

The relationship between age and gender with the severity of copd at Bandung Lung Hospital from 2020 to 2024

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ABSTRACT

Background: Chronic Obstructive Pulmonary Disease (COPD) is a long-term respiratory condition marked by a gradual decline in airflow that cannot be fully reversed, caused by abnormalities in the airways and lung structures such as chronic bronchitis and emphysema. It remains one of the leading causes of global morbidity and mortality. Age and gender are suspected to influence COPD severity, though previous findings have been inconsistent. Methods: This study applied an analytical quantitative approach with a cross-sectional design using secondary data from the medical records of COPD patients at Dr. H. A. Rotinsulu Pulmonary Hospital, Bandung, from 2020 to 2024. A total of 135 patients meeting inclusion criteria were selected through consecutive sampling. Data were analyzed using univariate and bivariate tests, with Spearman Rank for age and Chi-Square for gender. Results: Most respondents were male (74.8%) and over 60 years old, with the majority having very severe COPD (45.9%). Statistical analysis showed no significant relationship between age ($p = 0.956$) or gender ($p = 0.359$) and the severity of COPD ($p > 0.05$). Conclusion: There was no significant association between age and gender with COPD severity. Behavioral and environmental factors, such as smoking habits and pollutant exposure, may play a greater role in disease progression.

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INTRODUCTION

Long-term respiratory problems such as chronic cough, sputum production, dyspnea, and/or exacerbation phases are characteristic features of Chronic Obstructive Pulmonary Disease (COPD), a heterogeneous lung condition caused by abnormalities in the airways (such as bronchitis and bronchiolitis) and/or alveoli (such as emphysema), leading to persistent and often progressive airflow obstruction (Perhimpunan Dokter Paru Indonesia, 2023).

Globally, COPD remains one of the leading contributors to mortality, with its ranking steadily increasing over time and projected to become one of the top causes of death in the coming decades. According to data from the World Health Organization (WHO), COPD ranked as the

sixth leading cause of death globally in 1990 and became the fifth leading cause of death in 2002. After cancer and cardiovascular disease, COPD is projected to become the third leading cause of death worldwide by 2030 (Venkatesan, 2024).

Smoking is widely recognized as the main contributing factor to COPD, although prolonged exposure to air pollutants and individual susceptibility such as genetic factors and airway sensitivity also play important roles in disease development. However, passive smokers are also at risk of developing COPD due to long-term exposure to toxic gases, smoke, and particles, combined with individual internal factors such as genetic predisposition and heightened airway responsiveness. In addition to smoking, several studies indicate that age is an important risk factor for COPD, particularly in individuals over 40 years old, due to cumulative exposure to pulmonary irritants and age-related decline in respiratory function. Epidemiological studies have also reported that gender is associated with COPD risk, with women showing a higher susceptibility compared to men after controlling for smoking exposure and other factors, possibly due to biological vulnerability and differences in pulmonary metabolism of harmful substances (Firdausi, 2019; Steinberg, A. W., Ozga, 2025; Wahyudi, 2022).

Cigarette smoking is one of the main risk factors for COPD because it contains various harmful substances such as tar, nicotine, carbon monoxide, arsenic, and nitrosamines, which can damage lung tissue. Long-term exposure to these substances can cause pulmonary dysfunction in both active and passive smokers (Najihah, Theovena, E. M., Ose, M. I., & Wahyudi, 2023).

The occurrence of COPD is influenced not only by smoking exposure but also by individual characteristics such as age and gender. Increasing age is associated with physiological aging processes that reduce lung elasticity and respiratory function, thereby increasing vulnerability to COPD. Gender has also been reported to be associated with COPD incidence and severity, which is thought to be related to biological and hormonal differences as well as airway responses to risk factor exposure. According to Global Burden of Disease (GBD) data, COPD is one of the leading causes of mortality due to non-communicable diseases in Indonesia. Therefore, examining the relationship between age, gender, and COPD severity is essential to understand patient characteristics and to support more targeted management and prevention strategies (World Health Organization, 2021).

