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Correlation of Brinkman's Index, CAT Scores, Lung Function in Chonic Obstructive Pulmonary Disease

Susanthy Djajalaksana[1], Arinto Yudi Ponco Wardoyo[2], Aditya Sri Listyoko[3], Rizki Diah Anggraeni[4], Silvy Amalia[5], Aisyah Nurul Amalia[6], Zata Dini[7], Anthony Christanto[8]

[1,3,4,6,7,8]Pulmonology and Respiratory Medicine Department, Medical Faculty of Brawijaya University
[2]Environmental Physics and Instrumentation, Faculty of Mathematics and Natural Sciences, Brawijaya University
[3]Doctoral Student, Division of Respiratory Medicine and Rheumatology, Department of Multidisciplinary Internal Medicine, Faculty of Medicine, Tottori University, Tottori, Japan
[5]Faculty of Medicine, Universitas Islam Malang

Abstract
Chronic obstructive pulmonary disease (COPD) is a disease of airflow limitation due to persistent and progressive chronic inflammation in airways and lung parenchyma. The prevalence of COPD in Indonesia was 3.7% and ranked 6th in mortality. Spirometry is required for diagnosing and evaluating COPD, but it is not available in all primary healthcare centers. The COPD assessment test (CAT) can be used to assess complaints. This research aims to evaluate the condition of COPD patients and high risk of COPD group in Malang. The study was designed as an observational analytic with a cross-sectional approach. The subjects were divided into COPD patients and COPD risk groups at primary healthcare in Malang from November 2022 to April 2023. The results were calculated statistically using Mann-Whitney and Spearman rho correlation. The total subjects was 166 divided into 112 men and 54 women. The results showed smokers with COPD had a significant impact on Brinkman's index. The CAT scores of COPD patients were not significantly different. COPD patients had strong correlation with history of exacerbations ($p < 0.01$). The correlation between COPD and pulmonary function values of FEV1% and FEV1/FVC was not significantly different ($p > 0.05$). Based on research findings, the CAT Score can be an early evaluation tool for COPD conditions at primary health centers. The CAT Score correlates with the patient's history of exacerbations. Therefore, the CAT Score can serve as a benchmark for improving the quality of life for COPD patients.

Keywords: COPD, Brinkman's Index, CAT Scores, Lung Volume Function

1. INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a lung disease that can be prevented and treated. COPD is characterized by respiratory symptoms and persistent airflow limitation which are progressive and associated with excessive chronic inflammatory responses in the airways and lung parenchyma due to

harmful gases or particles [1,2]. Exacerbations and comorbidities contribute to the severity of the disease. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines define COPD as a disease characterized by irreversible, progressive respiratory disorders and associated abnormal inflammatory responses in the lungs due to inhalation of air particles or harmful gases [2]. The characteristics of COPD airflow obstruction are caused by a combination of small airway obstruction (obstructive bronchiolitis) and parenchymal damage (emphysema) which varies in each individual, due to chronic inflammation causing loss of connection between the alveoli and small airways and decreasing the elasticity of lung recoil [3], [4]

COPD in globally causes as many as 3 million deaths per year, which is offset by an increase in the prevalence of smoking in developing countries and aging in high-income countries. The prevalence of COPD is estimated to increase in the next 40 years and by 2060 it could reach more than 5.4 million deaths per year [4]. COPD is one of the four most severe noncommunicable diseases that account 60% of mortality in Indonesia. The results of Basic Health Research (Riskesdas) in 2013 show that COPD in Indonesia among >30 years has a prevalence of 3.7% and is ranked 6th of the 10 causes of death in Indonesia [5].

However, the type of cigarette also has the risk of increasing lung function abnorleemalities. Research of the Indonesian pneumobile project shows that filtered cigarettes have a 5 times higher risk, and unfiltered cigarettes have a 13 times higher risk of lung function abnormalities. Passive smokers or secondhand smokers also have the same risk of developing COPD [^{6}]. As the economy and the automotive industry advanced, the number of motorized vehicles has increased last decade in Indonesia. Exhaust gas from these vehicles causes air pollution. 70-80% of air pollution comes from motor vehicle exhaust gases, while 20-30% of air pollution is caused by industry. The increase in the number of smokers and air pollution as risk factors for COPD will also increase sufferers of the disease [6]-[8].

