



Original Research

Factors Determining the Risk Level of Chronic Obstructive Lung Disease (COPD) in Smokers in Bandung City: A Secondary Data Analysis

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Abstract

Chronic obstructive pulmonary disease (COPD) is a major contributor to illness and death. COPD can result in the obstruction of airflow and disturbance of the respiratory system. These symptoms have a tendency to be enduring and progressively worse. In Indonesia, the number of persons affected by COPD is estimated to be 9.2 million, with smokers being the primary cause of COPD cases. Hence, the objective of this study was to determine the risk variables linked to the occurrence of COPD among smokers in Bandung City in 2022. This study employed a cross-sectional design, with a sample size of 189 smokers aged over 40 years in Bandung City. The participants were selected via total sampling. This study employed secondary research methodology, utilising chi-square and binary regression analysis for data analysis. The findings indicated that the prevalence of high-risk COPD cases in Bandung City in 2022 was 12.7%. A relationship was seen between age, smoking intensity, namely 20-30 packs of cigarettes per year, and level of physical activity. After controlling for age, physical activity, and degree of smoking, the primary cause of the increased risk of COPD was the consumption of 20-30 packs of cigarettes per year (PR= 11.34; 95% CI = 1.65 to 77.67). This study highlights the significance of lifestyle interventions, such as smoking cessation programmes and CERDIK's behaviours, in managing COPD.

Keywords: COPD, consumption cigarette, smokers, cross-sectional

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a non-communicable disease that is one of the burdens of health problems and a major cause of chronic morbidity and mortality worldwide (PDPI, 2016). According to the Global Initiative For Chronic Obstructive Lung Disease (GOLD), COPD is a disease characterized by airway limitation that is not entirely reversible. The airway limitation is usually progressive and immune-related. Globally, it is estimated that the burden of COPD will increase due to continued exposure to risk factors (GOLD, 2020). According to the World Health Organization (WHO), COPD is the third

leading cause of death in the world, with approximately 3.23 million deaths occurring in 2019. COPD deaths of around 90% under the age of 70 years predominantly occur in low- and middle-income countries. According to the American Lung Association, there was an increase in the number of COPD cases from 2014 to 2018; around 14.9 million people were diagnosed with COPD in 2014, and in 2015 and 2016, there was an increase of around 15 million people, until there was a continued increase in 2018 of around 16.4 million people diagnosed with COPD.

Basic Health Research (RISKEDAS) in 2013 showed that the prevalence of COPD in Indonesia is around 3.7% diagnosed with COPD or around 9.2 million people who experience COPD, and the mortality rate due to COPD is ranked 6th out of 10 causes of death in Indonesia. West Java Province ranks 13th with a prevalence of 4%. The prevalence of COPD increases with age in the age group of 75 years and over at 9.4% and often occurs in men at 4.2% compared to women at around 3.3% (Kemenkes RI, 2014). The high number of cases in Indonesia is directly proportional to the increase in the number of people who smoke (Kemenkes RI, 2021).

Smoking is the main factor that causes COPD and is estimated to be the most significant contributor to about 9 out of 10 COPD cases in the world (National Institute for Health Research, 2022). According to the Global Adult Tobacco Survey (GATS), in 2021, the number of adult smokers in Indonesia reached 68.9 million, or 33.5% of the adult population. Men tend to have higher smoking behavior (64.7%) compared to women (2.3%). Findings from the GATS show that the prevalence of electronic smokers will increase up to 10 times, from 0.3% in 2011 to 3% in 2021. Based on previous research, it is found that the risk factors for COPD incidence are male gender (Pertiwi et al., 2022), age (Ariesta, 2021), occupation (Wijayasari Inne dan Arulita Ika Fibriana, 2016), BMI (Baiq Diana Meilinda, Risky Irawan Putra Priono, 2019), smoking frequency based on the degree of smoking per (Pertiwi et al., 2022), smoking frequency based on the number of cigarettes smoked, smoking frequency based on the number of packs of cigarettes per year (Rey-Brandariz et al., 2023), fruit/vegetable consumption (Dianah et al., 2021), and physical activity (Lontoh & Rini, 2022). This study examines explicitly smokers regarding factors associated with high-risk levels of COPD. This study used COPD Early Detection data in 2022 to investigate the determinants of the risk level of Chronic Obstructive Pulmonary Disease (COPD) among smokers in Bandung City in 2022.

