e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(12); 3313-3320

Original Research Article

BODE Index as a Predictor of Hospitalization and Disease Severity in Patients with Chronic Obstructive Pulmonary Disease

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Received: 18-10-2025 / Revised: 21-11-2025 / Accepted: 02-12-2025
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Conflict of interest: Nil

Abstract

Background: Chronic obstructive pulmonary disease (COPD) is a leading cause of global morbidity and mortality, and forced expiratory volume in one second (FEV_1) alone inadequately reflects its systemic burden. The BODE index, integrating body mass index, airflow obstruction, dyspnoea and exercise capacity, was developed as a multidimensional prognostic tool. The present study was undertaken to evaluate the BODE index as a predictor of hospitalization and disease severity in COPD patients attending a tertiary care hospital.

Methods: A prospective observational study was conducted on 100 stable COPD patients diagnosed by post-bronchodilator spirometry as per Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria. Baseline BODE index was computed and patients were stratified into four quartiles. All participants were followed up for 12 months for episodes of exacerbations and hospitalizations. Correlations of BODE score with GOLD stage, six-minute walk distance and modified Medical Research Council (mMRC) grade were analyzed. Receiver operating characteristic (ROC) analysis and multivariate logistic regression were used to compare the predictive value of BODE versus FEV_1 for hospitalization.

Results: The mean age of participants was 62.4 ± 8.7 years with a male predominance (82%). The mean BODE score was 4.28 ± 2.31. BODE score correlated strongly with GOLD stage ($r = 0.782$, $p < 0.001$) and inversely with six-minute walk distance ($r = -0.814$, $p < 0.001$). Mean annual hospitalization rate increased progressively across BODE quartiles from 0.28 in quartile 1 to 2.64 in quartile 4 ($p < 0.001$). The area under the ROC curve for BODE in predicting hospitalization was 0.874 (95% CI 0.802–0.946) compared with 0.712 (95% CI 0.612–0.812) for FEV_1 percent predicted ($p = 0.004$). On multivariate analysis, BODE quartile emerged as the strongest independent predictor of hospitalization (adjusted odds ratio 3.42, 95% CI 1.86–6.29, $p < 0.001$).

Conclusion: The BODE index is a robust, multidimensional predictor of hospitalization and disease severity in COPD, and outperforms FEV_1 alone. Its routine incorporation into outpatient assessment can help identify high-risk patients who may benefit from intensified interventions.

Keywords: BODE index, chronic obstructive pulmonary disease, hospitalization, six-minute walk distance, disease severity.

Introduction

Chronic obstructive pulmonary disease (COPD) is a common, preventable and treatable respiratory disorder characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response of the airways and lungs to noxious particles or gases [1].

It represents an increasingly important cause of morbidity, disability and mortality worldwide, with the most recent global modelling analysis estimating a prevalence of approximately 10.3% in adults aged 30 to 79 years, translating to nearly 391 million cases in 2019 [2]. In India, where combined exposure to tobacco smoke, biomass fuel and ambient air pollution is highly prevalent, systematic reviews have documented a pooled prevalence of 7 to 10% in adults above 30 years of age, making COPD the second leading cause of mortality and disability-adjusted life years attributable to non-communicable diseases [3].

Historically, the severity of COPD has been graded on the basis of post-bronchodilator forced expiratory volume in one second (FEV_1), as embodied in the Global Initiative for Chronic Obstructive Lung Disease (GOLD) spirometric classification [1]. However, it has become increasingly apparent that FEV_1 alone does not adequately capture the clinical, functional and

systemic dimensions of the disease. Two patients with an identical FEV_1 may differ markedly in their symptom burden, exercise tolerance, nutritional status and frequency of exacerbations. Nishimura and colleagues, in a large prospective cohort, demonstrated that dyspnoea as assessed by the modified Medical Research Council (mMRC) scale was a better predictor of five-year survival in COPD than airway obstruction, thereby underscoring the limitations of a purely physiological staging framework [4].