The diagnosis and evaluation of COPD severity according to GOLD, based on lung function with FEV1/FVC and FEV1 (%). However, this evaluation sometimes experiences difficulties, especially in primary care, so the COPD assessment test (CAT) questionnaire is used. and modified British Medical Research Council (mMRC) began using GOLD to assess patient complaints. This questionnaire is subjective regarding the signs and symptoms that patients felt. The most common and easier to use is CAT. This method aims to assess the quality of life and period of COPD exacerbations in patients, especially when relapses or complaints have decreased [7] – [10].

Health service facilities in Indonesia rely on primary healthcare centers in comparison with hospital centers still lack facilities for COPD. The competence of human resources, and standard equipment for diagnosing COPD such as spirometry is only available in large hospitals. Guidelines for treating COPD according to the patient's current condition need to be immediately disseminated to prevent, early diagnosis, rational management, and improve the patient's quality of life. This study aims to describe characteristic profiles of COPD patients and high-risk groups of COPD using CAT scores in primary healthcare centers.

2. METHOD

This research used an analytical observational research design with a cross-sectional experiment. This research aims to collect data on patients diagnosed with COPD and high-risk groups of COPD diagnosed. The study was conducted at 6 primary healthcare centers in Malang, including Kendalsari, Kedungkandang, Kendalkerep, Polowijen, Gribig, and Ciptomulyo health centers in the period November 2022-

April 2023. All team visits at the primary health centers in the last week of each month. This research has received ethical approval from the Brawijaya University Research Ethics Committee with Ethics number 400/153/K.3/302/2021.

Subjects diagnosed with COPD were obtained through primary healthcare center medical record data and COPD high-risk groups based on primary healthcare center screening data through inclusion and exclusion criteria. The subject collects from each primary health center around 20-30 patients either COPD patients or the high risk of COPD patients. Inclusion criteria from COPD patient were men or women with age more than 18 years old, diagnosed with COPD from medical records. Exclusion criteria for COPD patients were patients with asthma or another obstructive disease like interstitial lung disease (ILD), or syndrome obstructive post tuberculosis (SOPT), that is not diagnosed with COPD. The high-risk COPD patients had inclusion criteria were men or women with age more than 40 years old, active smokers or ex-smokers, or someone who was exposed to hazardous fumes/gases/inhalants related to work. The exclusion from the patient with a high risk of COPD was the patient with COPD itself. All the patients should be agreed to join the experiment with sign-in informed concern.

Subjects with COPD-diagnosed will be examined starting with anamnesis, SGRQ questionnaire, CAT score calculation, and spirometry examination before and after the bronchodilator. The high risk of COPD group will undergo anamnesis and a questionnaire to calculate the PUMA score, if the score ≥ 7 then the patient will be examined with spirometry test before and after the bronchodilator. If the patient's post-bronchodilator spirometry results show Force Expiratory Volume in 1st second/Force Vital Capacity (FEV1/FVC%) < 70 so it will be diagnosed as COPD. Then the data of all subjects was collected and analyzed by statistical test.

3. RESULTS AND DISCUSSION

3.1 The Result of Statistical Data

3.1.1 Characteristics of COPD Subjects in 6 Primary Healthcare Centers

Table 1. Characteristics Subjects of COPD Patients and COPD High-Risk Groups According to Spirometry Diagnosed

Public health center	Subject		Age (Average)	BB (kg)	TB (cm)	Work		Smoking Risk Factors		COPD	No COPD	COPD from Early Detection	
Kendalsari	L	22	58	66	163	Worker	18	Active	19	8	3	11	
						Unemployed	4	Passive	0				
								No	3				
	P	7	60	55	153	Worker	1	Active	1	3	2	2	
						Unemployed	6	Passive	5				
								No	1				

