (2001) on lung function impairment and functional performance. This could be explained by the observation that patients often compensate for their ADL participation by using adaptive techniques to minimise dyspnoea in spite of lung function decline.

Age and BMI were found to have relatively low correlations with C-SOBQ. It is commonly observed that many patients, even those who are very elderly or have a low BMI, can still perform functionally well in terms of ADL. The regression results demonstrated good agreement with the results of the correlation analysis, showing that the BODE index, MMRC scale, and 6MWD are valid predictors of C-SOBQ. In fact, all three are actually essential components of the evaluation of most COPD cases in a pulmonary rehabilitation programme. These results indicate that C-SOBQ is complementary to each of them and the information it generates is specifically important for occupational therapists as it directly reflects the patient's ADL functioning.

The C-SOBQ was also used to predict group membership of BODE quartile, GOLD COPD classification, and MMRC levels using discriminant analysis. The percentage of cases classified correctly is called the hit ratio. The hit ratio must be compared not to zero but to the percentage that would have been correctly classified by chance alone. The results show that less than 50% of the original group cases (GOLD COPD stage = 40.0%, MMRC = 41.7%) were correctly classified by the total score of C-SOBQ alone. The percentage of cases correctly classified by the discriminant analysis showed a hit ratio below 50% suggesting the discriminative power of the measure is questionable (Hair, Anderson, Tatham, & Black, 1995) and warrants further investigation.

The most likely reason for the total score of the C-SOBQ demonstrating an unsatisfactory discriminative power is that the sample population was skewed towards high severity. Among the GOLD COPD classification, only seven

Table 5 Classification of COPD Stage, MMRC Level and BODE Quartiles Using Total Score of C-SOBQ.

COPD stage	GOLD: predicted group membership, n (%)				
	I	II	III	IV	Total
I	6 (85.7)	1 (14.3)	0 (0)	0 (0)	7
II	18 (46.2)	11 (28.2)	2 (5.1)	8 (20.5)	39
III	5 (12.8)	12 (30.8)	7 (17.9)	15 (38.5)	39
IV	1 (3.3)	4 (13.3)	3 (10)	22 (73.3)	30
40.0% of original grouped cases correctly classified					

MMRC	MMRC: predicted group membership, n (%)				
	0	1	2	3	4	Total
0	5 (100)	0 (0)	0 (0)	0 (0)	0 (0)	5
1	18 (43.9)	13 (31.7)	4 (9.8)	3 (7.3)	3 (7.3)	41
2	3 (8.8)	11 (32.4)	9 (26.5)	5 (14.7)	6 (17.6)	34
3	0	1 (3.6)	3 (10.7)	19 (67.9)	5 (17.9)	28
4	0	1 (14.3)	1 (14.3)	3 (42.9)	2 (28.6)	7
41.7% of original grouped cases correctly classified						

BODE quartile	BODE quartiles: predicted group membership, n (%)				
	0–2	3–4	5–6	7–10	Total
Q1 (0–2)	26 (76.5)	3 (8.8)	3 (8.8)	2 (5.9)	34
Q2 (3–4)	15 (53.6)	7 (25.0)	4 (14.3)	2 (7.1)	28
Q3 (5–6)	1 (3.7)	9 (33.3)	6 (22.2)	11 (40.7)	27
Q4 (7–10)	0	3 (11.5)	4 (15.4)	19 (73.1)	26
50.4% of original grouped cases correctly classified					

Note. COPD = chronic obstructive pulmonary disease; C-SOBQ = Chinese version of the Shortness of Breath Questionnaire; GOLD = Global Initiative for Chronic Obstructive Lung Disease; MMRC = Modified Medical Research Council Dyspnoea Scale.

patients were in GOLD Stage I which is small compared with that of other stages (39 patients in each of Stages II and III and 30 at Stage IV). In terms of MMRC levels, only five patients were at Level 0 and seven at Level 5 respectively, with the majority in Levels 2−4. Many studies suggest that a ratio of 20 observations for each predictor variable should be available for the discriminant analysis process to be completed successfully (Huberty, 1994; Sanchez, 1974). Nevertheless, the hit ratio of predicting the group membership of quartiles of the BODE index by C-SOBQ total score reached 50.7% which is an acceptable percentage. This implies that the instrument could assist in the prediction of the mortalities and hospitalization of the study population (Ong, Earnest, & Lu, 2005). Like other prospective observational studies of patients with COPD, the degree of dispend and health-status scores are more accurate predictors of the risk of death than the airflow limitation in the lungs (Bartolommeo et al., 2010) and our results on the C-SOBQ and BODE index confirm this observation.

