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Reliability and Validity of the Monitored Functional Task Evaluation (MFTE) for Patients with Chronic Obstructive Pulmonary Disease (COPD)

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This article describes the development of a new functional measure — the Monitored Functional Task Evaluation (MFTE) — a symptom-limited evaluation that is used to measure the functional performance of an individual with chronic obstructive pulmonary disease (COPD), and to document a client's physiological changes through repeated testing. Stage I of the study included developing the content validity of the instrument. Stage II consisted of establishing the performance profile, test-retest and inter-rater reliability using a convenience sample of 27 inpatients and outpatients who had COPD. In stage III, the criterion-related and discriminative validity of the instrument was verified in a retrospective sample of 124 inpatients and day patients who had COPD. Results indicated that there was high intra- and inter-rater reliability for the total score of MFTE. Significant correlation of the MFTE was found with parameters such as Moser's Activities of Daily Living (ADL) class, COPD disability class, 6-minute walking distance, work capacity in terms the ratio of the metabolic rate associated with a given activity to the resting metabolic rate, and the fatigue dimension of the Chronic Respiratory Disease Questionnaire. In addition, prediction of group membership to Moser's ADL class revealed that 52.4% of the original grouped cases could be correctly classified by the MFTE alone. In conclusion, the MFTE is a useful measure to evaluate functional performance as well as document physiological changes in patients with moderate-to-severe COPD from both conceptual and empirical perspectives.

KEY WORDS: Chronic obstructive pulmonary disease • Functional capacity • Monitored functional performance • Classification of functional disability

Introduction

Patients with chronic obstructive pulmonary disease (COPD) often experience shortness of breath and a decline in physical tolerance, resulting in disability in the performance of activities of daily living (ADL). The kind of daily activities affected were mainly high-level (or complex) activities such as bathing, carrying or walking up stairs, which determine a person's necessity to be homebound or the level of care that he or she may require. Occupational therapists often conduct ADL assessments for patients with COPD by evaluating their functional performance using monitoring physiological parameters such as pulse rate and oxygen saturation during daily activities, and assessing whether the workload of the

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activities is excessive to the cardiopulmonary system (Ogden, 1980). The most common way is to evaluate one to two functional tasks (e.g., bathing or cooking) that are important to the patient as part of his daily activities, or some other activity that the patient has a strong desire to perform successfully (Hodgkin, Connors, & Bell, 1993). However, assessment using this approach lacks objectivity and yields high inter-subject variability because often the same task is not appropriate for another patient. This makes it difficult to accurately evaluate the daily performance among patients with COPD in the hospital environment.

There is a recent trend for researchers in pulmonary rehabilitation to construct functional assessments that are quantifiable. A number of traditional questionnaires such as the Chronic Respiratory Disease Questionnaire (CRDQ) (Guyatt, Berman, Townsend, Pugsley, & Chambers, 1987), St. George's Respiratory Questionnaire (SGRQ) (Jones, Quirk, Baveystock, & Littlejohns, 1992), Baseline Dyspnoea Index (BDI) and Transition Dyspnoea Index (TDI) (Mahler, Weinberg, Wells, & Feinstein, 1984), Breathlessness Inventory (Hodgkin et al, 1993), and recently developed measures such as the Pulmonary Functional Status and Dyspnoea Questionnaire (PFSDQ) (Lareau, Carrieri-Kohlman, Janson-Bjerklie, & Roos, 1994) and the San Diego Shortness of Breath Questionnaire (SOBQ) (Eakin, Resnikoff, Prewitt, Ries, & Kaplan, 1995) have already been used to measure the functional status, level of disability, and quality of life of patients with COPD in a quantifiable manner. However, most of these are paper-and-pencil self-administered questionnaires, which rely heavily on patients' subjective ratings, complaints of symptoms, and even talent in filling in the questionnaire. Moreover, most of these questionnaires emphasize the intensity of shortness of breath, but are not sensitive to subtle changes between mild-to-moderate dyspnoeic levels for most of the patients when performing ADL.