These observations paved the way for multidimensional prognostic tools that could integrate pulmonary and extra-pulmonary manifestations of COPD. In 2004, Celli and coworkers introduced the BODE index, a 10-point composite grading system combining Body mass index, degree of airflow Obstruction (FEV_1 percent predicted), severity of Dyspnoea (mMRC grade) and Exercise capacity (six-minute walk distance, 6MWD) [5]. In their landmark cohort of 859 patients, the BODE index proved superior to FEV_1 in predicting all-cause and respiratory-cause mortality, with each one-point increment associated with a hazard ratio of 1.34 for death from any cause [5]. Subsequent work by Ong and colleagues extended the utility of the index by demonstrating that higher BODE scores predicted hospitalization for acute exacerbations more accurately than FEV_1 alone in a Singaporean COPD cohort [6].

The prognostic reach of the BODE index has since been consolidated across multiple domains. Marin and coworkers reported that BODE quartile strongly predicted both the rate and severity of subsequent exacerbations, with mean time to first exacerbation shortening progressively from 7.9 years in the lowest quartile to 1.3 years in the highest [7]. Severe exacerbations, particularly those requiring hospital admission, have themselves been shown to be independent determinants of mortality: Soler-Cataluna and colleagues observed a more than four-fold increase in the risk of death among frequently hospitalized patients when compared with those not requiring inpatient care [8]. Consequently, any tool that reliably identifies patients at risk of hospitalization carries direct implications for morbidity, mortality and healthcare expenditure.Recognizing that the six-minute walk test may not be feasible in every clinical setting, Cote and coworkers developed and validated a modified BODE index that replaces 6MWD with peak oxygen uptake as a percentage of predicted, and demonstrated comparable predictive performance for long-term mortality in COPD [9]. Indian data on the BODE index remain relatively limited but consistent in direction. Sarkar and colleagues, in a cohort of 114 stable COPD patients attending a tertiary hospital in Kolkata, reported that higher BODE quartiles were strongly correlated with worsening health-related quality of life on the St George's Respiratory Questionnaire and with increased frequency of exacerbations and hospitalizations over the preceding year, with correlations that outperformed the GOLD classification [10].

Despite this growing evidence base, the BODE index remains under-utilized in routine outpatient practice in many Indian tertiary care settings, where risk stratification often continues to rely on spirometry alone. Prospective validation of the BODE index as a predictor of subsequent hospitalization and disease severity in Indian COPD patients, using structured 12-month follow-up, is therefore of clinical relevance. Such data can inform decisions regarding pulmonary rehabilitation referral, intensification of pharmacotherapy, oxygen prescription and prioritization of scarce inpatient resources. Against this background, the present prospective observational study was designed to evaluate the BODE index as a predictor of hospitalization and disease severity in patients with stable COPD attending a tertiary care hospital, and to compare its performance with that of the traditional FEV_1-based GOLD staging system.

Aims and Objectives: The present study was undertaken with the aim of evaluating the utility of the BODE index as a multidimensional predictor of hospitalization and disease severity in patients with chronic obstructive pulmonary disease. The primary objective was to determine the relationship between baseline BODE index score and the frequency of hospitalization for acute exacerbations during a 12-month prospective follow-up period. The secondary objectives were to assess the correlation between the BODE index and established markers of disease severity including the GOLD spirometric stage, the mMRC dyspnoea grade and the six-minute walk distance; to compare the predictive accuracy of the BODE index with that of FEV_1 percent predicted for hospitalization using receiver operating characteristic analysis; and to identify independent predictors of hospitalization through multivariate logistic regression. Distribution of participants across BODE quartiles and their concordance with GOLD stages was also examined to provide a clinically usable stratification framework.

Materials and Methods

Study design and setting: A prospective observational study was carried out in the Department of General Medicine at a tertiary care teaching hospital over a period of 18 months, following approval by the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrolment. The

reporting of the study adhered to the STROBE guidelines for observational research.

