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The Relation of COPD Assessment Test (CAT) and BODE Index in Assessing Patients with COPD: Is Cat Alone Simple and Good Enough?

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is a significant cause of disability and death worldwide. It is often evaluated with outcome measures like lung function test (LFT), health status and BODE (Body mass, Obstruction, Dyspnoea and Exercise capacity) index, to initiate appropriate treatment. Objectives: To determine the association between the BODE index and COPD assessment test (CAT) in COPD patients. To ascertain the utility of CAT alone as an assessment tool for COPD patients in primary care setting and low resource countries. **Methods:** A cross-sectional study of sixty (60) patients with clinical and lung function test diagnosis of COPD were recruited consecutively from the outpatient clinic. The body mass index (BMI) of the patients, CAT scores, modified medical research council dyspnoea scale and six-minute walk distance test (6MWDT) was assessed and recorded. The individual score was summed up to obtain the BODE index score for the particular patients. **Results:** The mean age was 68.8years (± 10.3). There was a strong correlation between the BODE index and CAT scores (r= 0.77 P <0.0001). Inter-rater agreement between the tools (CAT and BODE index) was moderate (k=0.46). The CAT questionnaire also correlated well with the modified medical research council dyspnea scale, the six-minute walk test and the forced expiratory volume in the first second. **Conclusion:** CAT can serve as a simple, easy to administer tool for the assessment of patients with COPD especially in low resource countries and primary care setting.

Keywords: Health Status, BODE Index, COPD assessment test.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a significant cause of morbidity and mortality worldwide.[1] At present, it is the fifth leading cause of death globally, and it is projected to become the third by 2030.[1] Most of the deaths from COPD will occur in middle and low resource countries.[2] The prevalence and incidence of COPD are high although most of the cases are unrecognized and undiagnosed. The high prevalence is attributed majorly to the increasing smoking prevalence, advancing age, as well as exposure to indoor and outdoor pollution.[2] It is currently labeled as a "silent epidemic" in sub-Saharan Africa because despite the large number of individuals who suffer from the disease, the diagnosis, and treatment of it are inadequate. The economic and social burden associated with the management of the disease is equally enormous. Management and treatment of COPD patients are based primarily on spirometric assessment of the disease. But this conventional method of assessment of the severity of COPD remain unsatisfactory because it does not assess the other aspect of the disease such as fatigue, exercise deconditioning, muscle weakness, sleep, social isolation and mood disorders which are known to contribute significantly to the health of affected people. In addition, performing spirometry in routine clinic setting is not practically feasible considering the busy schedules vis-a-vis the shortage of trained and qualified healthcare personnel.[4,5,6] Furthermore, current guidelines recommend a combined evaluation of symptoms, the severity of airflow limitation, history of exacerbations and comorbidities in assessing the severity of patients with COPD.[7] Other ways of assessing COPD must take into consideration the multisystemic effect of the disease. Such comprehensive measures will include, health status measurement and the BODE (Body mass, Obstruction, Dyspnoea and Exercise capacity) index.

Health status measurement is a means of quantifying in a standardized and objective manner, the overall impact of the disease on patient's daily life, health,

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and wellbeing.[8] Instruments that measure health status are designed in such a way as to provide a comprehensive estimate of the primary and secondary effects of the disease.[8] There are a number of psychometric tools (questionnaire) that may be described as COPD specific health status instrument. Some of these instruments are complex to use, also they require time to complete and this makes them unsuitable for regular usage in clinics. The COPD Assessment Test (CAT) is a fairly new health status instrument developed to overcome some of these shortcomings. The CAT is an eight-item health status instrument that takes 2-3 minutes to complete and score. It has been validated in several studies.[9,10] The BODE index is a multidimensional scoring system used for assessing patients with COPD and to predict long-term outcomes for them.[11] The index uses the four factors of body mass index (BMI), Airflow obstruction, Dyspnoea, and Exercise capacity to predict mortality.[12] It predicts survival of COPD patients.[13] It also determines the frequency and duration of hospitalizations, and pulmonary rehabilitation.[14-16] There are few studies in sub-Saharan African on health status assessment of patients with COPD. This study aims to determine the relationship between the BODE index, and the COPD Assessment test scores. Furthermore, to ascertain the suitability of using the CAT alone as an effective tool for assessing COPD patients especially in low resource countries.