Kedung Kandang	L	30	56	68	161	Worker	25	Ac-tive	23	15	4	11	
						Unem-ployed	5	Pas-sive	3				
								No	4				
	P	7	56	62	150	Worker	2	Ac-tive	0	4	2	1	
						Unem-ployed	5	Pas-sive	5				
								No	2				
Kendalk-erep	L	12	57	64	159	Worker	11	Ac-tive	8	11	1	0	
						Unem-ployed	1	Pas-sive	4				
								No	0				
	P	9	69	56	148	Worker	0	Ac-tive	0	9	0	0	
						Unem-ployed	8	Pas-sive	3				
								No	6				
Polowijen	L	17	58	58	160	Worker	16	Ac-tive	11	8	8	1	
						Unem-ployed	1	Pas-sive	2				
								No	4				
	P	8	52	61	150	Worker	3	Ac-tive	0	4	3	1	
						Unem-ployed	5	Pas-sive	5				
								No	3				
Gribig	L	25	62	61	159	Worker	24	Ac-tive	19	14	5	6	
						Unem-ployed	1	Pas-sive	5				
								No	1				
	P	4	39	47	147	Worker	3	Ac-tive	0	1	0	3	
						Unem-ployed	1	Pas-sive	2				
								No	2				
Cipto-mulyo	L	6	54	61	159	Worker	5	Ac-tive	5	2	2	2	

						Unemployed	1	Passive	0				
								No	1				
	P	20	46	55	151	Worker	8	Active	1	6	4	10	
						Unemployed	12	Passive	8				
								No	11				
Number (N)	L	112	57	63	160	Worker	126	Active	87	59	19	30	
	P	54	54	56	150	Unemployed	40	Passive	42	26	14	18	
								No	37				
Total Patient		**166**					**Total COPD Patients**			**133**			

This research is dedicated to the general public in primary healthcare centers with COPD-diagnosed based on previous medical records and people at risk of COPD in 6 Malang City Primary Healthcare Centers. These health centers include Kendalsari, Kedungkandang, Kendalkerep, Polowijen, Gribig, and Ciptomulyo health centers.

In total, there were 166 research subjects at 6 primary healthcare centers, with a total of 112 male subjects and 54 female subjects. Based on the results of the examination, it was found that the total number of subjects diagnosed with COPD based on spirometry results was 133 people, with a total of 85 subjects previously diagnosed with COPD, and 48 people as a result of early detection. Based on the examination, the mean age, weight, and height for male subjects were as follows: 58 years, 64 kg, 157 cm, and for female subjects 55 years, 51 kg, 154 cm (Table 1).

The characteristics of the subjects at each primary healthcare center are explained based on Table 1. The largest number of COPD participants diagnosed from spirometry, early detection participants at Kendalsari and Ciptomulyo health centers were 11 and 10 patients. According to the result, there are more active smokers compared to passive smokers and non-smokers (Table 1).

Based on 6 health centers, it was found that more subjects were previously diagnosed with COPD, namely men with a total of 59 people, while there were 26 women. After early detection and post-bronchodilator spirometry examination, it was found that 30 male subjects and 18 female subjects were diagnosed with COPD (Table 1).

Most sufferers experienced COPD onset in the first 1-5 years, with the number 44 subjects, for COPD onset > 5 years around 36 subjects with the longest onset being 50 years. The most common medical history experienced by COPD participants in this study was Asama, 28 people, followed by high blood pressure, 25 people, Tuberculosis (TB) 23 people, heart disease 16 people, and Diabetes Mellitus (DM) 5 people. The most frequent symptom is shortness of breath followed by coughing. The patient's most frequent history of exacerbations was moderate exacerbations, 28 times, followed by severe exacerbations, 22 times, with the highest history being 9 times. Patients more often use LABA + ICS bronchodilators as therapy currently, namely 30 people and SABA if there is a sudden attack as many as 16 people (Table 2). The severity degree of COPD which is called GOLD classified according to FEV1 result of spirometry. Based on spirometry data, COPD subjects, the GOLD group with the most results being in the GOLD 2

category at 38% (50 people), followed by GOLD 3 at 25% (34 people), GOLD 1 21% (28 people) and GOLD 4 16% (21 people) (Figure 1).