Sample size

The sample size was calculated based on the reported correlation coefficient between the BODE index and hospitalization frequency in previous work by Ong and coworkers [6]. Assuming an expected correlation of 0.34, a two-sided type I error of 5% and a power of 90%, the minimum required sample size was calculated to be 89 patients. To allow for a 10% attrition rate over the 12-month follow-up period, the sample size was rounded to 100 patients.

Inclusion Criteria: Patients aged 40 years and above with a clinical diagnosis of COPD, confirmed by post-bronchodilator spirometry showing a forced expiratory volume in one second to forced vital capacity ratio (FEV_1/FVC) of less than 0.70 in accordance with GOLD guidelines, were considered eligible. Only patients in a clinically stable state, defined as absence of any exacerbation requiring change in therapy or hospital admission in the four weeks preceding recruitment, were enrolled. Participants were required to provide written informed consent and be willing to attend scheduled follow-up visits.

Exclusion Criteria: Patients with a documented history of bronchial asthma, bronchiectasis, active or previously treated pulmonary tuberculosis with residual sequelae, interstitial lung disease, lung malignancy or thoracic cage deformity were excluded. Individuals with recent myocardial infarction within the preceding three months, uncontrolled congestive cardiac failure, unstable angina, severe musculoskeletal or neurological limitations preventing performance of the six-minute walk test, or cognitive impairment precluding informed consent were also excluded. Patients unwilling to participate in follow-up were not enrolled.

Clinical assessment and BODE index computation: At enrolment, all participants underwent a detailed history and clinical examination including anthropometric measurements. Body mass index (BMI) was calculated as weight in kilograms divided by height in metres squared. Pulmonary function testing was performed using a calibrated spirometer in accordance with American Thoracic Society and European Respiratory Society standards, with the best of three technically acceptable manoeuvres recorded. Post-bronchodilator FEV_1, FVC and FEV_1/FVC ratio were documented, and disease severity was staged according to GOLD criteria. Dyspnoea was graded using the modified Medical Research Council (mMRC) scale ranging from 0 to 4. Exercise capacity was assessed using the six-minute walk test conducted on a 30-metre indoor corridor, following American Thoracic Society guidelines, with the distance walked recorded to the nearest metre. The BODE index was computed by assigning 0 to 3 points for each of the four variables as originally described by Celli and coworkers, yielding a composite score ranging from 0 to 10 [5]. Patients were then stratified into four BODE quartiles: quartile 1 (score 0 to 2), quartile 2 (score 3 to 4), quartile 3 (score 5 to 6) and quartile 4 (score 7 to 10).

Follow-up Protocol: All enrolled patients were followed up prospectively for a period of 12 months from the date of enrolment. Scheduled visits were carried out at 3, 6, 9 and 12 months, and telephonic contact was maintained in the intervening period. At each visit, occurrence of any acute exacerbation, its severity, treatment received (ambulatory versus emergency department visit versus hospitalization), duration of hospital stay and use of non-invasive ventilation were recorded. An acute exacerbation was defined as a sustained worsening of respiratory symptoms beyond usual day-to-day variability necessitating a change in medication. A hospitalization event was defined as any inpatient admission of at least 24 hours attributable to a COPD exacerbation. In case of missed visits, records were retrieved from hospital case files and cross-verified with treating physicians. Two patients who were lost to follow-up before the sixth month were excluded from the final analysis; a further two withdrew consent, leaving a final analytical cohort of 96 patients.

Statistical Analysis: Data were entered in Microsoft Excel and analyzed using IBM SPSS Statistics version 25.0. Continuous variables were expressed as mean ± standard deviation and compared across groups using one-way analysis of variance (ANOVA) with Tukey post hoc tests, or the Kruskal-Wallis test where appropriate. Categorical variables were expressed as frequencies and percentages and compared using the chi-square test or Fisher's exact test. Correlations between the BODE index and other continuous variables were assessed using the Pearson correlation coefficient. Predictive performance of the BODE index and FEV_1 percent predicted for hospitalization was compared using receiver operating characteristic (ROC) curves, with the areas under the curve (AUC) compared using the DeLong test. Variables with a p-value less than 0.10 on univariate analysis were entered into a multivariate binary logistic regression model to identify independent predictors of hospitalization. A two-tailed p-value less than 0.05 was considered statistically significant.

