Journal of Respiratory and CardioVascular Physical Therapy

REVIEW ARTICLE

FUNCTIONAL EVALUATION INSTRUMENTS IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE: A REVIEW OF THE LITERATURE

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Received June 20, 2012; accepted August 23, 2012

KEYWORDS:
Physiotherapy; COPD; Activities of daily living; evaluation

Background: COPD is a disabling disease that causes dyspnea and physical fatigue, affecting the activities of daily living (ADL). **Objective:** To detect, through a literature review, the main tools used to evaluate functioning of patients with COPD and to determine the most widely used test in clinical practice and scientific research.
Methods: A literature search was conducted in Medline, Lilacs and SciELO covering the period from 1992 to 2011 and studies were selected for posterior analysis, according to pre-established criteria.
Results: 53 articles on the functioning of patients with COPD were found, 22 specifically addressing the creation and/or implementation of clinical tests or functional assessment questionnaires. Five questionnaires and four clinical trials were found, all with good psychometric properties.
Conclusion: The main instruments were: London Chest Activity of Daily Living Scale (LCADL), Pulmonary Function Status and Dyspnea Questionnaire (PFSDQ), Pulmonary Functional Status Scale (PFSS), Human Activity Profile (HAP), Manchester Respiratory Activities of Daily Living Questionnaire, Glittre ADL-test, Shuttle Test (ST), 6-minute walk test (6MWT) and the Sit-to-stand test (STST). The most commonly used test was the 6MWT, which is also often used as a parameter to correlate and validate other tests and questionnaires.

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INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is one of the most important causes of morbidity and mortality in the world[1]. Although it is a pulmonary disease, COPD also has significant systemic consequences[1, 2].

With disease progression, peripheral and respiratory muscle strength decline, with a pronounced reduction in functional status and exercise capacity[3]. Dyspnea and fatigue also have a negative impact on activities of daily living (ADL) in this patient population[2,4], and eventually some of the individuals become limited or completely restricted in terms of performing their ADL[5]. This can be partially explained by the high metabolic and ventilatory cost, with significantly increased values of oxygen consumption (VO_2), minute ventilation (VE), and VO_2/VO_{2max} and VE/MVV ratios during the performance of ADL, leading to increased perception of dyspnea, with consequent functional limitation[6].

Dyspnea, one of the main complaints of patients with COPD, is a limiting factor for the performance of ADL. Furthermore, a reduction in physical activity leads to deconditioning, which can further enhance dyspnea[5, 7].

In a recent study, the time spent by patients with COPD in ADL was measured and it was found that they spend most of their time sitting or lying down when compared to older healthy matched subjects[3].

A multidimensional evaluation of patients with COPD is essential for the health professional to have information about the impact of the disease on the functional status and to complement traditional evaluation[5]. Therefore, knowledge and proper use of valid and reliable instruments are essential and can be used to monitor disease progression and measure the results before and after the rehabilitation of patients with COPD.

This study aimed to identify clinical trials in the literature and questionnaires used in the functional evaluation of patients with COPD and detect the most commonly used in clinical practice and scientific research.

MATERIALS AND METHODS

MEDLINE, LILACS and SciELO databases were searched considering the period from 1992 to 2011 and using a combination of the following keywords: COPD, functional status, performance, capacity, activities of daily living, instruments and tests. The study selection initially involved analysis of titles. Next, abstracts were inspected and the articles that described the creation of instruments or those which used these instruments as an outcome measure were selected. Furthermore, reference lists of the selected articles were hand searched in order to find other potentially eligible studies. After identifying the clinical tests and questionnaires, the psychometric properties, reliability measures and possible correlations between tests and ventilatory and metabolic variables were analyzed. The applicability of the tests and clinical feasibility of the questionnaires were also identified.

RESULTS

The search strategy produced a total of 50 articles on the functioning of patients with COPD. Of these, 22 articles addressed the creation and/or implementation of clinical tests or functional assessment questionnaires.

The following questionnaires were identified: London Chest Activity of Daily Living Scale (LCADL), Pulmonary Function Status and Dyspnea Questionnaire (PFSDQ), Pulmonary Functional Status Scale (PFSS), Human Activity Profile (HAP), Manchester Respiratory Activities of Daily Living Questionnaire.