Table 2. Data on Conditions of COPD Subjects at 6 Primary Healthcare Centers

Criteria	Total (n)
Time of COPD diagnosis (years)	
- < 1 year	42
- 1-5 years	44
- > 5 years	32
History of Disease	
- TB	23
- Asthma	28
- Heart	16
- HT	25
- DM	5
Symptoms	
- Cough	58
- Congestion	60
History of. Exacerbation	
- Mild-moderate	28
- Severe	22
Spirometry Results (FEV1/VC (%))	
- < 70	58
- ≥ 70	50
Use of Bronchodilators	
- SABA	16
- LABA	10
- LAMA	6
- LABA+LAMA	8
- LABA+ICS	30

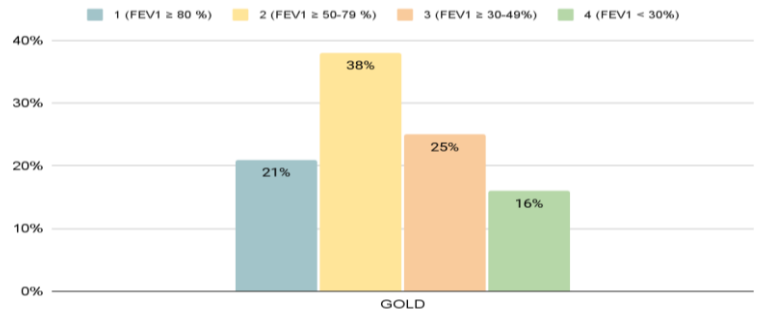

Figure 1. GOLD classification in COPD patients based on spirometry result

3.1.2. The Examination Result of Smokers COPD Patients on the Brinkman's Index

Based on the examination results on COPD who smoked and unsmoked, Brinkman's index value was not normally distributed ($p < 0.05$) so the Mann-Whitney test had significant results of $p < 0.05$. This shows that the number of cigarettes smoked and the length of time smoked by someone with COPD have significant differences in the Brinkman's index (Table 3). Besides that, the correlation value with Spearman's rho test shows significant results with a coefficient (r) of 0.77. This shows that Brinkman's index has a strong correlation with COPD patients who smoke (Table 3).

Table 3. Brinkman Index Test Values and correlation with smokers and non-smokers COPD Patients

	Number (N)	Percentage (%)	p-value	Correlation	
				Coefficient (r)	p-value
1. Smoker					
a. Type of Smoker					
- Active	71	53			
- Passive	35	26			
b. Brinkman Index					
- Mild	28	41	< 0.01	0.77	< 0.01
- Moderate	18	26			
- Severe	23	33			
2. Non-Smoker	64				

Note: Significance $p < 0.05$

3.1.3. The Examination Results of CAT Scores on COPD Patient

Based on the results of examinations on COPD who smoked and unsmoked, the CAT score values were not normally distributed ($p < 0.05$) so a Mann-Whitney test was carried out with insignificant results of p 0.69 ($p > 0.05$). The results show that (table 4) there are more subjects with CAT < 10, with the number of subjects 100 people (75%), and subjects with CAT score ≥ 10, with the number of subjects 33 people (25%). COPD who smoked and unsmoked did not have a significant difference in CAT score values. Then a correlation test was carried out using Spearman's rho with a coefficient result (r) of 0.046 and a p-value of 0.6 ($p > 0.05$) (Table 4). This result shows that the CAT score is not correlated to the subject's smoking habits (Table 4).

Table 4. The Results of CAT Scores in smoker and non-smoker COPD Patients

	Number (N)	Percentage (%)	p-value	Correlation	
				Coefficient (r)	p-value
CAT Score					
- < 10	100	75	0.69	0.046	0.6

- ≥ 10	33	25			

Note: Significance p < 0.05

3.1.4 The Examination result of COPD patients on post-bronchodilator lung function values

Based on the results, it was found that the distribution of FEV1/FVC (%) values for COPD subjects was normally and homogeneously distributed (p-value> 0.05). Next, the data was tested with an independent t-test with a p-value of 0.146 (p > 0.05). The result shows no significant difference in the lung function values of patients who smoke or not. FEV1% values in COPD subjects were normally distributed and homogeneous (p-value> 0.05). Statistical tests with an independent T-test showed a significant difference in the subject's description with a p-value <0.01.