METHODS

This study was a quantitative study with a cross-sectional research design. This study used secondary data, namely the Early Detection Data 2022, Ministry of Health. The Chronic Lung Disease and Immunological Disorders 2022, Ministry of Health, collected this data using the interview method. The data collection was carried out in the Cigondewah and Dago areas of Bandung City in 2022. The population used in this study was people who smoke and are aged 40 years and over in Bandung City. The total population in 2022 who participated in early detection was 193 people. The sampling technique used total sampling, which met the inclusion criteria of 189 samples. The inclusion criteria were people aged ≥ 40 years in Bandung City who were smoking, and the exclusion criteria were the data of the dependent variable (the risk level of COPD) that was not found. Data were analyzed in univariate, bivariate, and multivariate ways to get the description, relationship, and risk factors. The independent variables in this study were age, gender, occupation, body mass index, degree of smoking, number of packs of cigarettes per year, fruit/vegetable consumption, and physical

activity. The dependent variable was the risk level of COPD. The risk level of COPD was measured using the PUMA score, which was categorized into low risk if the score is <6 and high risk if the score is ≥6.

RESULTS

Distribution of Respondent Characteristics

Table 1 illustrates that the proportion at the risk level of COPD incidence is dominant at a low-risk level of 87.3%, in the majority age category at the age of 40-59 years by 75.13%, the male group by 92.59%, the proportion in the most occupational category is working by 91.53%, the proportion of the most body mass index categories is average by 52, 38% and obese by 42.33%, the proportion of smoking degree is moderate to severe by 60.85%, the majority of respondents with the number of cigarette packs consumption per year is <20 packs per year by 65.61%, the proportion of fruit/vegetable consumption is mostly less by 64.55%, and the majority of physical activity in the moderate category by 59.26%.

Table 1. Distribution of Respondent Characteristics (n=189)

Variable	n	%
The Risk Level of COPD		
High-risk	24	12.70
Low-risk	165	87.30
Age Group		
≥60 years	47	24.87
40-59 years	142	75.13
Sex		
Male	175	92.59
Female	14	7.41
Employment		
Working	173	91.53
Not working	16	8.47
BMI		
Thin	10	5.29
Obese	80	42.33
Normal	99	52.38
Degree of Smoking		
Moderate – severe	115	60.85
Light	74	39.15
Number of Packs of Cigarettes per Year		
>30 packs/ year	27	14.29
20-30 packs/ year	38	20.11
<20 packs/ year	124	65.61
Fruit/ vegetable consumption		
Not good	122	64.55
Good	67	35.45
Physical Activity		
Not good	77	40.74
Good	112	59.26

The Relationship of Independent Variables with the Risk Level of Chronic Obstructive Pulmonary Disease in Bandung City

The analysis of the relationship between age, gender, occupation, body mass index, smoking degree, number of packs of cigarettes per year, fruit/vegetable consumption, and physical activity with the risk level of COPD incidence in Bandung City can be seen in Table 2.

Table 2. Bivariate Analysis of Factors Associated with the Risk Level of Chronic Obstructive Pulmonary Disease Among Smokers (n=189)

Variable	The Risk Level of COPD				Total		PR (95% CI)	p
	High-risk		Low-risk		n	%		
	n	%	n	%				
Age Group								
≥60 years	14	29.8	33	70.2	47	100	4.22 (2.01-8.87)	0.001
40-59 years	10	7	63	93	142	100	<i>Reff</i>	
Sex								
Male	24	13.7	151	86.3	175	100	-	1.000
Female	0	0	14	100	14	100	<i>Reff</i>	
Employment								
Working	23	13.3	150	86.7	173	100	2.12 (0.30-14.73)	0.445
Not working	1	6.2	15	93.8	16	100	<i>Reff</i>	
BMI								
Thin	2	20	8	80	10	100	1.41 (0.37-5.35)	0.610
Obese	8	10	72	90	82	100	0.70 (0.31-1.60)	0.406
Normal	14	14.1	85	85.9	97	100	<i>Reff</i>	
Degree of Smoking								
Moderate-severe	23	20	92	80	115	100	14.8 (2.04-107.26)	0.008
Light	1	1.3	73	98.7	74	100	<i>Reff</i>	
Number of Packs of Cigarettes per Year								
>30 packs/ year	13	48.1	14	51.9	27	100	29.85 (7.14-124.65)	0.001
20-30 packs/ year	9	23.7	29	76.3	38	100	14.68(3.31-65.05)	0.001
<20 packs/ year	2	1.6	122	98.4	124	100	<i>Reff</i>	
Fruit/ vegetable consumption								
Not good	16	13.1	106	86.9	122	100	1.09 (0.49–2.43)	0.817
Good	8	11.9	59	88.1	67	100	<i>Reff</i>	
Physical Activity								
Not good	18	23.4	59	76.6	77	100	4.36(1.18-10.49)	0.001
Good	6	5.4	106	94.6	112	100	<i>Reff</i>	