In Indonesia, data describing the characteristics and severity of COPD patients are still limited, particularly in referral pulmonary hospitals that manage more complex and advanced respiratory cases. As a referral center in West Java, Dr. H. A. Rotinsulu Pulmonary Hospital receives COPD patients from Bandung and surrounding regions with varying clinical conditions and disease severities. Therefore, data obtained from this hospital are important to provide a more comprehensive overview of COPD characteristics in Bandung, especially regarding demographic profiles and disease severity patterns. In addition, referral hospitals generally have more complete spirometry facilities and standardized medical record systems, allowing more accurate assessment of COPD severity and supporting the development of evidence-based prevention and management strategies at regional healthcare levels.

Previous studies have shown varying results. Christopher (2020) reported that among 68 COPD patients, consisting of 48 men and 20 women, COPD was more prevalent in men than women. Najihah et al. (2023) found that most COPD patients were elderly (92.2%) and predominantly male (73.3%), with severe disease severity observed in 47.4% of cases. However, this contrasts with the findings of Torres et al., who reported that women exhibited more severe COPD.

Previous studies examining the relationship between age, gender, and COPD severity have produced inconsistent findings. Several studies reported that COPD severity was more common among elderly male patients, while other studies showed that female patients experienced more severe disease progression. These differences may be influenced by variations in population characteristics, smoking exposure, environmental factors, and methods used to assess COPD

severity. Furthermore, most previous studies in Indonesia primarily focused on the prevalence and risk factors of COPD rather than specifically analyzing the relationship between demographic characteristics and disease severity based on spirometry findings. Studies using data from referral pulmonary hospitals with standardized spirometry examinations, particularly pre-bronchodilator measurements, also remain limited. Therefore, further research is needed to clarify the relationship between age, gender, and COPD severity in order to provide more representative local evidence for COPD management in Indonesia.

Spirometry is the primary diagnostic test used to diagnose COPD and objectively assess airflow obstruction. This test evaluates the mechanical function of respiratory muscles, chest wall, and lungs by measuring the volume of air expelled from total lung capacity to residual volume. COPD diagnosis and assessment of forced vital capacity (FVC), forced expiratory volume in one second (FEV₁), and the FEV₁/FVC ratio are performed using spirometry. These values are measured in liters and converted into predicted percentages based on GOLD classification stages 1 to 4 (Hall, J. E., & Hall, 2021; McCormick, 2023).

According to GOLD guidelines, pre-bronchodilator spirometry can be used as an initial examination to determine whether patients with respiratory symptoms have airflow obstruction. Unless there is strong clinical suspicion of COPD, post-bronchodilator spirometry is not required if pre-bronchodilator results do not indicate obstruction. However, if pre-bronchodilator values show obstruction, post-bronchodilator measurements are necessary to confirm the diagnosis. Bronchodilator therapy aims to prevent respiratory failure, which can be fatal, by relaxing airway smooth muscles and improving lung emptying during respiration (Indonesia, 2023; Rizky Fadilla & Ayu Wulandari, 2023).

Dr. H. A. Rotinsulu Pulmonary Hospital in Bandung has diagnostic advantages, including spirometry services and an integrated medical record system, allowing accurate medical data collection. With these facilities, research can be conducted to enhance understanding of the relationship between age, gender, and COPD severity, particularly based on pre-bronchodilator spirometry results (Alter, P., Orszag, 2020; Rosida, 2024).

To address these research gaps, this study aims to investigate the relationship between age and gender and the severity of COPD among patients treated at Dr. H. A. Rotinsulu Pulmonary Hospital Bandung during the period 2020–2024, specifically focusing on patients who did not receive bronchodilators prior to spirometry, in order to obtain a more accurate representation of baseline lung function.

RESEARCH METHOD

Study Design

Using secondary data from medical records at a specific point in time, this study employed a quantitative analytical research design with a cross-sectional approach to determine the relationship between age and gender and the severity of Chronic Obstructive Pulmonary Disease (COPD).

Population and Accessible Population

Patients registered at Bandung Lung Hospital between 2020 and 2024 constituted the study population. The accessible population in this study included all patients recorded in the medical records of Bandung Lung Hospital during the period 2020–2024. This population may include outpatients who had undergone spirometry examinations.