MATERIALS AND METHODS

Study design

This was a cross-sectional study of stable COPD patients. Sixty (60) patients were recruited consecutively from the medicine out-patients clinic of tertiary hospital south west, Nigeria.

Sample size was determined using the Taro Yamane formula for sample size determination, assuming the standard error to be 5% (0.05) and the population under study from clinic attendance was estimated to be seventy. This gave a sample size of sixty (60)

Inclusion Criteria

Patients with the diagnosis of COPD as defined by the GOLD guideline and who were judged to be clinically stable. The post-bronchodilator ventilatory ratio of forced expiratory volume in one second (FEV1) to the forced vital capacity of less than 70% and a reversibility test of <12% change in post-bronchodilator FEV1 and or a change of not more than 200ml with the administration of short-acting β2 agonist (400μg Salbutamol). Patients were judged to be clinically stable if there was no change in their medication dosage or frequency of administration and no worsening of symptoms or hospital admission in the preceding twelve weeks.

Patients with other obstructive airway disease like bronchial asthma were excluded from the study. In addition, other comorbid medical conditions like a congestive cardiac failure and corpulmonale were also excluded.

Information on socio-demographic characteristics and respiratory symptoms of the patients were obtained using a modified version of the Medical Research Council (MRC) questionnaire. The clinical features of the patients such as height and weight were measured with a stadiometer and weighing scale respectively. Body Mass Index (BMI) was calculated according to weight (kg)/ (height)2 (m2)

Health status: This was assessed using the COPD assessment test (CAT). CAT is a self-administered questionnaire consisting of 8 items. Each is presented on a 6-point scale from 0 (best) to 5 (worse), providing a maximal score of 40. The CAT was completed by each patient recruited at the outpatient clinic.

Lung function test (LFT): Each patient performed a spirometric test to assess airflow limitation. The spirometry was performed using the Spiro lab-II spirometer manufactured by Medical International Research (MIR) in accordance with the ATS/ERS criteria.[17] The FEV1 was used to divide the patients into four groups based on levels of their airway obstruction using the GOLD criteria as follows; Mild FEV1 ≥ 80% (GOLD grade 1) and Moderate FEV1< 80% but ≥ 50% (GOLD grade 2). Patients with severe airflow obstruction had FEV1< 50% and ≥30% (GOLD grade 3) and very severe had FEV1< 30% (GOLD grade 4).

Exercise test performance was evaluated using the six-minute walk test (6MWT) according to the set guidelines of the American Thoracic Society.[18] The total length covered in six minutes was measured.

For each value of FEV1, MMRC dyspnoea scale, and six-minute walk test, points ranging from 0 to 3 were assigned to patients, while for the BMI, patients were awarded either a score of 0 or 1. The individual score was summed up to obtain the BODE index score for the particular patients. The BODE index was further divided into four quartiles: first quartile (a score of 0 to 2points), second quartile (a score of 3 to 4 points), third quartile (a score of 5 to 6 points) and the fourth quartile (a score of 7 to 10 points).

Ethical consideration: All participants gave written informed consent and the study protocol received approval of the local ethics committee of the university teaching hospital.

Data analysis: Data was analyzed with SPSS statistical software. Descriptive analysis was used to express proportions of interest. Continuous variable at different quartiles of the BODE index score was tested using analysis of variance (ANOVA) and p-value. Cohen kappa analysis was performed to determine the level of agreement of CAT questionnaire and BODE index.

RESULTS

A total of sixty patients were recruited for the study which comprise of 36(60%) males, and 24(40%) females. Seven (11.7%) of the patients have low level of health status impairment while a small proportion about 5.0% have very high impairment of their health status measured by the CAT questionnaire. Majority of the patients have moderate to high impairment of their health status. In terms of classification of the disease by BODE Index 13.3% were in category A (0-2) with mean score of 1.3 ± 0.5, 41.7% in category B (3-4) with mean score of 3.2 ± 0.5, while 33.3% and 11.7% were categorized into C (5-6) and D (7-10) with mean scores of 6.2±0.7 and 8.7±0.7 respectively. The GOLD staging, dyspnoea ratings of the patients and other details of patients' socio-demographic information are displayed in [Table 1].