London Chest Activity of Daily Living Scale (LCADL): developed in order to assess limitations of patients with COPD in ADL[4]. This instrument consists of four domains, with a total of 15 quantitative questions. The total score can range from 0 to 75 points and the higher the score, the greater the limitation in ADL. The LCADL is a valid instrument for the assessment of ADL in patients with severe COPD, showing good correlation with activity and impact components of the Saint George Respiratory Questionnaire (SGRQ) and the Nottingham Extended Activity of Daily Living Questionnaire (NEADL), and moderate correlation with the Hospital Anxiety and Depression score (HAD). The LCADL also exhibited a significant correlation with the Shuttle Test (ST), suggesting a relationship between impaired exercise capacity and low scores on the ADL performance. Test-retest reliability of the total score of the instrument was analyzed using the interclass correlation coefficient (ICC = 0.96). The sensitivity of LCADL was evaluated in 59

patients with stable severe COPD after pulmonary rehabilitation, demonstrating a statistically significant reduction in all components of the scale, with the exception of domestic activity, which showed a tendency[8]. This scale was recently translated to Portuguese and Brazilian versions, showing excellent inter and intra-rater reproducibility for total score and most ADL items. The total score of this version showed a weak to moderate negative correlation with forced expiratory volume in one second (FEV_1) in liters. Correlation with the 6MWD increased when the percentage of the total score was used, excluding items that scored zero. The Brazilian version of LCADL proved to be reliable, reproducible and valid for assessing dyspnea during ADL in patients with severe COPD and average time of questionnaire completion was eight minutes[9].

Pulmonary Function Status and Dyspnea Questionnaire (PFSDQ): specific functional status for patients with COPD that provides information on symptoms and level of activity[5]. It consists of a 164-item self-administered questionnaire with two components, assessing patient perception of changes in dyspnea and activity level. The first component assesses self-reported changes in activity level, with scores ranging from 1 to 710. The second component assesses dyspnea in two ways: (1) general evaluation of dyspnea on most days of the year and today and (2) a total score for perceived dyspnea in each of the 79 activities. The scores range from 0 to 10, with higher scores indicating worse results[10]. Construct validity was demonstrated by comparing groups with high and low level of change in activities and dyspnea. The groups with the greatest difficulty in performing activities and increased dyspnea had worse pulmonary function[10]. The total score of PFSDQ activity correlated with predicted FEV_1% and VO_{2max}[11]. The time taken to complete the questionnaire ranged from 10 to 15 minutos[10].A modified and shorter version of this instrument (PFSDQ-M) was later developed containing 40 items, with the addition of a third component to assess fatigue and a universal scoring system for the sub-scales, using an 11-point scale ranging from 0 to 10[12]. The applicability was supported by easy reading, self-administration, reduced data loss and limited short application time (7 minutes). The reliability of the three components was supported by the internal consistency of changes experienced by patients in activities, dyspnea and fatigue. It is considered a valid instrument for measuring change in functional status and dyspnea-related activity for women and men[13]. Two studies used the PFSDQ-M as an outcome measure after a pulmonary rehabilitation program. One concluded that it was possible to observe a significant increase in functional status for all its domains[14] and in the other the instrument was sensitive in detecting changes in functional status only for "changes in activities"[15]. The PFSDQ-M has been validated for use in patients with COPD in Brazil[16], showing good test-retest reliability for the three components (dyspnea, fatigue and change).

Pulmonary Functional Status Scale (PFSS): 64-item self-administered functional status questionnaire, specific for patients with COPD, with functional and emotional components. The functional component includes sub-scores related to ADL, social participation and dyspnea. The emotional component includes sub-scores for anxiety and depression. Higher scores indicate good functional performance[17]. Its psychometric properties include: content validity by a group of experts; concurrent validity demonstrated by good correlation between the responses of the total PFSS and Sickness Impact Profile scores, the 12-minute walk test (12MWT) and the 6MWT; and to a lesser degree VEF_1[17,18,19]. Three uncontrolled studies suggested that PFSS is sensitive to pulmonary rehabilitation intervention[19, 20,21].