Sample

The study sample consisted of COPD patients at Dr. H. A. Rotinsulu Lung Hospital during the period 2020–2024.

Inclusion Criteria

Patients registered at Dr. H. A. Rotinsulu Lung Hospital Bandung during 2020–2024. Patients who had undergone spirometry and were recorded in medical records during 2020–2024. Age >35 years. The age criterion of >35 years was applied because COPD generally develops gradually after long-term exposure to risk factors such as cigarette smoke, air pollution, and occupational irritants. Clinical manifestations and measurable airflow limitation are more commonly identified in individuals over the age of 35–40 years due to cumulative pulmonary damage and age-related decline in lung function. Therefore, including subjects aged >35 years was considered more appropriate to represent the population at risk for COPD and to minimize the inclusion of patients with other respiratory disorders that may mimic COPD in younger age groups.

Exclusion Criteria

Incomplete medical record data. Spirometry results obtained after bronchodilator administration, because bronchodilator effects can gradually improve lung function.

Sampling Technique

This study used a consecutive sampling method. All COPD patient data documented in medical records between 2020 and 2024 were included using this method, provided that the data met the inclusion criteria and did not fall under the exclusion criteria. Through this method, all eligible data were included sequentially according to the recording period to ensure consistent sampling and optimal representation of the study population. The sampling procedure included population identification, chronological data sorting, data verification to avoid duplication, and sample selection based on the established criteria.

Research Variables and Operational Definitions**Research Variables**

The independent variables in this study were age and gender of COPD patients. The dependent variable was the degree of COPD severity (mild, moderate, severe, and very severe) based on spirometry results.

Operational Definitions

Operational definitions are clear and measurable explanations of the variables used in the study within the research framework. COPD severity was determined based on spirometry results according to GOLD guidelines, categorized as mild ($FEV1 \geq 80\%$ predicted), moderate ($50\% \leq FEV1 < 80\%$ predicted), severe ($30\% \leq FEV1 < 50\%$ predicted), and very severe ($FEV1 < 30\%$ predicted).

Research Instrument

The research instrument consisted of secondary data in the form of medical records from Bandung Lung Hospital, which has implemented an electronic medical record system since 2019.

The collected data included patient identity, gender, age, spirometry examination results ($FEV1$, FVC , and $FEV1/FVC$ ratio), GOLD stage of COPD, as well as diagnostic history and clinical conditions. COPD diagnosis was based on physician records, with severity classification determined according to GOLD staging when available. It was ensured that patients did not have a history of bronchodilator use prior to spirometry.

Pre-bronchodilator spirometry was used in this study to evaluate baseline lung function before pharmacological airway dilation occurred. This approach was intended to provide a more objective representation of the patient's initial airflow limitation and to minimize the influence of bronchodilator responsiveness on spirometry values. In addition, the use of pre-bronchodilator measurements allowed the researchers to assess the natural severity of airflow obstruction recorded in routine clinical practice, particularly in retrospective medical record data where post-bronchodilator measurements were not consistently available for all patients.

Study Location and Period

This study was conducted at Dr. H. A. Rotinsulu Lung Hospital Bandung from February 2025 until the end of May 2025.

Research Procedure and Data Collection

Retrospective data were collected from medical records of COPD patients who underwent spirometry at Bandung Lung Hospital. The initial stage included submission of research permits, implementation of a preliminary survey, and collection of relevant literature. The implementation stage involved reviewing medical records, analyzing data, and preparing the research report. Medical record data that met the inclusion criteria were analyzed by recording parameters including age, gender, diagnosis, diagnosis date, and spirometry results based on COPD severity, which were then entered into data collection tables.

Data Analysis

Univariate analysis was used to describe sample characteristics, including age, gender, and COPD severity, presented as frequencies and percentages.

Bivariate analysis aimed to determine the relationship between independent and dependent variables. The Chi-Square test was used to analyze relationships between categorical variables, while the Spearman correlation test was used to analyze relationships between ordinal variables that were not normally distributed, with a significance level of $p < 0.05$. The relationship between age and COPD severity was analyzed using the Spearman correlation test. The relationship between gender and COPD severity was analyzed using the Chi-Square test.