Limitations of the study

Although seven hospitals and outpatient clinics, and two self-help groups from different geographical regions in Hong Kong were included in the study to enhance the representativeness of subject recruitment, the inclusion of participants was still based on convenience sampling which limits the generalisability of the results to a larger population. Furthermore, there were far fewer participants with mild COPD in the sample. It is suggested that further studies should include more patients with milder COPD in community settings. The C-SOBQ could also be applied to the study of patients with other chest diseases, such as pneumoconiosis, or those having had lung transplantation, in order to determine functional dyspnoea level in their ADL.

Conclusion

We have developed a Chinese version of the SOBQ with pictorial enhancement and shown that it is a reliable and valid instrument for occupational therapists or other healthcare professionals to assess the level of dyspnoea related to ADL among patients with COPD in Hong Kong. The unique self-administration method of the C-SOBQ allows it to replace the text version of the SOBQ which greatly enhances its efficiency and clinical application among literate and illiterate subjects, and patients from different cultural and linguistic backgrounds.

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Appendix I. The Chinese Shortness of Breath Questionnaire (C-SOBQ).

1. 休息
2. 以你慣常速度行平路
3. 與你年紀相若的人一同行平路
4. 行山 或 行上斜坡
5. 行上樓梯
6. 進食
7. 由椅子站立起來

8. 擦牙漱口
9. 剃鬚 和/或 梳頭
10. 沖涼 或 花洒浴
11. 穿衫褲
12. 彎低腰執拾物件
13. 煮飯
14. 掃地 或 吸塵

15. 收摺床被
16. 購物
17. 洗晾衣服
18. 洗車 或 洗窗
19. 或搬動傢俬
20. 拖地/抹地
21. 快速行上樓梯/斜坡

以下的情況，對你的生活有多大限制？

22. 氣喘   ○ 0   ○ 1   ○ 2   ○ 3   ○ 4   ○ 5

23. 害怕過度操勞有害身體   ○ 0   ○ 1   ○ 2   ○ 3   ○ 4   ○ 5

24. 害怕引起氣喘   ○ 0   ○ 1   ○ 2   ○ 3   ○ 4   ○ 5

Appendix II. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines (GOLD, 2011).

Stages	Description	Classification of severity of airflow limitation
GOLD I	Mild COPD	$FEV_1 \geq 80\%$ predicted
GOLD II	Moderate COPD	$50\% \leq FEV_1$ 80% predicted
GOLD III	Severe COPD	$30\% \leq FEV_1$ 50% predicted
GOLD IV	Very severe COPD	$FEV_1 < 30\%$ predicted

Note. FEV_1 = forced expiratory volume in 1 second.

Appendix III. Modified Medical Research Council (MMRC) Dyspnoea Scale (Eltayara et al., 1996).

Grade	Description of breathlessness
0	I only get breathless with strenuous exercise.
1	I get short of breath when hurrying on level ground or walking up a slight hill.
2	On level ground, I walk slower than people of the same age because of breathlessness, or have to stop for breath when walking at my own pace.
3	I stop for breath after walking about 100 yards or after a few minutes on level ground.
4	I am too breathless to leave the house or I am breathless when dressing.

Appendix IV. Calculation scale of the BODE Index (Celli et al., 2004).

Variable	Points on the BODE Index			
	0	1	2	3
FEV_1 (% predicted)	≥ 65	50—64	36—49	≤ 35
6-minute walking test (m)	≥ 350	250—349	150—249	≤ 149
MMRC Dyspnoea Scale	0—1	2	3	4
Body mass index	>21	≤ 21		

Note. FEV_1 = forced expiratory volume in 1 second.