Manchester Respiratory Activities of Daily Living Questionnaire (MRADL): 21-item self-administered questionnaire specific for patients with COPD, containing four areas: mobility, kitchen activities, housework and leisure activities. It is scored from 0 to 21, where 21 indicates the absence of physical disability[22]. This questionnaire was developed by combining and adapting the Nottingham Extended ADL Scale and the Breathing Problems Questionnaire[22]. It is valid, reliable, reproducible, easy and quick to administer (10 minutes), in addition to discriminating between COPD and healthy elderly controls and being sensitive to pulmonary rehabilitation[22,23]. This questionnaire, which has good internal consistency, was associated with the 6MWT and psychological well-being assessed by the Brief Assessment Schedule Depression Cards[22]. MRADL alone

proved to be a useful tool in predicting mortality: MRADL<10 predicts mortality in one year with 75% sensitivity and 63% specificity, while with MRADL<12, predictive values were 86% sensitivity and 55% specificity[24].

Human Activity Profile (HAP): is a self-report measure of energy expenditure or physical fitness originally designed to assess individuals with COPD[25,26]. It is derived from the 105-item Additive Daily Activities Profile Test. Activities were selected according to the average estimate of the energy required to perform them. The HAP, which contains activities that require approximately 1 to 10 MET[27], can be used to assess the level of functional and physical activity, both for healthy individuals, at any age, and those with some degree of dysfunction[27,28]. During the development of the instrument, routine activities were selected, varying from low to a high functioning level, in order to avoid application problems, and ensuring multiple levels of difficulty[26]. The 94 items are arranged based on energy cost, with lower numbers requiring less energy expenditure and higher numbers demanding more energy expenditure[28]. For each item there are three possible answers: "I still do", "stopped doing" or "never done"[26,27], with the advantage that the answer "never done" is not considered in score computation, minimizing the risk of cultural bias[28]. Based on the response, estimated maximum activity (EMA) and adjusted activity score (AAS) were calculated. EMA numbering corresponds to the activity with the highest energy expenditure that the individual "still does." AAS is calculated by subtracting the EMA from the number of items that the individual "stopped doing ", prior to the last activity that he/she is "still doing"[27,28]. The HAP can be used to measure the improvement in functional performance in patients with COPD; this is corroborated by its relationship with the 6MWD, dyspnea and sensitivity to pulmonary rehabilitation. However, it is limited in assessing energy expenditure[29]. The HAP was translated and culturally adapted to Portuguese; the Brazilian version can be applied to individuals with different functional levels. The time spent applying the instrument is approximately 20 minutes[28].The following clinical tests were found in the literature: Glittre ADL-test, Shuttle Test (ST), 6-minute Walk Test (6MWD) and the Sit-to-stand test (STST).

Glittre ADL-test: was developed to measure the functional status of patients with COPD using a standardized group of ADL that is difficult for this patient population to perform. The test begins with the patient in the sitting position wearing a backpack weighing 2.5 kg (women) and 5.0 kg (men). The patient is instructed to get up and walk along a flat 10-meter course, ascend and descend two steps (17 cm high and 27 cm wide) located in the middle of the course, facing two shelves upon arrival at the end of the course: one positioned at shoulder height and the other at waist height. . Three 1 Kg pots are positioned on the top shelf and the patient moves them one at a time, to the bottom shelf, and then to the floor. Afterwards, the patient returns the pots to the bottom shelf and then back to the top shelf. After accomplishing this task the patient returns, following the course to the original position on the chair, and immediately starts another lap as described above. The test consists of five rounds, and patients are instructed to complete them as quickly as possible. The result is given in terms of the time taken to complete the test (time-ADL)[30]. Patients are allowed to rest if necessary, but they are told to return to work as soon as possible[30]. This test was administered in 20 minutes, including preparation. Patients exhibited good understanding of the standardized instructions, and no adverse events were observed[30]. The ADL-time correlated with FEV_1, the activity component of the SGRQ, dyspnea during ADLs, hospitalization rate, exercise capacity, and the report of dyspnea-related restriction during ADLs. The test is sensitive to pre-and post-pulmonary rehabilitation, valid, reliable, easy to administer and able to differentiate the functional capacity of patients with COPD and healthy subjects[30,31].