Table 2 shows that based on age, the prevalence of high-risk levels of COPD events at age ≥60 years was 29.8%, and in the 40-59 years age group was 7%. The prevalence ratio in the ≥60 years age group is 4.22 (95% CI: 2.01 to 8.87), which means that smokers at the age of ≥60 years have a 4.22 times risk of experiencing a high-risk level of COPD compared to the 40-59 years age group. Based on gender, it can be seen that the prevalence of high-risk levels of COPD in men is 13.7%, and in women, it is 0%. Based on the employment group, it can be seen that the prevalence of high-risk levels of COPD in the working group is 13.3%,

and in the non-working group, it is 6.25%. The prevalence ratio = 2.12 (95% CI: 0.30 to 14.73).

Table 2 also shows that the prevalence of high-risk levels of COPD in the thin category is 20%, in the normal category is 14.1%, and in the fat category is 10%. The prevalence ratio in the thin category body mass index is 1.41 (95% CI: 0.37 to 5.35). For body mass index in the obese category, the prevalence ratio = 0.70 (95% CI: 0.31 to 1.60). Based on the degree of smoking, it can be seen that the prevalence of high-risk levels of COPD in the moderate to severe group is 20%, and in the mild group, it is 1.35%. The prevalence ratio in moderate to severe degrees is 14.8 (95% CI: 2.04 to 107.26), which means that smokers with moderate to severe degrees can be at risk 14.8 times experiencing a high-risk level of COPD events compared to the light smoking degree group.

Based on the number of packs of cigarettes per year, it can be seen that the prevalence of high-risk levels of COPD in the >30 packs per year group is 48.15%, in the 20-30 packs per year group is 23.7%, and in the <20 packs per year group is 1.6%. The prevalence ratio in the >30 packs per year group obtained 29.85 (95% CI: 7.14 to 124.65), which means that smokers who consume >30 packs per year can be at risk 29.85 times experiencing a high-risk level of COPD compared to smokers who consume <20 packs per year. For the 20-30 packs per year group, the prevalence ratio = 14.68 (95% CI: 3.31 to 65.05), which means that smokers who consume 20-30 packs per year can be at risk 14.68 times experiencing a high-risk level of COPD compared to smokers who consume <20 packs per year.

Table 2 also demonstrates that the prevalence of high-risk levels of COPD events in smokers who consume less (not good category) fruit/vegetables is 13.1%, and in smokers who consume fruit/vegetables in a good category is 11.9%. The prevalence ratio in smokers who consume less (not good category) fruit/vegetables is 1.09 (95% CI: 0.49 to 2.43). Based on physical activity, it can be seen that the prevalence of high-risk levels of COPD events in the group of less (not good category) physical activity was 23.4%, and physical activity in the good group was 5.4%. The prevalence ratio in the group who did less (not good category) physical activity is 4.36 (95% CI: 1.18 to 10.49), meaning that smokers who do less (not good category) physical activity can be at risk 4.36 times experiencing a high-risk level of COPD compared to smokers who do physical activity in good category.

Dominant Factors on the Risk Level of Chronic Obstructive Pulmonary Disease in Bandung City

The bivariate analysis results were utilised to choose multivariate models. Variables with a P-value ≤ 0.25 were considered for inclusion in the multivariate model. Variables having a P-value greater than 0.25 may be included in the model if they are deemed to be significantly necessary. The final version of the multivariate analysis is displayed in Table 3.

Table 3. Multivariate Analysis of Risk Factors for COPD among Smokers in Bandung City

Variable	PR	95% CI	p
Age Group			
≥60 years	3.07	(1.67-5.65)	0.001
Number of Packs of Cigarettes per Year			
20 - 30 packs/ year	10.99	(1.59-75.67)	0.015
> 30 packs/ year	11.34	(1.65-77.67)	0.013
Physical Activity			
Not good	3.13	(0.43-6.86)	0.004
Degree of Smoking			
Moderate - Severe	1.65	(0.11-24.18)	0.712

The multivariate analysis shows that the variables of age, number of packs of cigarettes per year, and physical activity are associated with a high-risk level of COPD. From the results of the analysis, it was found that the dominant factor in the high-risk level of COPD in smokers was the variable number of packs of cigarettes per year with a prevalence ratio value of 11.34, meaning that people who consume >30 packs of cigarettes per year are at risk of developing COPD 11.34 times after being controlled by variables of age, physical activity and degree of smoking.