Leidy (1995) differentiated between "functional performance" and "functional capacity" in patients with COPD. Functional performance is the extent to which people normally perform their ADL, while functional capacity is the maximum potential to perform ADL. The latter is usually assessed in terms of maximum metabolic rate in exercise physiology. Traditionally, physical therapists use exercise tests such as walking or cycle ergometry to assess the maximal functional capacity of patients. However, they are considered insufficient to meet the needs of an occupational therapy assessment. They do not reflect the functional performance because patients usually do not execute their maximum effort in their functional performance due to different subjective responses; for example, perceived dyspnoea towards normal daily activities. Leidy claimed that subjective responses, such as self-limited exercise tolerance or activity-induced dyspnoea, presented as the major obstacle to functional performance.

The Monitored Functional Task Evaluation (MFTE) is designed to test five physical components that contribute to occupational performance. These items include indoor mobility, sit-to-stand transfers, lifting, carrying, and stepping — tasks that represent various energy levels. It aims to measure patients' monitored functional performance in a laboratory-based environment, but not the "maximum" functional capacity in exercise testing. It also minimizes subjective reporting on the part of using self-reported questionnaires and facilitates inter-subject comparisons. The aim of this article is to describe the establishment of psychometric properties of the instrument.

Methods

Procedure

The reliability and validity of the instrument were developed in three consecutive stages. The first stage aimed at defining the content of the instrument, whereas stage II involved the investigation of performance profile, test-retest and inter-rater reliability. Stage III involved testing its criterion-related and discriminative validity.

Stage I

An expert panel comprised of one respiratory medical consultant and five occupational therapists with experience in pulmonary rehabilitation generated the content of the instrument and testing procedures. The panel considered functional tasks to be included in the instrument according to three criteria: 1) they should be disease-specific and sensitive to physiological changes for patients with moderate-to-severe COPD; 2) they should be convenient for therapist use in a laboratory-based environment; and 3) they should be objective and quantifiable during measurement. The panel asked 30 patients with COPD who attended the outpatient pulmonary rehabilitation programme to grade five activities that caused them dyspnoea, and to assess these in order of importance to the patient. They identified walking up stairs, bathing, carrying, strolling, and shopping as five activities that were important and caused dyspnoea. Five task items that incorporate the components of those important activities were selected, including indoor mobility, sit-to-stand transfers, lifting, carrying, and stepping. Face validity was an important criterion considered in the decision of whether an item would be included or removed from the instrument. The panel also standardized the testing equipment and procedures of the instrument.

Stage II

The performance profile, intra- and inter-rater reliabilities were developed by administering the instrument prospectively to a group of patients with COPD. The group was a convenience sample of 27 patients admitted consecutively into the respiratory medical wards of a local rehabilitation hospital. They included both male (n = 22) and female (n = 5) patients aged 41 to 85 years; the mean age was 72 years. Fifteen (54%) were inpatients and 12 (46%) were day patients. All patients were evaluated and re-evaluated with the instrument by the same rater 24 hours later for the test-retest study. This time period was suitable to allow stability of the instrument over time, while minimizing physiological changes in the patient.

The inter-rater reliability was established by having the same patient scored separately, but simultaneously, by two raters in the convenience sample of patients. All raters in the study were occupational therapists who had knowledge in conducting the MFTE. Alternatively, the distribution of the raw scores in each sub-test were used to set up a profile score from 0 to 4 according to the assumption of three standard deviations (SDs) in a normal distribution curve. The raw score for each sub-test was the number of actions the patient completed within 2 minutes. A conversion scale was developed for each raw score to be transformed into a profile score. Since the authors assumed that all five sub-tests were of equal dimensionality in the test construct, each task component then carried equal weight in the test construct. A profile score ranging from 0 to 4 for each sub-test was produced so that addition of the sub-test scores totaled 0 to 20 to represent the overall performance of the measurement. To reflect the actual performance of patients and for the ease in outcome of statistical analysis, the profile score was constructed in the form of continuous data (to one decimal place) with unequal distance between each interval. For example, a profile score of 3.2 represented the carrying of a 6 kg weight along a 3 metre distance 16 times, while a score of 1.4 represented stepping up and down on an 8 inch-high step 16 times.