Shuttle Test (ST): maximal incremental test in which the patient is encouraged to walk to exhaustion at increasing speeds, standardized into twelve levels, lasting one minute each, separated by an audible signal. The initial velocity is 0.50 m/s with the addition of 0.17 m/s every minute, resulting in a speed of 2.37 m/s[32] at the 12^{th} level. The ST is performed on a flat 10-meter course. The distance is identified using two cones, positioned 0.5 meters from the end of each lap to avoid an abrupt change in direction. Speed is determined by the emission of an

audible sound, which indicates when the patient must reach the cone and change walking speed [32]. The test ends when the patient experiences dyspnea and/or fatigue, preventing them from maintaining the required speed, fails to cover distance equal to or greater than 0.5 meters from the cone when the buzzer sounds or reaches 85% of predicted HR_{max}[32]. The ST, which measures the functional capacity of patients with widely varying disability, is reproducible after only one walking test [31,32,33,34]. The ST performance correlated strongly with the direct measurement of VO_{2max} and poorly with FEV_1[35]. This test displays moderate to excellent reliability and validity with the endurance walk test in patients with COPD. It has been used in the scientific and clinical research in patients with COPD[37,38], in seniors[36], children with cystic fibrosis[39], cardiac rehabilitation[40], and after thoracic surgery[41], among others.

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Six-minute Walk Test (6MWT) is a simple, self-paced test, used to assess submaximal functional capacity. This test measures the distance that a patient can quickly and firmly walk on a flat course in 6 minutes. The individual is allowed to stop or rest during the test. It is a comprehensive evaluation of responses and integrates all the systems involved during exercise[42]. The 6MWT has been used to measure the response to therapeutic interventions in cardiac and pulmonary diseases, as well as for pre and postoperative situations. It is a useful measure of functional capacity, and a predictor of mortality and morbidity in people with moderate to severe disability[42]. To consider a clinically significant effect of treatment, the distance covered during 6MWT should increase about 35 meters in patients with moderate to severe COPD. This corresponds to a 10% change in baseline distance walked in 6 minutes[43]. A previous study[44] established a 54-meter change as a clinically significant effect. The 6MWT should be performed on a flat and firm course measuring at least 30 meters, with turning points indicated with cones[42]. Standardized phrases of encouragement should also be used during the test [41,44] and at least two practice tests should be performed before the real measure to avoid the learning effect[34,45]. There is a strong correlation between 6MWD and VO_{2max} and maximum work capacity (W_{max}). The 6MWT is simple to run, better tolerated, and the test that best reflects ADL when compared to other walking tests[42,45]. Its psychometric properties have been extensively researched and established[45].

Sit-to-stand test (STST): is carried out using a standard height chair (46 cm) without armrests. Before starting, test procedures are shown to the patient. He/she is told to sit down and rise from a chair at the command "Go!", repeating the procedure several times as fast as possible in a period of 1 minute. The number of repetitions completed is computed[46]. This test is considered an indicator of functional status in elderly people[48]. However, it is also used to assess the functional status of patients with COPD and compared to the 6MWT. A significant increase in heart rate and systolic blood pressure and a decrease in peripheral O_2 saturation has been demonstrated in patients with COPD during this test, with no changes observed during STST; however, the degree of dyspnea increased significantly in both tests ($p < 0.05$)[49]. Good correlation was observed between STST and 6MWT and both correlated with age, quality of life, peripheral muscle strength and dyspnea severity in patients with COPD. None of the tests was associated with pulmonary function variables[49]. The STST is able to evaluate the functional status of patients with COPD, with less hemodynamic stress, thereby facilitating its application in some specific cases. The STST is a sensitive test in evaluating pulmonary rehabilitation intervention[20].

DISCUSSION

Symptoms such as fatigue and dyspnea impair functional capacity, including the performance of ADL in patients with COPD [1, 2,3,4,5]. Many tools for assessing functional capacity in this patient population are available in the literature, with simple and less costly methods more applicable to both clinical practice and scientific research. Moreover, to evaluate the functional capacity of patients with COPD, one should give preference to disease-specific instruments that better reflect the reality of the patient and adequately define the most important functional limitations[7].

Direct observations of activity performance through clinical tests may provide the best means of assessing functional status; however, this strategy is usually impractical[7]. In these cases, the questionnaires reviewed [4,10,12, 17,22,25,26] may be an alternative to provide useful information in the evaluation, in addition to being easy to

use, reproducible, correlated with other health outcomes and exhibiting good sensitivity to change. Nevertheless, questionnaires can be influenced by several factors such as psychological aspects, literacy, performance perception and gender, which can compromise the reliability of the answers. The 6MWT, Glittre ADL, ST and STST tests are easy to apply and indirectly reflect the patient's ADL performance.