Ethical Considerations

This study was conducted in accordance with research ethics principles, including beneficence, non-maleficence, respect for autonomy, and justice. Ethical approval was obtained through the Medical Research Ethics Committee of Universitas Pasundan and the ethics committee of Dr. H. A. Rotinsulu Lung Hospital Bandung. Participant privacy was strictly protected. Data were securely stored and accessed only by authorized parties, and no identifying subject information was disclosed without permission.

RESULTS AND DISCUSSIONS

This study analyzed secondary data obtained from medical records of patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD) at Dr. H. A. Rotinsulu Pulmonary Hospital, Bandung, from December 2020 to November 2024. After data cleaning and selection based on inclusion and exclusion criteria, a total of 135 medical records were included in the final analysis.

Distribution of Respondents

The distribution of respondents by year is presented in Table 1. Most of the study subjects were recorded in 2023, accounting for 123 respondents (91.1%). The limited number of respondents from 2020 to 2022 was mainly due to incomplete spirometry data, whereas data collection in 2024 was relatively low as it was conducted early in the year.

Table 1. Distribution of respondents by year

Age	Frequency (n=135)	Percentage (%)
2020	1	0,7
2021	2	1,5
2022	1	0,7
2023	123	91,1
2024	8	5,9

Characteristics of Respondents

The demographic characteristics and COPD severity of respondents are shown in Table 2. Most respondents were aged over 65 years (36.3%), followed by those aged 56–65 years (34.1%). The majority of respondents were male (74.8%). Regarding disease severity, most patients were classified as having very severe COPD (45.9%), while only one respondent (0.7%) had mild COPD.

Table 2. Characteristics of respondents

Respondent Characteristics	Frequency (n=135)	Percentage (%)
Age		
36 – 45 Year	15	11,1
46 – 55 Year	25	18,5
56 – 65 Year	46	34,1
> 65 Year	49	36,3
Gender		
Man	101	74,8
Woman	34	25,2
Degrees of PPOK		
Light	1	0,7
Currently	20	14,8
Heavy	52	38,5
Very Heavy	62	45,9

Body Mass Index and Smoking History

Additional characteristics related to nutritional status and smoking history are summarized in Table 3. Most respondents were classified as underweight (71.9%), and the majority had a history of smoking (79.3%).

Table 3. Distribution of respondents based on BMI and smoking history

Another Factor	Frequency (n=135)	Percentage (%)
Nutritional Status		
Underweight	97	71,9
Normal	35	25,9
Excessive Body Weight	1	0,7
Obesity I	0	0
Obesity II	1	0,7
Smoke		
Yes	107	79,3
No	28	20,7

Relationship Between Age and COPD Severity

The relationship between age and COPD severity is presented in Table 4. Statistical analysis using the Spearman correlation test showed a p-value of 0.956, indicating no significant relationship between age and the severity of COPD.

Table 4. Relationship between age and COPD severity

	Light	Currently	Heavy	Very Heavy	Total	P-Value
36-45 Age	0	1	7	7	15	0,956
46-55 Age	0	6	11	8	25	
56-65	0	3	18	25	46	
>65 Age	1	10	16	22	49	
Total	1	20	52	62	135	

Relationship Between Gender and COPD Severity

The association between gender and COPD severity is shown in Table 5. The Chi-square test revealed a p-value of 0.359, demonstrating no statistically significant relationship between gender and COPD severity.

Table 5. Relationship between gender and COPD severity

Derajat	Ringan	Sedang	Berat	Sangat Berat	Total	P-Value
Jenis kelamin						
Laki-laki	1	17	35	48	101	0,359
Perempuan	0	3	17	14	34	
Total	1	20	52	62	135	

Discussion

The distribution of respondents in this study showed that the majority of participants were recorded in 2023, totaling 123 individuals (91.1%). This finding indicates an improvement in the quality and completeness of medical record documentation during that period. This improvement is likely associated with the implementation of the Electronic Medical Record (EMR) system in healthcare facilities, as regulated by the Regulation of the Indonesian Ministry of Health Number 24 of 2022 concerning Medical Records. The adoption of this system has contributed to better patient data management, easier tracking of clinical histories, and improved availability of supporting data such as spirometry results, which constitute a key variable in this study (Kementerian Kesehatan Republik Indonesia, 2024; Rosida, 2024).