DISCUSSIONS

This study found that the determinants of the high-risk level of COPD in smokers were age, the number of packs of cigarettes consumed per year, and physical activity, with the dominant factor being the number of packs of cigarettes per year. The risk of smokers who consume >30 packs of cigarettes per year is 11.34, and those who consume 20 to 30 packs per year are 10.34. Cigarette smoke exposure is proven to be the leading cause of COPD. Cigarettes contain harmful chemicals, especially nicotine, tar, and carbon dioxide, which are the main components of cigarettes (Hartina et al., 2021). Over time, exposure to harmful substances can cause irritation and damage to the lungs and respiratory tract, which can then lead to COPD and increase the risk of smokers (Lukito, 2019).

COPD often develops after a person smokes more than 20 cigarettes a day over 20 years (equivalent to 20 packs per year), which can be caused by damage to the airway. Usually, in addition to hypoxemia, there are also elevated carbon dioxide (CO₂) levels due to chronic CO₂ retention. This results in the respiratory center becoming highly responsive to hypercarbia (hypoxemic) stimuli, which makes the respiratory center highly sensitive to drugs that suppress respiratory center activity and high oxygen concentrations. Therefore, a person who is susceptible to cigarette smoke exposure may experience changes in spirometry test results between the ages of 40 and 45 years if they start smoking in adolescence. Although it is estimated that 15-20% of smokers develop COPD, recent studies suggest that up to 50% of smokers may develop COPD when they reach old age (Stratelis et al., 2004). Therefore, there is a need to improve comprehensive anti-smoking programs by implementing stricter tobacco control regulations and implementing cross-sector collaboration activities tailored to the Indonesian context to address the issue of individuals starting to smoke for the first time (Ilmaskal et al., 2023).

In addition, this study also found that the degree of smoking is a determinant of the high-risk level of COPD in smokers. The degree of smoking or the level of the smoking dose

has a significant impact on a person's risk of developing COPD, and this can be influenced by factors such as the age at which smoking started, the number of cigarettes consumed per day, and the duration of smoking. In this study, the Brinkman Index was used. The Brinkman Index is used as a method of calculating smoking dose by multiplying the number of cigarettes consumed per day by the length of smoking in years (Najihah & Theovena, 2022). The higher the level of a person's smoking degree, the greater the exposure to various substances that are considered toxic by the body in the respiratory tract, which ultimately leads to a decrease in lung function at a higher rate compared to someone who is not a smoker (El Naser et al., 2016). The level of the smoking dose has a significant impact on a person's risk of developing COPD. The degree of smoking based on the Brinkman index is used as a method of calculating smoking dose by multiplying the number of cigarettes consumed per day by the length of smoking in years (Najihah & Theovena, 2022).

The age factor (≥ 60 years) has a three times higher risk of COPD in smokers (aPR = 3.07; 95%CI: 1.67 to 5.65). The body's organs naturally decline as we age, including lung function. During the aging process, there is a decrease in the elasticity of the alveoli (air sacs in the lungs), thickening of the bronchial glands, and reduced lung capacity. A person getting older will also be easily exposed to an unfavorable environment and can suffer from the disease, so the possibility of experiencing a decrease in lung function will be greater (Pratiwi et al., 2019). In the elderly population, the risk of COPD can increase because the respiratory system experiences a decrease in endurance. Changes in the structure of the chest wall can result in reduced chest wall flexibility and decreased elasticity of the lung parenchyma. In addition, there is an increase in the number of mucous glands and thickening of the bronchial mucosal layer (Agustin et al., 2022).

Furthermore, physical inactivity was found to have three times the risk of high COPD incidence (aPR = 3.13; 95%CI: 0.43 to 6.86). Physical activity is the body's movement involving muscles and skeleton, requiring energy consumption. There are two main categories of physical activity: moderate and vigorous (Lorensia et al., 2021). Lack of physical activity is considered one of the main risk factors that can cause death from non-communicable diseases, potentially increase the level of disability, and reduce quality of life. Regular physical activity can provide various benefits to the body, including increased muscle and bone strength, while reducing the risk of non-communicable diseases (Llamas-Saez et al., 2023).

CONCLUSIONS

To promote a healthy lifestyle and manage COPD in the community, particularly among individuals aged 60 and above who smoke, it is recommended to adopt CERDIK behaviour. Smokers are required to engage in education, family support, and smoking cessation programmes, which involve counselling, nicotine replacement medication, and information about the positive effects of quitting smoking on lung health. Furthermore, it is anticipated that smokers will partake in physical exertion by arranging consistent exercise sessions, ideally lasting 30 minutes each day. Regularity in engaging in physical activity can contribute to a steady enhancement of fitness. Finally, it is essential to regularly undertake health check-ups.

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