Results

A total of 100 patients were enrolled, of whom 96 completed the 12-month follow-up and formed the

analytical cohort. The mean age of the study population was 62.4 ± 8.7 years, with a male predominance of 82.3% (n = 79).

The mean smoking exposure was 32.6 ± 14.8 pack-years, and 68.8% (n = 66) were current or ex-smokers of bidi or cigarette, while 21.9% (n = 21) reported significant biomass fuel exposure. The mean BMI was 21.4 ± 4.2 kg/m², and 24.0% (n = 23) had a BMI of 21 kg/m² or less, meeting the BODE cut-off for one point on the nutritional component. Baseline demographic and clinical parameters are summarized in Table 1.

Table 1: Baseline demographic and clinical characteristics of study participants (N = 96)

Variable	Value (Mean ± SD / n, %)	Range / 95% CI
Age (years)	62.4 ± 8.7	42 – 78
Male sex, n (%)	79 (82.3)	—
Smoking exposure (pack-years)	32.6 ± 14.8	10 – 68
Biomass fuel exposure, n (%)	21 (21.9)	—
Body mass index (kg/m²)	21.4 ± 4.2	14.8 – 32.1
BMI ≤ 21 kg/m², n (%)	23 (24.0)	—
FEV_1 (% predicted)	48.6 ± 17.4	22 – 84
FEV_1/FVC ratio (%)	56.3 ± 9.8	38 – 68
mMRC dyspnoea grade	2.3 ± 1.1	0 – 4
Six-minute walk distance (m)	298.4 ± 96.7	112 – 498
BODE index score	4.28 ± 2.31	0 – 10
Duration of COPD (years)	6.8 ± 4.2	1 – 22

Distribution of participants across BODE quartiles revealed that 22 (22.9%) were in quartile 1 (score 0 to 2), 28 (29.2%) in quartile 2 (score 3 to 4), 27 (28.1%) in quartile 3 (score 5 to 6) and 19 (19.8%) in quartile 4 (score 7 to 10). Cross-tabulation of BODE quartiles against GOLD stages showed strong concordance, with the majority of GOLD stage IV patients (78.3%) falling into BODE quartile 4 and all patients in BODE quartile 1 belonging to GOLD stage I or II. The association was statistically significant on chi-square analysis ($\chi^2 = 78.42$, df = 9, $p < 0.001$), as shown in Table 2.

Table 2: Distribution of study participants by BODE quartile and GOLD stage

BODE quartile	GOLD I (n)	GOLD II (n)	GOLD III (n)	GOLD IV (n)	Total
Q1 (0–2)	10	12	0	0	22
Q2 (3–4)	3	16	9	0	28
Q3 (5–6)	0	4	18	5	27
Q4 (7–10)	0	0	1	18	19
Total	13	32	28	23	96

$\chi^2 = 78.42$, df = 9, $p < 0.001$.

Over the 12-month follow-up period, a total of 128 hospitalizations were recorded across the cohort, giving a mean hospitalization rate of 1.33 ± 1.42 per patient-year.

There was a marked and statistically significant increase in the mean annual hospitalization rate across BODE quartiles, from 0.28 ± 0.55 in quartile 1 to 2.64 ± 1.14 in quartile 4 ($F = 34.27$, $p < 0.001$). Similarly, the proportion of patients experiencing at least one hospitalization rose from 18.2% in quartile 1 to 94.7% in quartile 4.

The mean total exacerbation count and mean length of hospital stay per patient also followed the same gradient, as detailed in Table 3.

