

## EDITORIAL

# BODE Index Superior to Lung Function Alone, as a Predictor of COPD Exacerbation

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Chronic obstructive pulmonary disease (COPD) is characterized by a progressive and incompletely reversible limitation in lung function, usually associated with a constellation of debilitating symptoms and physical impairments.<sup>1</sup>

COPD will become the third most common cause of death and the fourth cause of disability in the world by the year 2020.<sup>1,2</sup> As COPD progresses, patients develop more frequent and severe exacerbations,<sup>3,4</sup> and have an increased rate of emergency room visits and hospitalizations.<sup>3,5</sup>

Hospitalizations for COPD exacerbations account for most of the economic burden of the disease.<sup>4,6</sup> With frequent exacerbations there is rapid worsening of lung function and worse health-related quality of life (HRQoL). Needless to say that there is hand to hand increase in mortality rates. The mechanisms underlying COPD exacerbations are not well understood, but a few factors have been associated with the prediction of exacerbations. These include a history of prior hospitalizations for COPD, a lower FEV<sub>1</sub>, and more severe respiratory symptoms. With this staggering morbidity and very high mortality there is urgent need to identify factors that help predict these COPD exacerbations.

The multi-systemic nature of COPD has prompted a more global evaluation of this condition, other than just relying

on the traditional assessment of disease severity and mortality risk based solely on measures of pulmonary function.<sup>7</sup> In view of that, composite instruments such as the Body-mass index, airflow Obstruction, Dyspnea and Exercise (BODE) index have been developed. By combining body composition (B), airflow obstruction (O), dyspnea (D) and exercise capacity (E) assessments, the BODE index has been shown to have a superior discriminatory value over other COPD-related parameters as a surrogate marker of mortality risk.

The BODE index is a multidimensional index of disease severity in COPD that incorporates four factors known to be independent predictors of survival in this disease: the body mass index (BMI), the degree of airflow obstruction assessed by the FEV<sub>1</sub>, the functional dyspnea assessed by the modified Medical Research Council (mMRC) questionnaire, and the exercise capacity assessed by the 6 min walking distance (6MWD) test. The BODE index proved to be a good predictor of survival in a large cohort of patients with COPD. It also predicts hospitalizations and has been shown to comprehensively reflect the detrimental changes occurring during exacerbations.<sup>8</sup>

The BODE index combines four variables (body mass index, FEV<sub>1</sub>, dyspnea, and a six-minute walking test) by means of a 10-point scale (Table 1). The variables were graded 0 to 3 (0 or 1 for BMI) and summed to give a total score between 0 and 10. This score was called the BODE index, with higher scores indicating a greater risk of death.

The approximate 4-year survival rates based on the BODE index point system are divided into four quartiles:

- 80% (0–2 points, quartile I),
- 67% (3–4 points, quartile II),
- 57% (5–6 points, quartile III)
- 18% (7–10 points, quartile IV)

Over last 10 years there are number

of papers that looks at the BODE index and its comparison with CAT scoring; BODE index and inspiratory muscle performance; BODE index v/s GOLD classification in addressing various symptoms; BODE index and its relation with systemic inflammation; BODE index and pulmonary rehabilitation, though the principle utility of this index remains in predicting mortality in COPD patients.

In a cross-sectional study which included 290 clinically stable COPD patients and 80 smoker controls was conducted. Medical history, body mass index, pulmonary function tests, 6-minute walking test, and modified scale of Medical Research Council dyspnea scale were evaluated. BODE scores were determined. Systemic inflammation was evaluated with the measurement of CRP, TNF- $\alpha$ , and IL-6 in the serum samples of all studied subjects. The correlation between inflammatory biomarkers and BODE index was assessed in COPD patients. They found a significant relationship between COPD stages and BODE index. Analysis showed significant association between systemic biomarkers and components of the BODE index. Both TNF- $\alpha$  and CRP levels exhibited weak but significant correlation with BODE index. Serum IL-6 concentrations exhibited significant correlation with 6-minute walking test, modified scale of Medical Research Council, and BODE index ( $r=0.201$ ,  $P=0.004$ ;  $r=0.068$ ,  $P=0.001$ ; and  $r=0.530$ ,  $P=0.001$ , respectively). Also, an inverse and significant correlation was observed between BODE index and FEV<sub>1</sub> ( $r=0.567$ ,  $P=0.001$ ). IL-6 exhibited a highly significant and inverse correlation with FEV<sub>1</sub> ( $r=-0.580$ ,  $P=0.001$ ). The study concluded that BODE index should be considered for evaluating patients