The 6MWT is the most widely used functional capacity test because it is well tolerated, easy to perform, has high prognostic value, and is able to detect limitations in ADL[42,45,47], in addition to being a submaximal test of daily activities when compared to other physical fitness tests, such as ST. The psychometric properties of the 6MWT have been well-established and it can be applied to both healthy subjects and patients with different diseases[45]. However, this test does not identify specific activities in which the limitation is present or assess the impairment of upper limb (UL) activities, which are usually deeply involved in usual ADL. Thus, complementary to the 6MWT, the Glittre ADL-test can be used to measure functional status in patients with COPD using both upper and lower limb ADL[30].

Despite being simple tests, 6MWT and ST require a flat 30 or 10-meter course, respectively[31,32,40,42]. In most offices or clinics, this space is not available, precluding the use of these tests. On the other hand, the STST, also used to measure functional capacity, requires minimal space, shows good correlation with 6MWT, peripheral muscle strength and dyspnea[49] and can be an alternative when space is lacking.

Functional capacity, an important aspect in the life of any individual, is affected mainly by chronic diseases such as COPD. The increasing number of simple and inexpensive tools available to evaluate functional capacity provides even better service to patients, allowing health professionals to design individualized and more effective treatment strategies.

In conclusion, there are several clinical tests and questionnaires for the functional assessment of patients with COPD, and all the instruments reviewed demonstrated good psychometric properties. Therefore, the choice of the best measure should be based on the patient's clinical characteristics and selection of outcome measures with greater impact in both clinical and research settings. The 6MWT is the most widely used functional capacity test, albeit not specific for patients with COPD. Moreover, the 6MWT is extensively used as a parameter to correlate and validate other tests and questionnaires. The Glittre ADL-test, despite being a new, relatively unknown test, can be used as a complementary tool for the functional assessment of patients with COPD. In most literature reports, little or no association between instruments and pulmonary function variables was observed, confirming the hypothesis that these variables do not adequately explain functional status in this patient population. The following revised questionnaires were translated to Portuguese and culturally adapted to Brazil: the LCADL[9], PFSDQ-M[16] and PAH[27,28].

REFERENCES

1. Global Strategy for the Diagnosis, Management and Prevention of COPD: 2011 update. Acesso em www.goldcopd.com.

2. II Consenso Brasileiro sobre Doença Pulmonar Obstrutiva Crônica (DPOC). J Bras Pneumol 2004; 30:1S-42S.

3. Pitta F, Troosters T, Spruit MA, Probst VS, Decramer M, Gosselink R. Characteristics of physical activities in daily life in chronic obstructive pulmonary disease. Am J Respir Crit Care Med 2005; 171:972-977.

4. Garrod R, Bestall JC, Paul EA, Wedzicha JA, Jones PW. Development and validation of a standardized measure of activity of daily living in patients with severe COPD: the London Chest Activity of daily living scale (LCADL). Respir Med 2000; 94(6):589-96.

5. Reardon JZ, Lareau SC, Zuwallack R. Functional status and quality of life in chronic obstructive pulmonary disease. Am J Med 2006; 119 (10A): S32-S37.

6. Velloso M, Stella SG, Cendon S, Silva AC, Jardim JR. Metabolic and ventilatory parameters of four activities of daily living accomplished with arms in COPD patients. Chest 2003; 123(4):1047-53.

7. Lareau SC, Breslin EH, Meek PM. Functional status instruments: Outcome measure in the evaluation of patients with chronic obstructive pulmonary disease. Heart Lung 1996; 25(3):212-24.

8. Garrod R, Paul EA, Wedzicha JA. An evaluation of the reliability and sensitivity of the London Chest Activity of Daily Living Scale (LCADL). Respir Med 2002; 96(9):725-30.

9. Carpes MF, Mayer AF, Simon KM, Jardim JR, Garrod R.The Brazilian Portuguese version of the London Chest Activity of Daily Living scale for use in patients with chronic obstructive pulmonary disease. J Bras Pneumol 2008; 34(3):143-51.

10. Lareau, SC, Carrieri-Kohlman V, Janson-Bjerklie S, Roos PJ. Development and testing of the Pulmonary Function Status and Dyspnea Questionnaire (PFSDQ). Heart Lung 1994; 23:242-50.