Stage III

Another convenience sample of 124 patients was retrospectively selected for establishing the criterion-related and discriminative validity. Of the 124 patients selected, 66 (53.2%) were day patients and 58 (46.8%) were hospital inpatients in the same year (Table 1). One hundred and twenty (96%) were male, and the mean age was 71 years. Half of the patients were on oxygen therapy. The mean of the patient lung function impairment in terms of the ratio of forced expiratory volume in 1 second and forced vital capacity (FEV_1/FVC) was 47% (SD, 0.16), and the average work capacity in terms of the ratio of the metabolic rate associated with a given activity to the basal metabolic rate (MET*)* was 3.8 (SD, 1.27). This indicated that most of the patients who were selected had moderate-to-severe COPD. Patients with other lung diseases such as active tuberculosis and lung cancer, cardiac complications such as ischaemic heart disease, thromboembolism or cor pulmonale, and mobility problems requiring walking aids or manual assistance were excluded from the study (Barnes & Godfrey, 1997).

All personal information in the study was kept confidential so as to comply with the Personal Data (privacy) Ordinance in Hong Kong. Informed consent was obtained from subjects of the prospective study. Approval of the use of medical information obtained retrospectively was granted by the chief-of-service of the Respiratory Medical Department of Kowloon Hospital.

To establish the criterion-related validity, the MFTE was correlated with four types of criterion parameters: 1) functional parameters, which included Moser's ADL class (Moser, Bokinsky, & Savage, 1980) and the COPD Disability Scale (by the American Thoracic Society in 1981); 2) exercise tests, which included 6-minute walking distance (6MWD), and energy expenditure (MET) measured by a cycle ergometer test; 3) quality-of-life measure, i.e., CRDQ; and 4) a physiological parameter of lung function impairment as measured by vitalograph in terms of both percentage FEV_1, and the ratio of FEV_1 and FVC (FEV_1/FVC). These were used for comparison because they are the most commonly used indicators of disease severity in COPD (Leidy, 1995). Finally, the total score of MFTE was used to predict the group

Table 1. Demographic characteristics of patients with COPD

Patient characteristics (n = 124)	Mean	Standard deviation
Age	70.98	8.31
FEV_1	0.75	0.53
FEV_1/FVC	0.47	0.16
MET	3.8	1.27
Total score of MFTE	12.1	3.8
6 MWD	330.5	114.0
COPD Disability Scale	2.4	1.0
ADL class	3.2	0.75
CRDQ subscores		
Dyspnoea	22.9	6.0
Fatigue	20.5	4.4
Emotion	37.9	7.7
Mastery	21.9	4.6

FEV_1 = forced expiratory volume in 1 second; FVC = forced vital capacity; MET = energy expenditure in terms of the ratio of the metabolic rate associated with a given activity to the resting metabolic rate; MFTE = Monitored Functional Task Evaluation; 6 MWD = 6-minute walking distance; COPD = chronic obstructive pulmonary disease; ADL = activities of daily living; CRDQ = Chronic Respiratory Disease Questionnaire.

membership of ADL class in the sample of 124 COPD patients by discriminant analysis.