3.1.5 The correlation between CAT scores and lung function in stable COPD

Based on the examination result, the correlation test of CAT score value and lung function is based on the obstruction classification severity of COPD patients (FEV1/FVC%). The CAT score values were not normally distributed, so a correlation test was carried out using Spearman's rho on lung function, obtaining a coefficient value of 0.46 with a significance of p > 0.05. However, based on the positive coefficient (r) results, it is clear that the higher the CAT value, the higher the level of pulmonary function obstruction (Table 5). Meanwhile, the CAT score for the severity of obstruction shows a coefficient value of -0.024 with a p-value of 0.78. The result shows that there is no significant correlation between CAT score and lung function, both FEV1/FVC% and FEV1% as the basis for GOLD classification (Table 5).

Table 5. Correlation between CAT and lung function in stable COPD patients

Lung Volume Function Levels	CAT Score		Total	p-value	Correlation	
	< 10	≥ 10			r	p-value
Normal (FEV1/FVC ≥ 75%)	35	12	47	0.6	0.046	0.6
Mild (FEV1/FVC 60-74%)	39	14	53			
Moderate (FEV1/FVC 30-59%)	23	7	30			
Severe (FEV1/FVC < 30%)	3	0	3			
GOLD 1 (FEV1 ≥ 80%)	29	9	38	0.78	-0.024	0.78
GOLD 2 (FEV1 ≥ 50 – 79%)	41	12	54			

GOLD 3 (FEV1 ≥ 30 – 49%)	26	11	37			
GOLD 4 (FEV1 < 30%)	4	1	5			

Note: Significance p < 0.05

3.1.6 Correlation of Brinkman's Index with History of Exacerbation COPD patients

Based on Mann-Whitney statistical test results, there is no significant difference between the history of exacerbation in smokers from the classification index Brinkman's. The number of p-values was 0.54 (p > 0.05). The correlation test also did not obtain a meaningful result with a p-value of 0.54 and a coefficient (r) of 0.053. However, most patients with a history of exacerbation got Brinkman's index severe classification with a value of 20% (Table 6).

Table 6. Correlation between Classification Brinkman's Index with Exacerbation History of COPD

	History of Exacerbations	Percentage (%)	p-value	Correlation	
				Coefficient (r)	p-value
Brinkman's Index - Mild - Moderate - Severe	 4 6 8	 10 15 20	0.54	0.053	0.54
Non-Smoker	22	55			

Note: Significance p < 0.05

3.1.7. Correlation between CAT score and History of Exacerbation in COPD Patients

The data was not homogeneous and had normal distribution, it was statistically tested with non-parametric Mann Whitney. The values showed a significant difference in the CAT score of patients with a history of exacerbations (Table 7). Then a correlation test was carried out on the CAT score and the chronic history of COPD patients, obtaining a coefficient value (r) of 0.4 with a significance of p < 0.05. These results show that the CAT score is moderately related to the patient's history of exacerbations. The correlation coefficient (r) value shows a positive correlation, where the higher the CAT score, the more the patient suffers COPD exacerbation (Table 7).

Table 7. Correlation between CAT and Riw. Exacerbation COPD sufferers are stable

	History of Exacerbation (N)	Percentage (%)	p-value	Correlation	
				Coefficient (r)	p-value
CAT Score - < 10 - ≥ 10	 20 20	 50 50	< 0 , 01	0, 4	< 0.01
Total	40	100			

Note: Significance p < 0.05

3.1.8. The Correlation between Exacerbation History and Pulmonary Physiology in Stable COPD

The distribution value of COPD level of obstruction (FEV1/FVC%) and severity of obstruction with GOLD classification (FEV1%) in COPD subjects with a history of exacerbations was carried out by the Mann-Whitney test with results of p 0.06 and p 0.5 respectively (p> 0 .05). This shows that pulmonary function in COPD with a history of exacerbation has results that are not significantly different. The results of the Spearman rho's correlation test for lung function level of obstruction (FEV1/FVC%) showed a coefficient (r) of 0.12 with a p-value of 0.2 (p > 0.05). The results of the GOLD classification lung function correlation test (FEV1%) show a coefficient value (r) – 0.05 with a p-value of 0.6 (p>0.05). This result explained that the exacerbation history is unrelated to the lung function value. The level of obstruction has a very weak correlation, but it is not related to the degree of severity based on the GOLD classification in COPD subjects. A positive coefficient value for the level of obstruction (FEV1/FVC%) means that the more frequent exacerbations occur, the higher the level of obstruction and the lower the lung function value. A negative coefficient value for the severity of obstruction based on the GOLD classification means that the more frequent exacerbations occur, the lower the person's FEV1% lung function value and the higher the patient's GOLD severity (Table 8).