11. Lareau SC, Meek PM, Press D, Anholm JD, Roos PJ. Dyspnea in patients with chronic obstructive pulmonary disease: Does dyspnea worsen longitudinally in the presence of declining lung function? Heart Lung 1999; 28(1):65-73.

12. Lareau SC, Meek PM, Roos PJ. Development and testing of the modified version of the Pulmonary Functional Status and Dyspnea Questionnaire (PFSDQ-M). Heart Lung 1998;27(3):159-68.

13. Skumlien S, Haave E, Morland L, Bjortuft O, Ryg MS. Gender differences in the performance of activities of daily living among patients with chronic obstructive pulmonary disease. Chron Respir Dis 2006; 3(3):141-8

14. Pitta F, Troosters T, Probst VS, Langer D, Decramer M, Gosselink RAre patients with COPD more active after pulmonary rehabilitation? Chest 2008; 134(2):273-80.

15.Kovelis D, Zabatiero J, Oldemberg N, Colange AL, Barzon D, Nascimento CH, Probst VS, Pitta F. Responsiveness of three instruments to assess self-reported functional status in patients with COPD. COPD 2011; 8(5):334-9.

16. Kovelis D, Segretti NO, Prost VS, Lareau SC, Brunetto AF, Pitta F. Validação do Modified Pulmonary Functional Status and Dyspnea Questionnaire e da escala do Medica, Research Council para uso em pacientes com doença pulmonar obstrutiva crônica no Brasil. J Bras Pneumol 2008;34(12):1008-1018.

17. Weaver TE, Narsavage GL. Physiological and psychological variables related to functional status in chronic obstructive pulmonary disease. Nurs Res 1992; 41(5):286-91.

18. Weaver TE, Narsavage GL, Guilfoyle MJ. The development and psychometric evaluation of the Pulmonary Functional Status scale: an instrument to assess functional status in pulmonary disease. J Cardiopulm Rehabil 1998; 18(2):105-111.

19. Haggerty MC, Stockdale-Woolley R, Zuwallack R. Functional status in pulmonary rehabilitation participants. J Cardiopulm Rehabil 1999; 19(1):35-42.

20. Normandin EA, Mccusker C, Connor M, Vale F, Gerardi D, Zuwallack RL. An evaluation of two approaches to exercise conditioning in pulmonary rehabilitation. Chest 2002; 121(4):1085-91.

21. Votto J, Bowen J, Scalise P, Wollschlager C, Zuwallack RL. Short-stay comprehensive inpatient pulmonary rehabilitation for advanced chronic obstructive pulmonary disease. Arch Phys Med Rehabil 1996; 77(11):1115-8.

22. Yohannes AM, Roomi J, Winn S, Connolly MJ.The Manchester respiratory activities of daily living questionnaire: development, reliability, validity, and responsiveness to pulmonary rehabilitation. J Am Geriatr Soc 2000; 48(11):1496-500.

23. Yohannes AM, Greenwood YA, Connoly MJ. Reliability of the Manchester respiratory activities of daily living questionnaire as a postal questionnaire. Age Ageing 2002; 31(5):355-8.

24. Yohannes AM, Baldwin RC, Connoly MJ. Predictors of 1-year mortality in patients discharged from hospital following acute exacerbation of chronic obstructive pulmonary disease. Age Ageing 2005; 34(5):491-496.

25. Daughton DM, Fix AJ, Kass I, Bell CW, Patil KD. Maximum oxygen consumption and the ADAPT quality-of-life scale. Arch Phys Med Rehabil 1982; 63(12):620-2.

26. Human Activity Profile – professional manual. Nebraska: Psychological Assessment Resources; 1988.

27. Davidson M, Morton N. A systematic review of the Humam Activity Profile. Clin Rehabil 2007; 21(2):151-62.

28. Souza AC, Magalhães LC, Teixeira-Salmela LF. Adaptação transcultural e análise das propriedades psicométricas da versão brasileira do Perfil de Atividade Humana. Cad Saude Publica 2006; 22(12):2623-36.

29. Nield M, Hoo GS, Roper J, Santiago S, Dracup K. Usefulness of the human activity profile, a functional performance measure, in people with chronic obstructive pulmonary disease. J Cardiopulm Rehabil 2005; 25(2): 115-21.

