

Sociodemographic Factors Associated with Chronic Obstructive Pulmonary Disease Comorbidities: Based on Indonesia Family Life Survey-5

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ABSTRACT

COPD is still one of the major health problems in Indonesia. The aim of this study was to look at the relationship between sociodemographics and the incidence of comorbidities in COPD patients. Cross-sectional study design, using IFLS-5 data. Inclusion criteria were patients with a diagnosis of COPD by self-report, and at least 15 years old. Out of 34,252 people who filled out household health questionnaires in IFLS 5, 618 subjects had COPD. Based on multivariate test, gender (aOR: 1.792 (1.282-2.506); p-value: 0.001), age 36-45 years (aOR: 1.259 (0.764-2.074); p-value: 0.028), age 46-55 years (aOR: 2.418 (1.365-4.282); p-value: 0.002), age 56-65 years (aOR: 2.418 (1.365-4.282); p-value: 0.002), and age >65 years (aOR: 3.502 (1.884-6.510); p-value: 0.000), age 56-65 years (aOR: 3.502 (1.884-6.510); p-value: 0.000), and age >65 years (aOR: 6.508 (3.338-12.690); p-value: 0.000) had a significant association with the incidence of comorbidities in COPD patients in Indonesia. This study identified that being female and aged between 26 years and over 65 years are significant risk factors for the occurrence of comorbidities in COPD patient. It is essential to implement preventive measures against comorbidities in COPD patients who present risk factors for such conditions.

Keywords: COPD, Cigarette Consumption, IFLS 5, Risk factor, Comorbidities

Introduction

Chronic obstructive pulmonary disease (COPD) is one of the world's most prevalent chronic diseases, with a very high incidence in low- and middle-income countries (LMICs) (WHO, 2023a, 2023b, 2022). COPD is one of the leading causes of poor health worldwide and ranks as the number three cause of mortality in the world, with 3.23 million deaths in 2019 (WHO, 2023b). In Indonesia, COPD was one of the most frequent causes of death in 2019 (WHO, 2024). Several studies have revealed that smoking is a primary risk factor for COPD (Chung et al., 2023; Rey-Brandariz et al., 2023; Wheaton et al., 2019).

The incidence of comorbidities in COPD patients is quite high and can lead to reduced patient quality of life, medication failure, increased hospitalization, and even increased mortality (Crisafulli et al., 2008; Divo et al., 2015). Several studies have revealed that factors influencing the occurrence of comorbidities in COPD patients are due to the elderly, lack of physical activity, unhealthy diet, smoking habits, and the presence of systemic inflammation (Camiciottoli et al., 2016; Cavallès et al., 2013; Franssen and Rochester, 2014; Greulich et al., 2017; Martinez et al., 2014; Putcha et al., 2017). However, similar studies have not been conducted in Indonesia, and those that have focused on non-modifiable factors. The Indonesia Family Life Survey 5 offers a rich dataset encompassing a wide range of health and sociodemographic information, making it an ideal resource for examining the associations between sociodemographic factors and COPD comorbidities (Strauss et al., 2016). This nationally representative survey includes detailed data on health status, economic conditions, and family dynamics, enabling a multifaceted analysis of the interactions between these variables (Strauss et al., 2016). By analyzing this

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data, we aim to identify specific sociodemographic profiles that are at higher risk of developing multiple comorbid conditions alongside COPD.

Given the high prevalence of COPD and the fact that it is one of the 10 leading causes of death in Indonesia, the presence of comorbid diseases will worsen the patient's condition and increase mortality. Therefore, it is necessary to conduct research to see what factors influence the incidence of comorbidities in COPD patients in Indonesia, by not only looking at non-modifiable sociodemographic factors, but also looking at modifiable factors, such as smoking habits, the number of cigarettes consumed / day, and the duration of smoking and the presence of depressive symptoms. The purpose of this study was to examine the relationship between sociodemographics, smoking patterns and depressive symptoms on the incidence of comorbidities in COPD patients in Indonesia.