Table 8. The correlation between history of exacerbations and pulmonary function in stable COPD

	History of Exacerbation (N)	Percentage (%)	p-value	Correlation	
				Coefficient (r)	p-value
Degrees of Obstruction (FEV1/FVC%) - Normal (≥ 75%) - Mild (60-74%) - Moderate (30-59%) - Severe (< 30%)	 14 20 6 0	 35 50 15 0	0.06	0.12	0.2

Degrees Severity of Obstruction / GOLD (FEV1%) - GOLD 1 (≥80%) - GOLD 2 (≥ 50 – 79%) - GOLD 3 (≥ 30 – 49%) - GOLD 4 (<30%)	 10 18 10 2	 25 45 25 5	0.5	-0.05	0.6
Total	40	100			

Note: Significance p < 0.05

3.1.9. The correlation between Brinkman's Index and Forced Expiration Volume (FEV1%) in stable COPD patients

The result with the Mann-Whitney test showed a p-value of 0.058, there was no significant difference between the Brinkman index and lung function values. The data was subjected to the Spearman rho's correlation test with a coefficient (r) of -0.125 and a p-value of 0.15. The result showed no significant correlation of Brinkman's Index and severity obstruction degrees. According to the coefficient value is a very weak correlation. A negative coefficient value indicates that the higher the Brinkman's index classification, the lower the FEV1% value, which means the more severe the degree of obstruction (Table 9).

Table 9. Correlation between Brinkman's Index with Pulmonary Function (FEV1%) in COPD Patients

	Brinkman's Index			p-value	Correlation	
	Mild	Moderate	Severe		Coefficient (r)	p-value
Severity Obstruction Degrees / GOLD (FEV1%) - GOLD 1 (≥80%) - GOLD 2 (≥ 50 – 79%) - GOLD 3 (≥ 30 – 49%) - GOLD 4 (<30%)	 6 6 6 0	 9 9 9 1	 11 7 3 2	0.058	-0.125	0.15
Total	18	28	23			

Note: Significance p < 0.05

3.2. Discussion

Subjects involved in the study were 112 men and 54 women, with a mean age of 54-57 years. COPD worldwide has a prevalence of 10.1% in people aged 40 years or older [8]. The prevalence of COPD is greater in men over 40 years of age [9], but in developing countries, the prevalence of male and female COPD patients is not much different [10]. A total of 126 subjects were workers while 40 people were

unemployed. The prevalence of COPD was significantly higher in the outdoor work group than in the administrative workers group. In this situation, the risk factor for COPD is higher in jobs exposed to organic and non-organic dust, chemical agents, or smoke [10] – [12]. The highest history of previous illness in this study was asthma, there were 28 people (21%). Several studies showed that a history of asthma, atopy or allergies, and respiratory tract infections at a young age are significant risk factors for developing COPD as adults [10], [13]. Cardiovascular disease such as hypertension is also a risk factor for COPD [11]. Symptoms of COPD that often appear, especially during an exacerbation, are shortness of breath accompanied by wheezing, chest tightness, fatigue, limited activity and/or cough with or without phlegm [4], [10]. According to the sample characteristics, most patients experienced shortness of breath (45%), especially when walking or heavy activity, accompanied by coughing (44%) with or without phlegm but no wheezing.