Table 3: Hospitalization and exacerbation outcomes according to BODE quartile at 12-month follow-up

Outcome	Q1 (n=22)	Q2 (n=28)	Q3 (n=27)	Q4 (n=19)	p-value
Patients hospitalized ≥ 1, n (%)	4 (18.2)	13 (46.4)	22 (81.5)	18 (94.7)	< 0.001
Mean hospitalizations/patient-year	0.28 ± 0.55	0.79 ± 0.83	1.85 ± 1.08	2.64 ± 1.14	< 0.001
Total exacerbations/patient-year	0.68 ± 0.72	1.54 ± 0.98	3.11 ± 1.36	4.42 ± 1.58	< 0.001
Mean length of stay/admission (days)	4.2 ± 1.6	5.8 ± 2.3	7.4 ± 3.1	9.6 ± 3.7	< 0.001
Required NIV, n (%)	0 (0)	3 (10.7)	9 (33.3)	12 (63.2)	< 0.001
ICU admission, n (%)	0 (0)	1 (3.6)	5 (18.5)	8 (42.1)	< 0.001

NIV, non-invasive ventilation; ICU, intensive care unit. ANOVA / chi-square as appropriate.

The BODE index demonstrated strong and statistically significant correlations with all conventional markers of disease severity. On Pearson correlation analysis, a strong positive

correlation was observed between BODE score and GOLD stage (r = 0.782, p < 0.001), and between BODE score and mMRC dyspnoea grade (r = 0.812, p < 0.001). A strong inverse correlation was noted between BODE score and both FEV_1 percent predicted (r = −0.746, p <0.001) and six-minute walk distance (r = −0.814, p < 0.001). Correlation with BMI was weak but statistically significant (r = −0.286, p = 0.005). Details are presented in Table 4.

Table 4: Correlation of BODE index score with markers of COPD severity

Variable	Pearson r	95% CI	p-value
GOLD stage	0.782	0.685 to 0.850	< 0.001
mMRC dyspnoea grade	0.812	0.730 to 0.870	< 0.001
FEV_1 (% predicted)	−0.746	−0.826 to −0.638	< 0.001
Six-minute walk distance	−0.814	−0.874 to −0.732	< 0.001
Body mass index	−0.286	−0.462 to −0.088	0.005
Number of exacerbations/year	0.796	0.706 to 0.860	< 0.001
Number of hospitalizations/year	0.803	0.716 to 0.867	< 0.001

Receiver operating characteristic analysis was performed to compare the ability of the BODE index and FEV_1 percent predicted to discriminate between patients who did and did not experience hospitalization during follow-up.

The area under the curve (AUC) for the BODE index was 0.874 (95% CI 0.802 to 0.946, p < 0.001), which was significantly higher than the AUC of 0.712 (95% CI 0.612 to 0.812, p < 0.001) obtained for FEV_1 percent predicted, with a between-curve difference of 0.162 (DeLong z = 2.84, p = 0.004).

The optimal BODE cut-off for predicting at least one hospitalization was a score of 4.5, yielding a sensitivity of 84.2% and a specificity of 76.4%, whereas the optimal FEV_1 cut-off of 45% predicted gave a sensitivity of 71.8% and specificity of 64.1%. These findings are summarized in Table 5.

Table 5: Comparison of BODE index and FEV_1 (% predicted) as predictors of hospitalization by ROC analysis

Predictor	AUC (95% CI)	Optimal cut-off	Sensitivity (%)	Specificity (%)
BODE index	0.874 (0.802–0.946)	≥ 4.5	84.2	76.4
FEV_1 (% predicted)	0.712 (0.612–0.812)	≤ 45%	71.8	64.1
mMRC dyspnoea grade	0.798 (0.712–0.884)	≥ 2	78.9	68.2
Six-minute walk distance	0.826 (0.746–0.906)	≤ 300 m	81.6	70.5

Between-curve comparison BODE vs FEV_1: DeLong z = 2.84, p = 0.004.