Materials and Methode

Study Design

This research is an observational analytic study with a cross-sectional design. The data used in this study are secondary data from the "Indonesian Family Life Survey (IFLS)-5" longitudinal survey collected from 2014 to 2015. The IFLS-5 survey used a stratified sampling design that represented 83% of the Indonesian population. The population for the IFLS-5 survey was drawn from 13 provinces in Indonesia with the following distribution: four provinces on the island of Sumatra "(West Sumatra, North Sumatra, South Sumatra, and Lampung)", five provinces on the island of Java "(DKI Jakarta, West Java, Central Java, DI Yogyakarta, and East Java)", and four other provinces "(Bali, West Nusa Tenggara, South Kalimantan, and South Sulawesi)". The survey includes information collected from individuals, households, and health facilities. The survey contains individual and household health data, such as sociodemographic, socioeconomic, and others (Strauss et al., 2016). "The Indonesian Family Life Survey (IFLS)" and its procedures have been reviewed and approved by the "Institutional Review Board (IRB)" in the United States and in Indonesia by "Universitas Gadjah Mada (UGM)" for IFLS-3, IFLS-4, and IFLS-5. Therefore, all consent requirements for adults and children were met and approved by the IRB before the survey procedures began, and written informed consent was obtained from all respondents prior to data collection (RAND, 2024).

Study Population

The inclusion criteria in this study were subjects aged 15 years with self-reported Chronic obstructive pulmonary disease (COPD) a diagnosis data based on diagnoses from doctors, nurses, or midwives

Outcome Measure

The outcome seen in this study is the comorbidities on COPD subject, which is known through the answers to the following questions "Have a doctor/ paramedic/ nurse/ midwife ever told you that you had Hypertension/ DM/ TBC/ Asthma/ Hearth problem/ Liver/ Stroke/ Cancer/ Arthritis/ Hyperlipidemia/ Prostate illness/ Kidnes disease/ Stomach or other digestive disease/ Emotional, nervous, or psychiatric problems/ Memory-related disease?" if the respondent answers "Yes" then the respondent has comorbidities and if the respondent answare "No" then respondent has not comorbidities (IFLS-5, 2014).

Potential Factors Related to COPD

We collected several baseline factors that may be associated with the incidence of COPD such as sociodemographic factors, including gender, age, education level, income, and place of residence. Then we also collected data on smoking status, number of cigarettes consumed per day, age of starting smoking, and smoking duration.

Data on sociodemographic factors and other related factors were obtained from Book K, Book 3B and Book 3A. The data collected is gender data, Age data is categorized into five groups: late adolescence (15-25 years), early adulthood (26-35 years), late adulthood (36-45 years), early old age (46-55 years), late old age (56-65 years), and elderly (>65 years). Educational level data is categorized as no schooling,

primary/elementary school, junior high school/equivalent, senior high school/equivalent, and higher education. Economic status is obtained from income data over the last 12 months, where total family income in rupiah is divided by the number of family members (per capita income). Per capita income is classified per quintile. Comorbidity data is grouped into three categories: no comorbidities, 1-2 comorbidities, and ≥ 3 comorbidities. Residential data is categorized into two: rural and urban. Then for data on smoking history, number of cigarettes consumed per day, smoking duration and age of starting smoking obtained from book 3B (Strauss et al., 2016).

Checking Missing Data

In this study we use the little test statistic to see whether the missing data that occurs is classified as MCAR or not. MCAR (missing completely at random) is a type of missing data caused by a condition in data analysis where the missing data occurs randomly, without any particular pattern associated with the observed variable or other variables in the dataset. This means that the probability of a value being missing does not depend on the data values themselves or other variables in the dataset (Chicco et al., 2021). Missing data will be classified as MCAR when the little test statistic has a p-value > 0.005 . One way to overcome MCAR missing data is to perform a complete-case analysis (Heymans and Twisk, 2022), when data with missing values in the variable under study will automatically be excluded or discarded and only complete observation data will be analyzed (Heymans and Twisk, 2022).