In contrast, the relatively low number of respondents between 2020 and 2022 may be attributed to limited access to spirometry examinations during the COVID-19 pandemic. According to the 2021 Performance Report of the Indonesian Ministry of Health, many healthcare facilities restricted non-essential diagnostic procedures to reduce the risk of infection transmission. These restrictions resulted in fewer medical records meeting the inclusion criteria, particularly those with complete pulmonary function test results. Furthermore, healthcare services during this period were primarily focused on managing COVID-19 cases, which affected the documentation of chronic diseases such as chronic obstructive pulmonary disease (COPD) (Hikmatillah, 2023; Kementerian Republik Indonesia, 2016).

In 2024, the number of respondents was lower than in 2023 because data collection was conducted early in the year. This variation in respondent numbers across years reflects administrative and data collection dynamics rather than true epidemiological differences in COPD prevalence. This observation aligns with Notoatmodjo's assertion that, in secondary data-based research, data completeness and consistency are critical determinants of research validity. Additionally, integrated electronic reporting systems have been shown to enhance data quality and reduce the risk of missing or incomplete information (Kementerian Republik Indonesia, 2022; Notoatmodjo, 2018).

Most respondents in this study were over 60 years of age, indicating that older adults represent the population most vulnerable to COPD. Physiologically, lung function begins to decline after the age of 40 due to structural changes and reduced elasticity of lung tissue, with more pronounced deterioration occurring after the age of 60. This decline is characterized by reduced lung recoil and increased lung compliance at higher volumes, leading to decreased ventilatory efficiency and an increased risk of airway obstruction in elderly individuals (Hall, J. E., & Hall, 2021; Wahyudi, 2022).

The reduction in lung elastic capacity also affects forced expiratory volume in one second (FEV₁), a key diagnostic indicator for COPD. This condition is consistent with the natural aging process, which involves degeneration of elastin and collagen fibers in the alveoli, thereby reducing the lungs' ability to maintain optimal expiratory pressure (Sherwood, 2016). The findings of this study are consistent with previous research reporting that COPD occurs two to three times more frequently in individuals over 60 years of age compared to younger populations, reinforcing the dominance of COPD cases among older adults (Edra, 2023; Handaya, D., Amalia, 2024; Najihah, Theovena, E. M., Ose, M. I., & Wahyudi, 2023; Sari, 2025).

Regarding gender distribution, most COPD patients in this study were male. This finding suggests a higher proportion of COPD among men compared to women, which can be

epidemiologically explained by the higher prevalence of smoking among men. Long-term exposure to cigarette smoke leads to chronic airway inflammation, ciliary dysfunction, and alveolar destruction, ultimately resulting in decreased pulmonary ventilation capacity (Indonesia, 2023; Venkatesan, 2024).

Smoking history is considered one of the most important contributors to COPD severity because cigarette smoke contains toxic substances that continuously damage the airway epithelium and alveolar structures. Prolonged smoking exposure increases oxidative stress, mucus hypersecretion, chronic inflammation, and destruction of lung elastic tissue, resulting in progressive decline in FEV₁ values and worsening airflow obstruction. Unlike demographic factors such as age and gender, smoking behavior represents cumulative exposure that directly affects lung tissue over time. This may explain why many patients with a significant smoking history tend to present with severe or very severe COPD regardless of demographic background. In this study, the high proportion of respondents with smoking history supports the possibility that smoking exposure contributed more substantially to COPD severity than age or gender alone.

These results are consistent with numerous studies reporting male predominance among COPD patients. However, recent evidence indicates a rising incidence of COPD among women, paralleling increasing rates of active smoking and domestic pollutant exposure, such as biomass fuel smoke. This trend suggests that although men currently dominate COPD cases, shifts in social behavior and lifestyle may alter disease patterns in the future (Steinberg, A. W., Ozga, 2025; Wang, 2025; World Health Organization, 2021).