MFTE Instrument

The MFTE is a symptom-limited evaluation that measures patients' monitored functional performance in a laboratory-based environment. It consists of five functional tasks, namely indoor mobility, sitting-to-standing transfer, lifting, carrying, and stepping. The energy expenditures of each task in five sub-tests ranged from approximately 2 to 5 METs (Table 2). The whole evaluation takes 15 to 20 minutes to administer. The patient is required to carry out the tasks with monitored oxygen saturation using a pulse oximeter. Three "activity-induced" responses from the patient are reviewed: 1) functional response, including the level of participation, tolerance, pacing, and endurance for each task; 2) physiological response, including oxygen saturation, heart rate, and breathing pattern; and 3) symptomatic response, including the level of dyspnoea, effort, and fatigue. The evaluation begins with the patient in a restful situation. The resting values of the oxygen saturation percentage (% SaO_2) and pulse rate are taken at the same time. The maximum tolerable pulse rate for the patient, i.e., 70% of the predicted maximum pulse rate using the formula: resting pulse rate + 70%([220 – age] – resting pulse rate), is calculated by the therapist before the test. The patient is asked to perform each task within 2 minutes at his or her own pace so as to reflect the actual speed in typical daily performance. This design is based on the experiences of COPD patients whose exercise tolerance is usually of 2 to 3 minutes' duration. A short break within each task is allowed. The patient is also allowed to pause for breath if necessary. Each sub-test is stopped when any of the following situations occurs: 1) the time limit is up; 2) there is severe oxygen desaturation (< 80% SaO_2) and the patient cannot recover after a short break; 3) the pulse rate exceeds the maximum tolerable limit; 4) the patient rates the adapted Borg's scale of perceived effort (Hodgkin et al, 1993) greater than or equal to 17; 5) there is the presence of self-perceived symptoms such as too dyspnoeic or fatigued during exertion; or 6) there is the presence of noticeable risk symptoms such as chest pain or dizziness (McDowell & Newell, 1996). Patients are allowed to recover for at least 2 minutes during the interval between each individual task. The following information is recorded during and upon completion of each task: 1) level of participation and physical tolerance; 2) the lowest value along the decreasing trend of oxygen desaturation response, and the highest value along the increasing trend of the pulse rate as printed out in the oximetry report; and 3) level of dysponea, perceived effort and fatigue as rated by the subject according to the adapted Borg's scale (Hodgkin et al, 1993). When using the adapted Borg's scale, the patient is instructed to select the number that corresponds most closely to the highest perceived level after a task. The therapist is required to closely monitor the patient's signs and symptoms as well as their cardiac-pulmonary response throughout the entire process. Although not all of the information recorded during the test will directly contribute to the calculation of the profile and total score, it can be helpful in establishing a full clinical picture of the subject.

Moser's ADL Class

This is a classification system originally developed by Moser, Bokinsky and Savage in 1980 in an attempt to classify patients with COPD according to their functional pulmonary disability (Table 3). It is commonly used with the COPD Disability Scale of the American Thoracic Society in most of the pulmonary

Table 2. Description of the Monitored Functional Task Evaluation

Functional task	Description	Measurement of raw score
Indoor mobility	Walking to and fro on level ground for a fixed distance of 3.5 m for 2 minutes.	One action = 3.5 m
Sit-to-stand transfer	Standing up from an ordinary chair and then sitting down; action is repeated for 2 minutes.	One action = one sit-to-stand transfer
Lifting	Lifting a 3-kg weight load from waist level to a level 12 inches above and then returning the weight back to waist level; action is repeated for 2 minutes.	One action = one lift and return
Carrying	Walking to and fro on level ground for a fixed distance of 3.5 m while carrying in each hand a load of 3kg weight for 2 minutes.	One action = 3.5 m
Stepping	Rising up on a step of 8 inches in height and then stepping down; action is repeated for 2 minutes.	One action = one step up and return

Table 3. Classification of functional pulmonary disability (from Moser, Bokinsky, & Savage 1980)

Class	Functional ability
1	No substantial restriction of instrumental activities of daily living (ADL) tasks (e.g., taking a bus, shopping), but noted dyspnoea on strenuous exertion; may be employable
2	No dyspnoea with essential ADL tasks or on level walking and able to do complex household tasks, but noted dyspnoea on climbing stairs, slopes, and shopping
3	Dyspnoea with basic ADL tasks (e.g., bathing or dressing); able to walk at own pace for a short distance or in the home environment, but unable to keep up with healthy individuals of comparable age
4	Homebound and dependent on others for some basic ADL tasks (e.g., using the toilet, bathing); not dyspnoeic at rest, but becomes dyspnoeic with minimal exertion
5	Limited to bed or chair; dyspnoeic at rest and dependent upon assistance from others for most of the basic ADL tasks

rehabilitation programmes in Hong Kong. The therapist rates the activities of patients by asking them to rate their actual performance of ADL over the last 2-week period.