Data Analysis

Univariate data analysis of respondent characteristics with categorical data is displayed in the form of percentages and numbers for each data. To see the relationship between sociodemographics, smoking history, number of cigarettes consumed per day, age of starting smoking, and smoking duration, with the incidence of comorbidities in patients with COPD. The bivariate analysis used in this study was chi-square. Bivariate analysis results with p-value < 0.25 were considered as factors potentially associated with incidence of comorbidities in patients with COPD and these factors were included in the initial multivariate logistic regression model. To obtain Odds ratios, multivariate binary logistic regression with 95% confidence intervals (95% CI) and manual backward elimination were used. For factors included in the final model, the p-value was set at 0.05. The Hosmer-Lemeshow test was used to assess model fit. The Pseudo R-square value, which is the default value reported by Stata, was obtained as an equivalent value to the R-square reported in the regression. The R-square value ranges from 0 to 1 (Chicco et al., 2021), which indicates the extent to which the combination of independent variables simultaneously affects the value of the dependent variable. Statistical analysis in this study was conducted using Stata software version 17.0 for Windows.

Result and Discussion

The results of the Little test statistic show a p-value of 0.2194, this value is > 0.05 , which indicates that the missing data that occurs in this study is classified as MCAR. Therefore, to overcome the missing data in this study, a complete-case analysis was conducted. Then in this study, it was found that out of 34,252 respondents, 618 (1.80%) of them suffered from COPD. Furthermore, based on sociodemographic data, more than half of COPD subjects were men, this may be related to lifestyle such as smoking habits, where in general the majority of men have a smoking habit. (Han and Martinez, 2021). Furthermore, the majority of COPD subjects with primary school education (32.30%) and are in quintile 1 (22.82%), This may be related to the work environment. According to research conducted by Kontio et al., (2018), workers who have low or basic education levels tend to be placed in jobs with a high risk of exposure to hazardous substances, such as dust, smoke, and chemicals (Kontio et al., 2018). According to information released by the NHS, dust and chemicals in the workplace can damage the lungs and increase the risk of COPD (NHS, 2023). Then most COPD subjects live in urban areas (67.31%). Furthermore, 45.79% of COPD subjects had

comorbidities. Then based on smoking status, 58.58% of COPD subjects did not have a smoking habit and 41.42% of COPD subjects had a smoking habit. The average number of cigarettes consumed per day with the highest percentage is >39/day (59.71%). Then the majority of COPD subjects had a smoking habit starting at the age of >30 years (62.46%), and the most smoking duration of COPD subjects was with a length of >51 years (63.59%). Not only that, this study also found that there were COPD subjects who had symptoms of depression as many as 27.67% (see Table 1).

Table 1. COPD subject characteristic

Subject Characteristics	Number (n)	Percentage (%)
COPD		
Subjects not having COPD	33,622	98.16
Subjects with COPD	618	1.80
Missing	12	0.04
Gender		
Male	330	53.40
Female	288	64.60
Age		
15-25 years	132	21.36
26-35 years	151	24.43
36-45 years	118	19.09
46-55 years	83	13.43
56-65 years	67	10.84
>65 years	67	10.84
Education Level		
No/Not Yet in School	37	5.99
Elementary School/equivalent	198	32.04
Junior High School / equivalent	101	16.34
Senior High School/ equivalent	190	30.74
College/University	87	14.08
Missing	5	0.81
Economic Status		
Quintile 1	141	22.82
Quintile 2	121	19.58
Quintile 3	129	20.87
Quintile 4	109	17.64
Quintile 5	118	19.09
Residence		
Rural	202	32.69
Urban	416	67.31
Comorbid Status		
No Comorbidities	335	54.21
Have Comorbidities	283	45.79
Smoking Status		
Not Smoker	362	58.58
Smoker	256	41.42
Number of Cigarettes/days		
Never smokers		
1-9	79	12.78
10-19	131	21.20
20-29	27	4.37
30-39	12	1.94
>39	369	59.71
Age at start of smoking		
< 15	33	5.34
15-20	158	25.57

Subject Characteristics	Number (n)	Percentage (%)
21-25	30	4.85
26-30	11	1.78
>30	386	62.46
Smoking Duration (years)		
Never smokers	2	0.32
1-20	124	20.06
21-30	45	7.28
31-40	32	5.18
41-50	22	3.56
>51	393	63.59

Based on bivariate analysis, it was found that gender (p-value 0.001), age (p-value 0.000), education level (p-value 0.000), place of residence (p-value 0.020), having comorbidities, age at start of smoking (p-value 0.089), smoking duration (p-value 0.005) and having depressive symptoms (p-value 0.242) have a p-value <0.25 which means that these variables are potential factors that are dominantly associated with the incidence of comorbidities in COPD patients in Indonesia (see Table 2).