30. Skumlien S, Hagelund T, Bjørtuft O, Ryg MS.A field test of functional status as performance of activities of daily living in CPOD patients. Respir Med 2006; 100(2):316-23.

31. Krislainy SC, Manuela K, Letícia QM, Karoliny S, Anamaria FM. O teste de AVD-Glittre é capaz de diferenciar a capacidade funcional de indivíduos com DPOC da de saudáveis? Rev Bras Fisioter 2011;15(6):467-73.

32. Singh SJ, Morgan MD, Scott S, Walters D, Harman AE. Development of a shuttle walking test of disability in patients with chronic airways obstruction. Thorax 1992; 47(12):1019-24.

33. Skumlien S, Skogedal EA, Ryg MS, Bjørtuft O. Endurance or resistance training in primary care after in-patient rehabilitation for COPD? Respir Med 2008; 102:422-429.

34. Eiser N, Willsher D, Doré CJ. Reliability, repeatability and sensitivity to change of externally and self-paced walking tests in COPD patients. Respir Med 2003; 97(4):407-14.

35. Singh SJ, Morgan MD, Hardman AE, Rowe C, Bardsley PA. Comparison of oxygen uptake during a conventional treadmill test and the shuttle walking test in chronic airflow limitation. Eur Respir J 1994; 7(11):2016-20.

36. Campo LA, Chilingaryan G, Berg K, Paradis B, Mazer B. Validity and reliability of the modified shuttle walk test in patients with chronic obstructive pulmonary disease. Arch Phys Med Rehabil 2006; 87(7):918-22.

37. Dyer CA, Singh SJ, Stockley RA, Sinclair AJ, Hill SL. The incremental shuttle walking test in elderly people with chronic airflow limitation. Thorax 2002;57(1):34-8.

38. O'Neill B, Mckevitt A, Rafferty S.A comparison of twice- versus once-weekly supervision during pulmonary rehabilitation in chronic obstructive pulmonary disease. Arch Phys Med Rehabil 2007;88(2):167-72.

39. Coelho CC, Aquino ES, Almeida DC. Comparative analysis and reproducibility of the modified shuttle walk test in normal children and in children with cystic fibrosis. J Bras Pneumol 2007; 33(2):168-74.

40. Jolly K, Taylor RS, Lip GY, Singh S, Brum Streering Comitte. Reproducibility and safety of the incremental shuttle walking test for cardiac rehabilitation. Int J Cardiol 2008;125(1):144-5.

41. Win T, Groves AM, Ritchie AJ, Wells FC, Cafferty F, Laroche CM. The effect of lung resection on pulmonary function and exercise capacity in lung cancer patients. Respir Care 2007; 52(6):720-6.

42. ATS Statement: Guidelines for the Six-Minute Walk Test. Am J Respir Crit Care Med 2002; 166(1):111-7.

43. Puhan MA, Mador MJ, Held U, Goldstein R, Guyatt GH, Schünemann HJ.Interpretation of treatment changes in 6-minute walk distance in patients with COPD. Eur Respir J 2008; 32(3):637-43.

44. Redelmeier DA, Bayoumi AM, Goldstein RS, Guyatt GH.Interpreting small differences in functional status: the six minute walk test in chronic lung disease patients. Am J Respir Crit Care Med 1997; 155(4):1278-82.

45. Solway S, Brooks D, Lacasse Y, Thomas S. A qualitative systematic overview of the measurement properties of functional walk tests used in the cardiorespiratory domain. Chest 2001; 119(1):256-70.

46. Bohannon RW, Smith J, Hull D, Palmeri D, Barnhard R. Deficits in lower extremity muscle and gait performance among renal transplant candidates. Arch Phys Med Rehabil 1995;76(6):547-51.

47. Cote CG, Pinto-Plata V, Kasprzyk K, Dordelly LJ, Celli BR. The 6-min walk distance, peak oxygen uptake, and mortality in COPD. Chest 2007; 132(6):1778-85

48. Gross MM, Stevenson PJ, Charette SL, Pyka G, Marcus R. Effect of muscle strength and movement speed on the biomechanics of rising from a chair in healthy elderly and young women. Gait Posture 1998;8(3):175-185.

49. Ozalevli S, Ozden A, Itil O, Akkoclu A.Comparison of the sit-to-stand test with 6 min walk in patients with chronic obstructive pulmonary disease. Respir Med 2007; 101(2):286-93.