Chronic Respiratory Disease Questionnaire (CRDQ)

This is a disease-specific questionnaire on quality-of-life for patients with chronic respiratory diseases such as COPD (Guyatt et al, 1987). It is comprised of four dimensions: dyspnoea, fatigue, emotion, and mastery of skill, measured on a seven-point Likert scale. The dyspnoea dimension is individualized to five activities that might cause dyspnoea, and the activities are assessed in the order of importance to the patient. The questionnaire is administered as a structured interview by the therapist.

6-Minute Walking Distance (6MWD)

This is a common exercise evaluation used by physical therapists for patients with COPD in hospital settings. Each patient is required to walk 50 metres along a flat hospital corridor for 6 minutes, paced to cover the maximum possible distance, with short breaks allowed if necessary. Pulse rate and $\%SaO_2$ are measured before, during, and after walking.

Cycle Ergometer Test

This is an incremental symptom-limited exercise test. The patient is required to ride on a cycle while their physiological responses are simultaneously monitored by an oximeter. After 1 minute of unloaded pedalling, the work rate is increased by 10 watts every minute. The patient is instructed to stop when he or she cannot continue due to dyspnoea or fatigue. The maximum workload (W_{max}) is defined as the highest work level reached and maintained for 1 full minute. The W_{max} is then converted into units of energy expenditure in terms of MET by a standard formula. One MET represents the oxygen consumed per minute per unit of body mass at rest. For example, bathing costing 3.5 METs will require 3.5 times the oxygen consumed at rest.

Results

Test-retest and inter-rater reliabilities were determined using the intraclass correlation coefficient (ICC) from a two-way random effects model with a 95% confidence interval. An ICC of 0.75 or higher was accepted as showing good reliability (Portney & Watkins, 2000). Results indicated that the total score of MFTE demonstrated high stability over time with ICC (2, 1 = 0.82) as well as high reproducibility between two raters with ICC (2, 1 = 0.92).

When the MFTE was correlated with other functional parameters using Pearson's correlation coefficients on the sample of 124 patients, there was a significant relationship between the total score of MFTE, ADL class, COPD Disability Scale, 6 MWD, MET, and the fatigue dimension of the CRDQ (r = 0.26–0.58). However, the MFTE was not significantly correlated with lung function impairment in terms of FEV_1 or FEV_1/FVC, and the dimensions of dyspnoea, emotion, and mastery of skill of the CRDQ (Table 4).

Discriminant analysis was used to predict the group membership of Moser's ADL class for the combined analysis of 124 patients by independent variables of the total score of MFTE, age, and gender. The highest F value of MFTE and the small value of Wilks lambda of MFTE indicated that the total score of MFTE was the most important variable in predicting Moser's ADL class, and the group means were the most different for prediction (Table 5). Moreover, evaluation of the assumptions of equality of covariance matrices indicated that the covariance matrices were equal and the results had no

Table 4. Correlation matrix of the Monitored Functional Task Evaluation (MFTE) with other parameters

Functional parameter	MFTE
ADL class	0.479*
COPD Disability Scale	– 0.583*
FEV_1	0.033
FEV_1/FVC	– 0.061
6MWD	0.322*
MET	0.271†
CRDQ	
Dyspnoea	0.184
Fatigue	0.261†
Emotion	0.206
Mastery of skill	0.186

*$p \leq 0.01$; †$p \leq 0.05$; ADL = activities of daily living; COPD = chronic obstructive pulmonary disease; FEV_1 = forced expiratory volume in 1 second; FVC = forced vital capacity; 6MWD = 6-minute walking distance; MET = energy expenditure in terms of the the ratio of the metabolic rate associated with a given activity to the resting metabolic rate; CRDQ = Chronic Respiratory Disease Questionnaire.

violation on the assumption of the discriminant analysis model (Box's M value = 47.836; $p = 0.000$).