Table 2. Bivariate analysis of the relationship between sociodemographics and the incidence of comorbidities in COPD patients

Characteristic	Comorbidities				p-value
	No comorbidities		Have comorbidities		
	N	%	n	%	
Gender					
Female	136	46.60	152	53.71	0.001*
Male	199	59.40	131	46.29	
Age					
15-25 years	90	26.87	42	18.48	0.000*
26-35 years	96	28.66	55	19.43	
36-45 years	66	19.70	52	18.37	
46-55 years	39	11.64	44	15.55	
56-65 years	27	8.06	40	14.13	
>65 years	17	5.07	50	17.67	
Education Level					
No/Not Yet in School	9	2.70	28	10	0.000*
Elementary School/equivalent	98	29.43	100	35.71	
Junior High School / equivalent	65	19.52	36	12.86	
Senior High School/ equivalent	119	35.74	71	25.36	
College/University	42	12.61	45	16.07	
Economic Status					
Quintile 1	72	21.49	69	24.43	0.796
Quintile 2	69	20.60	52	18.37	
Quintile 3	69	20.60	60	21.20	
Quintile 4	63	18.81	46	16.25	
Quintile 5	62	18.51	56	19.79	
Residence					
Rural	96	28.66	106	37.46	0.020*
Urban	239	71.34	177	62.54	
Smoking Status					
Not Smoker	190	56.72	172	60.78	0.307
Smoker	145	43.28	111	39.22	
Number of Cigarettes/days					
1-9	46	17.37	33	11.66	0.540
10-19	73	21.79	58	20.49	
20-29	17	5.07	10	3.53	

Characteristic	Comorbidities				p-value
	No comorbidities		Have comorbidities		
	N	%	n	%	
30-39	8	2.39	4	1.41	
>39	191	57.01	178	62.90	
Age at start of smoking					
< 15	21	6.27	12	4.24	
15-20	94	28.06	64	22.61	
21-25	20	5.97	10	3.53	0.089*
26-30	4	1.19	7	2.7	
>30	196	58.51	190	67.14	
Smoking Duration (years)					
Never smokers	1	0.30	1	0.35	
1-20	85	25.37	39	13.78	
21-30	27	8.06	18	6.36	
31-40	13	3.88	19	6.71	0.005*
41-50	9	2.69	13	4.59	
	200	59.70	193	68.20	

*p-value <0.25 included in the initial multivariate test model

In the final multivariate test model, the final results showed that gender (aOR: 1.792 (1.282-2.506); p-value: 0.001), age 36-45 years (aOR: 1.259 (0.764-2.074); p-value: 0.028), age 46-55 years (aOR: 2.418 (1.365-4.282); p-value: 0.002), age 56-65 years (aOR: 3.502 (1.884-6.510); p-value: 0.000), and age >65 years (aOR: 6.508 (3.338-12.690); p-value: 0.000) had a dominant significant association with the incidence of comorbidities in COPD patients in Indonesia (see Table 3).

Table 3. Multivariate logistic regression analysis of the relationship between sociodemographic factors and the incidence of comorbidities in COPD subjects

Variable	Odds Ratio (95% CI)	p-value
Gender		
Female	1.792 (1.282-2.506)	0.001
Male	Reference	
Age		
15-25 years	Reference	
26-35 years	1.259 (0.764-2.074)	0.365
36-45 years	1.794 (1.063-3.025)	0.028
46-55 years	2.418 (1.365-4.282)	0.002
56-65 years	3.502 (1.884-6.510)	0.000
>65 years	6.508 (3.338-12.690)	0.000