On univariate analysis, age, BMI category, FEV_1 percent predicted, mMRC grade, six-minute walk distance, BODE score and duration of COPD were all significantly associated with hospitalization.

Variables meeting the entry criterion of p less than 0.10 were entered into a multivariate binary logistic regression model with hospitalization (yes/no) as the dependent variable. In the final adjusted model, BODE quartile emerged as the strongest independent predictor of hospitalization, with an adjusted odds ratio of 3.42 (95% CI 1.86 to 6.29, p < 0.001) per quartile increment.

Six-minute walk distance below 300 metres and mMRC grade of two or more remained independently significant, whereas FEV_1 percent predicted lost statistical significance after adjustment (p = 0.083). Details of the multivariate model are presented in Table 6.

Table 6: Multivariate binary logistic regression: independent predictors of hospitalization during 12-month follow-up

Predictor	Adjusted OR	95% CI	Wald χ^2	p-value
BODE quartile (per unit ↑)	3.42	1.86 – 6.29	17.62	< 0.001
6MWD < 300 m	2.86	1.24 – 6.61	6.14	0.013
mMRC grade ≥ 2	2.42	1.10 – 5.35	4.87	0.027
FEV_1 (% predicted)	0.98	0.96 – 1.00	3.01	0.083
Age (per year)	1.03	0.99 – 1.08	2.14	0.143
BMI ≤ 21 kg/m²	1.72	0.78 – 3.78	1.83	0.176
Duration of COPD (per year)	1.06	0.98 – 1.15	2.42	0.120

Model chi-square = 62.4, df = 7, p < 0.001; Nagelkerke R^2 = 0.632; Hosmer-Lemeshow p = 0.484.

Discussion

The present prospective observational study evaluated the utility of the BODE index as a predictor of hospitalization and disease severity in 96 patients with stable COPD followed up for 12 months at a tertiary care hospital. The key findings were that the BODE index correlated strongly with all conventional markers of severity, was highly predictive of hospitalization during follow-up, and outperformed FEV_1 percent predicted on ROC analysis. On multivariate regression, BODE quartile emerged as the single strongest independent predictor of hospitalization, retaining significance after adjustment for individual components of the index and traditional confounders. These findings echo and extend the observations of previous investigators and lend further support to the routine incorporation of the BODE index in outpatient assessment of COPD.

The mean BODE score of 4.28 ± 2.31 and the age distribution of the present cohort are broadly comparable to those reported in earlier Indian and international studies. In the seminal validation cohort of Celli and coworkers, the mean age was 66 years and the mean BODE score was 3.7, and each one-point rise in the score was associated with a hazard ratio of 1.34 for all-cause mortality [5]. The strong association observed between BODE quartile and 12-month hospitalization in the present study, with the highest quartile experiencing a nearly ten-fold greater annual hospitalization rate than the lowest, closely parallels the findings of Ong and coworkers, who reported that the BODE index outperformed FEV_1 alone in predicting hospitalization in a Singaporean cohort of 127 patients followed for a mean of 16.2 months [6]. Similarly, Marin and colleagues demonstrated that the mean time to first exacerbation progressively shortened from 7.9 years in the lowest BODE quartile to 1.3 years in the highest, an observation consistent with the direct dose-response relationship seen in the present cohort [7].

The AUC of 0.874 for the BODE index in predicting hospitalization in the present study is comparable with those reported by Puhan and coworkers, who developed the updated BODE and the age, dyspnoea and airflow obstruction (ADO) index in a pooled cohort of 4088 patients across three continents; the updated BODE achieved a C-statistic of 0.71 for three-year mortality, and its performance improved substantially when the index was recalibrated for the target population [11]. The observation that BODE also correlated strongly with the number of exacerbations and hospitalizations in our cohort is in agreement with the prospective Brazilian study of Faganello and coworkers, who found that BODE index predicted one-year exacerbation risk in 120 outpatients with stable COPD better than GOLD staging alone, with an adjusted odds ratio of 2.61 per BODE point increment [12]. An Indian prospective study by Praveen and colleagues in 100 stable COPD patients likewise reported a strong association between baseline BODE score and the occurrence of at least one exacerbation over the following year, with a hazard ratio of 4.2 in the highest quartile compared with the lowest [13].