From the group statistics, the means of the MFTE total scores for each ADL class were found except for class 5 (Table 6). The mean total score of MFTE ranged from 8.63 to 16.37 for classes 4 and 1, respectively, which indicated that most of the patients had attained the 40th to 75th percentile of the total score of MFTE. The results of the discriminant analysis showed that 52.4% of the original grouped cases (Wilks 1 = 0.952; $df = 4$; $p < 0.001$) were correctly classified by the total score of MFTE alone (Table 7).

Discussion

This study described the reliability and validity of the MFTE, which was designed to assess the monitored functional performance of patients with COPD. The high test-retest and inter-rater reliability indicators were good over time and there was consistency among the raters. The mild test-retest and inter-rater disagreement might have been derived from the functional decline of a patient over 24 hours and inaccurate readings of the pulse oximeters. The construction of the instrument covers most of the essential functional components in occupational performance, which are well defined and can be easily assessed in a laboratory-based environment. Although the test structure of MFTE was not explored with data reduction, the authors considered a phenomenon in that patients could perform most of the functional tasks once they had achieved a certain degree of ability with the lower extremities or could walk independently for a certain distance. This was shown for most of the tasks that involve lower extremity ability, i.e., indoor mobility, sitting to standing, stepping, and carrying. However, it has been reported that many patients with COPD complain of disabling dyspnoea during daily activities involving the upper extremities at energy levels much lower than that for lower extremity exercises (Celli, Rassulo & Make, 1986). The inclusion of lifting and carrying tasks in the instrument is essential to complement the lack of upper extremity evaluation in most of the assessments for patients with COPD (Hodgkin et al, 1993). On the other hand, the average work capacity of the group of patients measured was 3.8 METs (SD = 1.27), which was consistent with the goal of the instrument in measuring five functional tasks with energy levels from 2 to 5 METs.

Concerning the criterion-related validity, the moderate correlation with other functional parameters like 6-MWD, MET and the fatigue dimension of the CRDQ indicated that the instrument partially measured patients' exercise tolerance. These results were consistent with the study conducted by Bendstrup, Jensen, Holm, & Bengtsson (1997), in which exercise tests such as the 6MWD correlated with ADL and measured related aspects of daily functioning. It was surprising to find that the MFTE did not correlate with the dyspnoea dimension of the CRDQ. This might be due to the fact that the

Table 5. Tests of equality of group means during discriminant analysis

Independent variable	Wilks lambda	F	Significance
MFTE	0.452	48.549	0.000
Age	0.956	1.826	0.146
Gender			
Female	0.931	2.965	0.035
Male	0.931	2.965	0.035

MFTE = Monitored Functional Task Evaluation.

Table 6. Prediction of group membership by Monitored Functional Task Evaluation

ADL class	Mean	SD	*n*
4	8.63	3.38	24
3	10.52	1.84	34
2	13.14	2.67	39
1	16.37	1.94	27
Total	12.25	3.66	124

ADL = activities of daily living; SD = standard deviation.

Table 7. Correlation between the Monitored Functional Task Evaluation (MFTE)-predicted group classifications and activities of daily living (ADL) classifications*

Actual group ADL class		MFTE-predicted group class (%)			
	n	4	3	2	1
4	24	14 (58.3)	5 (20.8)	4 (16.7)	1 (4.2)
3	34	10 (29.4)	12 (35.3)	12 (35.3)	0
2	39	3 (7.7)	7 (17.9)	18 (46.2)	11 (28.2)
1	27	0	0	6 (22.2)	21 (77.8)

*Overall, 52.4% of originally grouped cases were correctly predicted by the MFTE.

construct of dyspnoea dimension, which required patients to select their own five important activities of daily living, limited the applicability across patients and its sensitivity to changes in dyspnoea apart from the five chosen activities. Alternatively, the lack of association with the emotion and mastery of skill dimensions of CRDQ implies that these areas of quality-of-life are independent constructs irrespective of patients' functional performance as measured by the MFTE. It was not surprising to find that the MFTE scores were not correlated with lung function impairment. These results were consistent with those of Leidy (1995), Bendstrup et al (1997), and Harper et al (1997), in that disease severity of patients with COPD, measured by respiratory function test, did not play a significant role in functional performance. Conversely, its significant correlation with both classification systems, i.e., Moser's ADL class and COPD disability scale, indicated that the MFTE might be a good evaluation tool to determine a patient's disability level.