Based on the findings obtained in this study, women who suffer from COPD are 1.73 times more likely to suffer from comorbid diseases compared to men. This may be due to several factors, the first can be influenced by psychological conditions, a researcher revealed that women tend to have a higher risk of developing depression / anxiety compared to men (Albert, 2015). Then according to several studies, depression/anxiety is one of the most common comorbid diseases experienced by people with COPD. (Anlló et al., 2022; Rahi et al., 2023; Yohannes and Alexopoulos, 2014). The second factor, which may influence the higher risk of comorbidities among women, is hormonal. Estrogen in women helps protect the lungs by maintaining alveolar structure and a small number of alveolar adhesions, ciliary pulses and epithelial nitric oxide (Kamil et al., 2013; Lou et al., 2012). When entering menopause, estrogen and progesterone decline, which can accelerate the worsening of lung conditions (Memoalia et al., 2018; Triebner et al., 2017). In addition, according to some studies, menopause is also associated with an increase in the occurrence of cardiovascular disease (Ardiani et al., 2015; Kamińska et al., 2023; Song et al., 2023). A third factor that may influence these findings is physiology, Women generally have smaller lungs and narrower airways than men (Aryal et al., 2014), so that airway obstruction due to COPD can be more severe. This increases

susceptibility to respiratory infections and other lung-related diseases. Furthermore, a study also showed that COPD patients with female gender are associated with an increased risk of developing comorbid diabetes mellitus (Meteran et al., 2015).

Furthermore, this study also found that age affects the incidence of comorbidities in COPD patients. Our findings show that the older a person is, the higher the risk of developing comorbid diseases in COPD patients, this can be seen from Table. 3 that COPD subjects aged >65 years have a 6.5 times greater risk of developing comorbid diseases compared to COPD subjects aged 15-25 years. This result is similar to previous studies (Alter et al., 2022; Kim-Dorner et al., 2022). Previous studies have shown that increasing age in COPD patients is associated with an increase in the prevalence of a number of heart diseases in COPD patients (Alter et al., 2022). Not only that, increasing age in COPD patients can also increase the risk of developing diabetes mellitus (Mannino et al., n.d.; Martinez et al., 2014). Some factors that may lead to an increased risk of comorbidities as patients age are, firstly, related to organ function, as we age, the function of the body's organs tends to decline, including the respiratory, cardiovascular, and immune systems (Arif and Pisani, 2020; Rojas et al., 2015; Sharma and Goodwin, 2006). This makes patients more susceptible to various diseases. Secondly, decreased physical condition and limited mobility, in older COPD patients there is less physical activity (Lee et al., 2016), this can lead to worsening of the condition of COPD patients, the occurrence of obesity, diabetes, cardiovascular disease, and depressive disorders (Lee et al., 2016; Tashiro and Takahashi, 2023; Wilby, 2019). Then third, the incidence of side effects is more experienced by older patients (Tarazona-Santabalbina et al., 2023).

Finally, our findings showed that modifiable factors such as smoking status, number of cigarettes consumed per day, age of starting smoking, and smoking duration were not statistically significantly associated with multivariate analysis. However, this study illustrates that factors such as gender and age have a significant association with the incidence of comorbidities in COPD patients. Therefore, this finding can be used as a consideration to develop health interventions for COPD patients in groups that are prone to have a high risk of developing comorbid diseases. In addition, the strength of our study is that we used IFLS 5 longitudinal survey data which represents 83% of the population in Indonesia. However, this study is not free from several limitations. Firstly, the cross-sectional study design that we used was unable to see the causal relationship between risk factors and the incidence of comorbid diseases in COPD patients. Second, our R-square value was low, indicating that there are other factors that have a greater influence on the incidence of comorbidities in COPD patients. Third, in this study, the self-reported diagnosis of COPD was taken from the questionnaire with the question 'Has a doctor/paramedic/nurse/midwife ever told you that you have a chronic lung condition?' This question does not specifically ask about COPD, but we assume that it refers to COPD because other chronic lung conditions, such as asthma, tuberculosis, and lung cancer, are specifically asked about in the IFLS-5 questionnaire.

Conclusion

This study identified that being female and aged between 26 years and over 65 years are significant risk factors for the occurrence of comorbidities in COPD patient. It is essential to implement preventive measures against comorbidities in COPD patients who present risk factors for such conditions.

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