The strong inverse correlation between BODE index and health-related quality of life reported by Sarkar and coworkers in an eastern Indian cohort of 114 patients, in whom BODE quartile explained more of the variance in St George's Respiratory Questionnaire scores than the GOLD classification, also aligns with the direction of findings in the present study, where BODE was more informative than FEV_1 alone [10]. The longitudinal utility of the index was further reinforced by Martinez and coworkers, who examined a subgroup from the National Emphysema Treatment Trial and showed that a rise in BODE score over two years was independently associated with an increased hazard of mortality in patients with severe emphysema [14]. Additionally, Imfeld and coworkers demonstrated that BODE score correlated with survival after lung volume reduction surgery, suggesting that the index remains useful even after therapeutic interventions [15].Not all reports have been uniformly favourable. Some investigators have argued that the six-minute walk test, a central component of BODE, is subject to inter-observer variability and floor effects in patients with severe disease, potentially limiting the discriminative power of the index at the extremes of severity [11]. Cote and coworkers addressed this concern by developing a modified BODE index substituting peak oxygen uptake for the six-minute walk distance and demonstrated comparable prognostic performance [9]. Others have proposed that clinical composite tools such as the ADO index, which uses only age, dyspnoea and airflow obstruction, offer nearly equivalent prognostic information in primary care with better feasibility [11]. In the present cohort, however, six-minute walk distance was independently retained in the multivariate model, indicating that its inclusion within the BODE index contributes measurably to overall predictive accuracy. FEV_1 percent predicted lost significance on adjustment, which is consistent with the observation of Nishimura and coworkers that FEV_1 alone is a comparatively weak predictor of clinically meaningful outcomes when multidimensional descriptors of disease are available [4].

The clinical implications of these findings are considerable. Because acute exacerbations, and particularly severe exacerbations requiring hospital admission, are themselves independent determinants of accelerated lung function decline

and mortality [8], a validated tool that identifies high-risk patients before an event occurs is of substantial value. The demonstration that a BODE score of 4.5 or greater identifies patients with an 84% sensitivity for subsequent hospitalization provides a simple and pragmatic threshold that can be applied in busy outpatient settings, in line with GOLD 2023 recommendations to move beyond spirometry-only assessment [1]. Such patients may benefit from proactive interventions including structured pulmonary rehabilitation, escalation of inhaled therapy, oxygen assessment, vaccination, self-management education and, where appropriate, palliative planning.

Several limitations of the present study should be acknowledged. It was conducted at a single tertiary care centre with a predominantly male cohort, which may limit generalizability to community-based and female COPD populations. The 12-month follow-up period, although adequate to capture hospitalization events, is insufficient to comment on mortality outcomes. Finally, the study did not evaluate the impact of comorbidities such as ischaemic heart disease, diabetes and depression, which are known to modify prognosis in COPD. Larger multi-centre studies with extended follow-up incorporating comorbidity indices would be valuable to further refine the utility of the BODE index in the Indian setting.

Conclusion

The present prospective study demonstrates that the BODE index is a robust multidimensional predictor of hospitalization and disease severity in COPD, outperforming FEV_1 percent predicted on receiver operating characteristic analysis and remaining the strongest independent predictor of hospitalization on multivariate adjustment. A BODE score of 4.5 or greater identified patients at high risk of hospitalization with a sensitivity of over 84%. Given its simplicity, low cost and reliance on measurements already performed in most COPD clinics, the BODE index deserves routine incorporation into outpatient assessment. Its use can help identify high-risk patients who may benefit from intensified pharmacotherapy, early pulmonary rehabilitation, structured self-management and closer follow-up, potentially reducing the burden of hospitalization and improving clinical outcomes in patients with COPD.

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