Of the subjects, it was found that 87 people were active smokers and 42 people were passive smokers. Smoking is one of the most frequent risk factors for COPD [14], [15]. Previous research shows that the prevalence of COPD based on age is 15.2% in current smokers, 7.6% in former smokers, and 2.8% in adults who have never smoked [16], [17]. In women diagnosed with COPD, there are more passive smokers and this is the scope of this study [12]]. Risk factors for passive smoking also cause airway symptoms and increased lung damage due to inhaling harmful particles and gases [19]. This is supported by the results of a significant difference test between COPD participants who smoked and unsmoked on Brinkman's index value. Even though in the research Brinkman's index value was highest in light smokers, 41% (IB < 200), this was followed by heavy smokers, 33% (IB ≥ 200). The large number and duration of cigarette exposure will cause nicotine to repeatedly cause oxidative stress and apoptosis thereby inducing an inflammatory response mediated by the cytokine NF-κB in the lungs [20]. Based on previous research, Brinkman's index classification will be related to lung function regarding the severity of the patient's obstruction [21,22]. Research in 2010 stated that smoking for a period of > 20 packs per year and smoking for > 40 years can reduce FEV1/FVC < 70% [21,23]. Even though smoking is the most dominant environmental factor, only a 15% reduction in Forced Expiratory Volume in 1 second (FEV1) is obtained [24]. This supports that currently > 50% of COPD sufferers are active smokers and this is significantly different, but the correlation between COPD and obstructive pulmonary function (FEV1/FVC%) is not significantly different. Based on the pulmonary function correlation test, it is also not related to the patient's current COPD condition. Smokers who have stopped smoking for > 10 years or only consume < 5 cigarettes can improve lung function values by increasing FEV1. However, in this study, there is no data on how long it takes for COPD patients to stop smoking or former smokers [24].

The correlation between CAT score and lung function in stable COPD patients should have a correlation analysis value. This was explained in research by Dalimunthe [23], which stated that the higher the CAT value, the lower the lung function in COPD patients [22]. However, this research did not get meaningful results because some patients had low CAT scores even in patients without complaints. The spirometry values of patients who showed airway obstruction showed a mild decrease in lung function values (FEV1/FVC 60-74%) as many as 39 people had CAT scores < 10. Furthermore, 35 people had normal lung function values (FEV1/FVC > 75 %). COPD patients who are in a stable condition with a CAT score < 10 are 75%, and currently without symptoms [26]. A low CAT score is associated with a high level of airway obstruction. The CAT score questionnaire method is subjective and assesses quality of life which is more aimed at evaluating complaints in current conditions to predict the patient's clinical outcomes. CAT can predict exacerbations, health status disorders, depression, and patient mortality [27,28]. This

condition is appropriate with the result that the patient's history of exacerbations differs significantly from the CAT score. Based on the correlation test, the CAT score also has a strong correlation with the patient's history of exacerbations. The highest number of patients' GOLD classification is GOLD 2, which is around 38%. This result follows research in 2014 which stated that the COPD category with the most spirometry classification was GOLD 1-2. The GOLD 2 spirometry classification is only found in COPD A and B populations [28], [29] .

Lung obstruction level (FEV1/FVC%) and obstruction degrees (FEV1) in this research are not significantly different in the history of exacerbations. The correlation between exacerbation history with lung function in COPD patients was not significantly different. In early patient detection, post-screening spirometry was performed with bronchodilators. This still could not diagnose COPD. For patients without symptoms or smoking risk factors, then spirometry screening still could not conclude the diagnosis, because the spirometry can be normal or no significant differences with the last lung function remodeling [30]. Follow-up spirometry examinations on different circumstances need to be considered for COPD diagnosis. However, if there are symptoms of shortness of breath, cough, with or without smoking risk factors, recurrent lung infections, or a history of premature birth might be a higher possibility of being diagnosed with COPD, and spirometry can be considered as evidence method [10]. This matter is supported by the data in which patients not having a history of exacerbation own having a severe obstruction in pulmonary function test (FEV1/FVC% < 30%), while patients with a lot of exacerbation history have a mild obstruction in pulmonary function test (FEV1/FVC 60-74%) and moderate obstruction severity (FEV1 ≥ 50 – 79%) or GOLD 2 [31].

4. CONCLUSION

Based on the study results in COPD patients and those high-risk of COPD, the Brinkman's index has an impact in both groups. The CAT score questionnaire can describe the quality of life and current condition of the patient. CAT score also can evaluate the history of exacerbation of the patients. This condition makes the practitioner predict the prognosis of the disease. Lung function test can evaluate obstruction severity in COPD patients but it will not fully describe the patient's latest condition.

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