Table 1: Socio-demographic distribution of the study population

Variables	Total (%)
Sex	
Male	36(60.0)
Female	24(40.0)
Smoking status	
Current/ EX- smoker	39(65.0)
Non-smoker	21(35.0)
Breathlessness	
MMRC0	9(15.0)
MMRC1	30(50.0)
MMRC2	16(26.6)
MMRC3	5(8.4)
GOLD staging	
Mild	8(13.3)
Moderate	19(31.7)
Severe	20(33.3)
Very severe	13(21.7)
CAT groups	
Low	7(11.6)
Medium	37(61.7)
High	13(21.7)
Very high	3(5.0)
BODE Index quartiles	
0-2	8 (13.3)
3-4	25 (41.7)
5-6	20 (33.3)
7-10	7 (11.7)

MMRC= modified medical research council, CAT= COPD assessment test, GOLD= global burden of obstructive lung diseases, BODE= Body mass, Obstruction, Dyspnoea and Exercise capacity, BODE categories A, B, C, and D corresponds to quartiles 0-2, 3-4, 5-6, 7-10

The results of some clinical parameters, lung function test, six-minute walk test and mean CAT scores across the various categories of the BODE index are represented in [Table 2] below. The mean age was 68.8(±10.2) and the mean body mass index (BMI) 21.6 (±4.8). Most of the patients were ex-smokers 33 (61.7%), the average quantity of cigarette smoked was 3.6 (± 0.7) pack years. The mean CAT score for patients in BODE Index category A was (11.7± 4.6), category B (14.5±2.5), category C (17.9±2.6) and category D (24.2± 4.6). Similarly, the CAT scores increase (health status become worse) as the risk of progression of the disease and deterioration of lung function (measured by the degree of air flow limitation) and the exercise tolerance (measured by the total distance covered) become significantly affected.

[Table 3], shows the Post hoc tests between dependent variable (COPD assessment test score) and the independent variable the BODE Index. There was a statistically significant difference between the groups determined by one-way ANOVA [F (22,37) = 3.639, p = 0.0001). A Tukey post hoc test revealed that the change in health status was statistically significantly worse after the third (17.9 ± 2.6, p = 0.014) and fourth quartile (24.2 ± 4.6, p = 0.001) compared to the first quartile. There was no statistically significant difference between the second and first quartile (p = 0.82).

Table 2: Distribution of patient characteristics according to BODE index category

BODE index category	Total Mean (SD)	0-2 Mean (SD)	3-4 Mean (SD)	5-6 Mean (SD)	7-10 Mean (SD)
Age	68.8 (10.2)	65.4 (11.4)	67.4 (8.7)	72.3 (10.1)	68.9 (9.4)
BMI (kg/m2)	21.6 (4.8)	23.8 (3.0)	24.9 (8.7)	19.8 (3.7)	18.1 (1.4)
PACK YEARS	3.6 (0.7)	2.2 (0.4)	3.2 (0.8)	3.3 (0.7)	7.2 (0.9)
PB-FEV1(L)	1.14 (0.5)	1.8 (0.5)	1.2 (0.3)	0.8 (0.2)	0.7 (0.1)
PB-FVC (L)	2.03 (0.8)	2.7 (0.7)	2.2 (0.6)	1.6 (0.4)	1.5 (0.5)
PB-FEV1predicted %	51.9 (20.7)	76.1 (15.2)	55.0 (11.6)	41.0 (7.4)	27.9 (5.2)
PB-FVC predicted %	74.3 (19.7)	95.0 (16.0)	76.1 (10.8)	64.7 (12.1)	55.5 (12.4)
PB-FEV1/FVC %	56.4 (10.4)	63.4 (6.9)	59.3 (9.5)	52.4 (9.0)	48.2 (10.6)
6MWDT (m)	281 (80.5)	366 (53)	311 (43.0)	244 (32)	174 (36)
CAT scores	16.5 (5.6)	12.5 (4.6)	14.5 (4.4)	18.7 (4.3)	24.2 (4.5)

BMI= body mass index, PB-FEV1= post bronchodilation forced expiratory volume, PB-FVC= post bronchodilation forced vital capacity, 6MWD= six-minute walk distance test, L= litres, m=meter, SD= standard deviation.