**Table 1: Bode INDEX Points<sup>9</sup>**

Variables	Bode Index Points			
	0	1	2	3
FEV <sub>1</sub> %	>= 65 %	50- 64 %	36 - 49%	<=35 %
Predicted (post bronchodilator)				
6 minute walk distance in meters	>= 350	250 - 349	150 - 249	<= 149
MMRC dyspnea scale	0-1	2	3	4
BMI	> 21	<= 21		

with COPD. Also, IL-6 seems to be a potential biomarker that may enable determination of the severity and prediction of the course of the disease.<sup>10</sup>

There is another scale named as the HADO-score which is made up of four variables (the answer to a single, general, self-rated health question; self-rated level of physical activity; dyspnea; and FEV<sub>1</sub>). Its score ranges from 0 to 12, with a lower score indicating a higher severity and therefore a worse prognosis. In a three-year study of 543 patients with COPD reinforces earlier findings that both the HADO-score and the BODE-index are good predictors of all-cause and respiratory mortality. However, the BODE-index yields better results among patients with the most severe COPD (FEV<sub>1</sub> < 50%), who are likely to be assessed at the hospital level. Among patients with less severe disease (FEV<sub>1</sub> ≥ 50%), who comprise majority of patients with COPD and who are generally seen in the outpatient or primary care setting, the HADO-score is as good a predictor of respiratory mortality, a crucial parameter in these patients, as the BODE-index. The HADO-score is also easier to compile in the outpatient and primary care settings. Therefore, we propose that these instruments are appropriate for different settings. The HADO-score offers a quick, simple assessment suitable for use by practitioners seeing patients with mild to moderate COPD and who do not immediately require more thorough evaluation. The BODE-index is more suitable for the evaluation of patients with more severe COPD, who require more accurate and specialized assessment requiring more resources of time and personnel.

BODE index was developed to predict the risk of death in COPD patients but over time researchers looked at BODE index as a predictor of COPD exacerbation. There was a prospective study done over 2 years on 60 stable COPD patients by evaluating the body-mass index, spirometry,

Modified Medical Research Council (mMRC) dyspnea scale and 6MWT and categorizing into mild, moderate and severe COPD cases on the basis of spirometry and into 4 quartiles on the basis of BODE index value (scores 0-2, 3-4, 5-6 and 7-10). The prognostic value of BODE quartiles for both the number and severity of exacerbations requiring ambulatory treatment, emergency room visit or hospitalization was studied. In this study spirometry showed mild obstruction in 16.7%, moderate obstruction in 26.7%, severe obstruction in 38.3% and very severe obstruction in 18.3% of patients. According to BODE score 52% of patients were quartile 1, 21% quartile 2, 15% quartile 3 and 12% were quartile 4. There was a significant relation between BODE index and COPD severity ( $p < 0.001$ ). 8.3% patients had no exacerbation; maximum number of exacerbation were 7 observed in 8.3% patients and 21.7% of patients had 3 exacerbations in 2 years and 16.7% patients had 1 exacerbation in 2 years. It was observed that higher the BODE index; greater is the severity of COPD and more are the number of exacerbations.<sup>12</sup>

In the current issue of JAPI, there is a very interesting observational study by Dr Mohan Manu on power of BODE index in predicting future exacerbation of COPD in Indian population. They studied 78 patients over a year and shown significant correlation between BODE index at baseline and number of exacerbations at 12 months. They have shown that a unit change in BODE index at baseline would have 1.25 times higher number of exacerbations at 12 months (95% CI: 1.17-1.33). They have beautifully narrated the limitations of their study including small sample size, low educational status of their study group, therapy influence on BODE index, relatively less female participants, uneven distribution of COPD severity in their cohort and presence of co morbidities that may affect patients health. In spite of these limitations the paper confirms the

power of BODE index in predicting the frequency of exacerbations of COPD and its applicability in Indian population.

BODE index has the potential to be a strong predictor of the number and severity of exacerbation in COPD patients along with its utility as a reliable predictor of mortality. This power of BODE index in predicting exacerbation is far superior to the conventional marker using FEV<sub>1</sub> alone. This may be due to better understanding of pulmonary as well as extra pulmonary effects of COPD by BODE.

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