When the group membership of Moser's ADL class was predicted by the MFTE using discriminant analysis, it showed that 52.4% of the original grouped cases were correctly classified by the total score of MFTE alone. Since the result of the hit ratio exceeding 50% was an acceptable level, the correct classification ratio of the instrument was acceptable. (Hairs, Anderson, Tatlam, & Black, 1995). This association between group membership of the ADL class and the predictor scores implies that the instrument is useful in classifying patients' functional disabilities. Another issue that should be addressed is the ceiling of MFTE, which would only limit it as a functional measure of patients with moderate-to-severe disability. This finding was congruent with the mean of lung function impairment of the sampling group (FEV_1/FVC = 46.9%; SD, 0.16), which indicated that most of our selected patients had COPD with moderate-to-severe disability.

It may be argued that the limitation of this study was the sampling procedure for data collection. The sampling procedure was not random, and inclusion was based on a convenience sample of patients who participated in the pulmonary rehabilitation programme. One possible study confounder was the class rating of Moser's ADL class, which might not reflect the patients' actual functional abilities. For example, a patient who was unwilling to go outdoors because of the existence of several flights of stairs would be assigned a disability level of class 3, rather than class 2. This would interfere with the hit ratio of discriminability of the instrument in the ADL class. Another drawback that should be addressed is the incapability of the instrument to test patients with COPD of class 5 disability, which could be seen from the zero variance of class 5 in the prediction of ADL class. In addition, it should be noted that the total score of the MFTE only allows a general inter- and intra-comparison of the functional capacity, and prediction of patient disability level. An "average" performance can be achieved if a patient does badly on one or two sub-tests, but very well on the remaining ones. The performance of individual sub-tests would then be masked and, therefore, the total score should be interpreted with caution or with other clinical information.

Conclusion

In conclusion, we described the development of the MFTE from both conceptual and empirical perspectives. The instrument was demonstrated to be a valid, accurate, and objective measure of monitored functional performance of patients with moderate-to-severe COPD. It proved useful as a criterion-referenced test for patients with COPD in different kinds of settings such as post-acute hospitals or outpatient rehabilitation centres. In addition, it will be particularly useful for predicting the functional disability level as well as documenting the physiological response of patients during assessment. Therapists can also evaluate whether there is any activity-induced hypoxaemia and hence the need for supplemental oxygen while the patient is performing the functional tasks. The uniqueness of the instrument rests in the fact that this is one of the few functional instruments available for occupational therapists who are treating COPD patients. However, in spite of its clinical significance, other psychometric properties need to be further investigated. Of course, evaluation

of COPD patient ADL performance should not rely solely on a single evaluation, but rather on a comprehensive review of a patient's multiple dimensions. The success of pulmonary rehabilitation also depends upon ongoing evaluation by members of a multidisciplinary team.

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APPENDIX

Recording form of the MFTE

Sub-test	Indoor mobility	Sit to stand	Lifting 3 kg	Carrying 6 kg	Stepping
Time completed	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
RPE	/20	/20	/20	/20	/20
RPD	/10	/10	/10	/10	/10
RPT	/10	/10	/10	/10	/10
Pace					
2-min recovery	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No
SaO_2					
Pulse rate					
Raw score					
Profile score					
Total score		RPD (Max)		SaO_2 range	

RPE = rated perceived exertion;[1] RPD = rated perceived dyspnoea;[2] RPT = rated perceived tiredness;[3] SaO_2 = resting values of percent oxygen saturation.