Table 3: Post hoc test of ANOVA between dependent variable COPD assessment test score independent BODE Index

Source category	Mean difference	Standard error	P	95% confidence interval Lower bound Upper bound
Between groups 0-2 3-4	- 1.62	1.88	0.824	-6.59 3.35
5-6	- 6.15	1.93	0.012	-11.27 -1.03
7-10	- 10.5	2.39	0.001	-16.84 - 4.16

The mean difference is significant at 0.05 level

[Table 4], shows details of the result of the Pearson correlation test between the CAT scores and measured outcome variables. The CAT scores were strongly correlated with the BODE index, while possible outcome measure show variable degrees of association with the CAT scores. The inter-rater agreement between the CAT and the BODE index Cohen kappa k=0.46

Table 4: correlation between CAT scores some patient reported outcome measures of the severity COPD

Variable	Correlation coefficient (r)	P value
GOLD stages	0.545	0.001
BODE Index category	0.937	0.001
Six-minute walk test	0.774	0.001
mMRC	0.425	0.010

DISCUSSION

The present study demonstrated a strong association between the BODE index and CAT scores and CAT levels of severity. The mean CAT scores increased across the different categories of the BODE index and the increase was statistically significant. This means that as the severity of COPD measured by BODE index gets worse, the health status measured by the CAT scores is likely to increase in a similar fashion. This is similar to previous observations made by Ghobadi and his colleagues on association of COPD Assessment Test Scores with Clinically Important Predictive Outcomes measures of COPD.[19] This finding is not surprising as health instrument are generally designed to measure a wide range of the various effects of a disease. Interestingly, COPD is a multisystemic disease which affects not just the lungs but also other parts of the body. By implication other important factors such as impaired exercise performance, the persistence of the daily symptoms and a high exacerbation frequency which are known to have impact on the overall wellbeing of the patients need to be considered in holistic assessment of patients with COPD. In addition, poor sleep quality, emotional disorders such as anxiety and depression, have also been shown to be important and common in patients with COPD. These factors are associated with a wide range of patient reported outcome measures that determine impairment of health status. Consequently, classification of the disease severity to effect appropriate management will require tools that incorporate more than one parameter.

In this study, the CAT questionnaire also correlated well with some of these patients reported outcome measures of COPD (such as the modified medical research council dyspnea scale which measure the level of breathlessness, the six-minute walk test that measures effort tolerance and forced expiratory volume in the first second - FEV 1 by spirometry which measure the degree of airflow limitation). This finding is a replication of observations made in a systematic review which demonstrated significant associations of the CAT score with prediction COPD exacerbation, health status deterioration, depression and mortality.[20] These parameters in turn are very important and integral components for calculating the BODE index. In the present study we observed that the CAT questionnaire had a better correlational strength with the BODE index than when compared to the other patient outcome measure. This suggest that it may be a better comprehensive evaluator of the disease compared to the other outcome measures. However, this finding needs to be interpreted with caution as this study was not designed to identify superiority of any of the assessment tool over the other. In addition, the items of CAT were carefully selected to cover a wide range of the disease severity; the items related to cough and phlegm have greater discriminant power for milder disease. Items concerning chest tightness and confidence leaving home are more discriminant in severe COPD and the remaining items capture moderate health status impairment. This, suggest that the CAT scores will be able to identify the various stages of the disease severity. These findings suggest that the questionnaire may be a handy tool for assessing the various aspects of this disease, as well as different classes of the severity.

A Cohen kappa statistic was performed to assess the level of agreement between the two instruments. We found a moderate agreement between the CAT stages and the BODE index (k= 0.46, p=0.001). This finding may be of clinical value in primary care health facility where it will aid attending physicians in adjusting treatment or early referral to higher centers for effective management.

The major limitation of this study was that it is a cross-sectional study that assessed stable COPD patients, only few of the patients have a severe health status scores, and also Patients with acute deterioration of their symptoms may perform differently with the CAT questionnaire. The second major limitation of this study was the small sample size.

CONCLUSION

In conclusion, the COPD assessment test (CAT) has a strong correlation with the multidimensional assessment tool the BODE index and other patient reported outcome measure of the disease such as; symptoms, lung function test and six-minute walk distance. It is a simple health status instrument that can serve as a quick, easy-to-use tool for measuring the severity, predicting prognosis and mortality in patients with chronic obstructive pulmonary disease especially in low resources countries. It may also alert the primary care physician on the need to adjust treatment and initiate early referral for specialized care.

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