Most respondents in this study were classified as having very severe COPD, indicating that many patients seek medical care only after the disease has progressed to an advanced stage. This pattern reflects low public awareness of early COPD symptoms and insufficient routine pulmonary function screening among high-risk groups. According to the Global Initiative for Chronic Obstructive Lung Disease (GOLD), COPD is frequently diagnosed at moderate to severe stages because early symptoms are often overlooked or mistaken for normal aging (Disease, 2024; Venkatesan, 2024).

The majority of respondents were classified as underweight based on body mass index. Malnutrition in COPD patients often results from increased energy expenditure due to excessive respiratory muscle workload, which contributes to declining lung function and increased mortality risk. These findings emphasize that nutritional status and smoking behavior play important roles in influencing COPD severity (Hall, J. E., & Hall, 2021; Muzlifa, R., Mulyadi, 2022; Sholikhah, 2019).

Bivariate analysis revealed no significant relationship between age or gender and COPD severity. This suggests that disease severity is more strongly influenced by cumulative exposure to modifiable risk factors—such as smoking habits and air pollution—rather than demographic characteristics alone. This finding aligns with previous studies indicating that behavioral and environmental exposures play a more decisive role in COPD progression than age or gender independently (Allfazmy, 2022; Firdausi, 2019; McCormick, 2023).

The absence of a significant relationship between demographic factors and COPD severity in this study suggests that other clinical and environmental factors may have a stronger influence on disease progression. Long-term exposure to cigarette smoke, occupational dust, biomass fuel, and environmental pollutants can cause chronic airway inflammation and irreversible alveolar damage, leading to progressive airflow limitation. In addition, occupational exposure in industries involving dust, chemicals, or smoke may accelerate lung function decline independently of age or gender. Comorbidities such as malnutrition, cardiovascular disease, and recurrent respiratory infections may also worsen the clinical condition and contribute to more severe COPD stages. Furthermore, the duration and intensity of smoking exposure are considered major determinants of COPD severity because cumulative toxic exposure directly affects airway remodeling and destruction of lung parenchyma over time. Therefore, modifiable environmental and behavioral

factors are likely to play a more dominant role in determining COPD severity compared to demographic characteristics alone.

CONCLUSION

Most of the research data were obtained from 2023, reflecting improvements in the completeness and quality of electronic medical record documentation at Dr. H. A. Rotinsulu Pulmonary Hospital Bandung. The majority of COPD patients in this study were elderly individuals and predominantly male, with most respondents classified as having severe to very severe COPD. These findings indicate that many patients are diagnosed at advanced stages of the disease, suggesting limited early detection and delayed healthcare utilization among high-risk populations.

The results of this study demonstrated that age and gender were not significantly associated with COPD severity. This finding suggests that disease progression is likely influenced more strongly by modifiable behavioral and environmental factors, such as smoking history, duration of smoking exposure, occupational exposure, air pollution, nutritional status, and comorbid conditions. In this study, the high proportion of respondents with smoking history supports the possibility that cumulative smoking exposure contributes more substantially to airflow limitation and worsening COPD severity than demographic characteristics alone.

The findings of this study have important implications for healthcare facilities in prioritizing COPD screening programs, particularly among individuals with significant smoking history, occupational pollutant exposure, and elderly populations. Routine spirometry screening in high-risk groups should be strengthened to enable earlier diagnosis before irreversible decline in lung function occurs. In addition, healthcare services should integrate smoking cessation counseling, environmental risk assessment, and regular pulmonary evaluation into primary healthcare programs to reduce disease progression and improve patient outcomes.

Future research is recommended to develop a more comprehensive predictive model of COPD severity by incorporating additional variables such as smoking duration, Brinkman index, occupational exposure, environmental pollution, nutritional status, physical activity, and comorbid diseases. Prospective multicenter studies with larger sample sizes and standardized spirometry assessments are also needed to improve the validity and generalizability of findings. The integration of demographic, behavioral, environmental, and clinical factors may help identify patients at higher risk for severe COPD and support the development of more targeted prevention and early intervention strategies.

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