International Journal of Chronic Obstructive Pulmonary Disease

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ORIGINAL RESEARCH

Identification of Psychosocial and Sociodemographic Factors Associated with Low Medication Awareness in COPD Subjects: A Cross-Sectional Study, Findings from the Indonesian Family Life Survey 5

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Purpose: To identify psychosocial and sociodemographic factors influencing low medication awareness among patients with Chronic obstructive pulmonary disease (COPD) based on Indonesian Family Life Survey 5 (IFLS-5).

Methods: This study used a cross-sectional design, with data from IFLS-5 (2014/2015). Inclusion criteria were subjects with a self-reported diagnosis of COPD and aged at least 15 years. Two main factors were identified as modifiable psychosocial factors (eg, insomnia, depressive symptoms, happiness status, general health check status, smoking status, and health service satisfaction) and as non-modifiable sociodemographic factors (eg, gender, age, education level, marital status, economic status, insurance ownership, religiosity, comorbidity, and place of residence). Multivariate logistic regression analysis was used to explore the relationship between these factors and the awareness of COPD medication, by observing the adjusted odds ratio (aOR) within a 95% Confidence Interval.

Results: There were 618 subjects identified with COPD, of which 53.40% were male. 84.30% of subjects have low medication awareness. Non-modifiable sociodemographic factors such as age 15–25 years (aOR: 2.531; 95% CI 1.024–6.253; p-value 0.044), age 26–35 years (aOR: 3.418; 95% CI 1.444–8.091; p-value 0.005), high school education level (aOR: 4.870; 95% CI 1.685–14.078; p-value 0.003), and modifiable psychosocial factors such as satisfaction with health services with the category "sufficient" (aOR: 2.510; 95% CI 510; 95% CI 1.508–4.176; p-value 0.000), and subjects who smoked (aOR: 1.894; 95% CI 1.147–3.127; p-value 0.013), were significantly associated with low COPD medication awareness.

Conclusion: This study shows that most subjects with COPD had low medication awareness, which is influenced by factors such as age, education level, smoking habits, and satisfaction with health services. This highlights the need for targeted interventions for high-risk groups. Limitations of this study include reliance on self-reported data, which may lead to recall bias. In addition, this study was unable to provide evidence of a causal relationship.

Keywords: COPD, medication awareness, medication adherence, IFLS-5

Introduction

Chronic obstructive pulmonary disease (COPD) is one of the chronic diseases with a high number of cases globally, particularly in Lower Middle-income Countries (LMIC).[1–3] This disease is a major contributor to poor health and ranks as the third leading cause of death globally, accounting for 3.23 million cases in 2019. Approximately 90% of COPD-related deaths occur in individuals under 70 years old and predominantly in LMIC.[3] In Indonesia, COPD was among the leading causes of death in 2019.[4] As a progressive disease characterized by persistent respiratory symptoms and airflow

Received: 27 September 2024
Accepted: 22 March 2025
Published: 9 April 2025

limitation,[3,5–7] it places a great burden on individuals and the healthcare system.[7] The medication given to COPD subjects plays an important role in controlling symptoms, reducing exacerbations, and improving clinical outcomes.[7] Despite the availability of effective medication, many subjects fail to achieve optimal disease control due to a lack of medication adherence caused by a lack of COPD medication awareness.[8–11] Therefore, improving medication awareness is essential to optimize effective management among COPD subjects.

A previous study has shown a strong relationship between medication awareness and adherence.[11] Subjects who are aware of the benefits are more prone to adhere to the prescribed medication regimen.[11,12] Medication adherence is essential in maintaining disease stability, to prevent exacerbations, and reduce the need for emergency medical care.[13,14] Non-adherence to COPD management is associated with high morbidity and mortality, hospitalization rates, and a significant increase in healthcare costs.[15–22] Therefore, low medication awareness is one of the most important issues in COPD medication management. This shows that intervention efforts from health professionals are needed to increase awareness of COPD medication.

In developing effective and targeted intervention strategies, health professionals need to understand the underlying factors influencing medication awareness.[23] Previous studies have found significant relationships between COPD awareness and some underlying factors, such as smoking status, age, gender, economic status, and employment.[24,25] Depression and anxiety also impact COPD medication,[26] although there is no similar study in Indonesia. Although previous research has identified various factors influencing medication awareness in different countries, Indonesia's geographic conditions may yield different findings. As the largest archipelagic country in the world with over 17 thousand islands,[27] the difference in residential location has a significant impact on people's access to healthcare facilities. For example, people living in rural areas often face greater barriers to accessing healthcare services compared to urban populations.[28,29] The Indonesian government has been working to address this issue through a chronic disease management program, which is designed to improve the control of chronic diseases and is available at healthcare facilities.[30] However, access to this program poses a challenge for communities living far from healthcare service facilities. This access barrier can impact the low level of public knowledge about medication, which may exacerbate medication awareness in certain regions.[31]

In addition to access to healthcare services, health literacy also contributes to awareness of medication. Individuals with good health literacy tend to better understand the importance of treatment.[32,33] The study carried out by Algifari et al (2024) shows that health literacy in Indonesia is influenced by various sociodemographic factors.[34] These sociodemographic factors also play a role in determining the level of medication adherence in patients with chronic diseases.[35] Healthcare professionals gain essential insights into medication awareness and can create more effective intervention strategies by understanding sociodemographic factors. Additionally, the psychosocial aspect is of equal importance. Studies indicate that a subject psychological state can impact their involvement in maintaining their health.[36] Additionally, the psychological condition is closely related to a person's overall health status.[37]

Indonesian Family Life Survey (IFLS) is a large-scale longitudinal survey in the country, providing data that enables understanding of various behaviors at individuals, household, family, and community levels.[38] However, studies on COPD using IFLS data have only focused on identifying factors that influence COPD incidence.[39] Based on previous research, the underlying factors explored focused predominantly on identifying non-modifiable factors.[24,25] Although these results are important, identifying modifiable underlying factors provides new information for healthcare professionals that allows the development of more population-specific and personalized interventions, leading to optimal medication management for COPD subjects. This highlights the need to identify underlying factors, especially modifiable factors, that contribute to the low awareness of COPD treatment in Indonesia. Therefore, this study aimed to identify psychosocial and sociodemographic factors influencing low COPD medication awareness based on data obtained from IFLS-5.

Materials and Methods

Study Design

This is an analytical observational study with a cross-sectional design. The secondary data used were obtained from the longitudinal IFLS-5, collected from 2014 to 2015. The IFLS-5 survey used a multistage stratified sampling design

representing 83% of the Indonesian population. The population was drawn from 13 provinces, comprising four from Sumatra (West Sumatra, North Sumatra, South Sumatra, and Lampung), five on the island of Java (DKI Jakarta, West Java, Central Java, DI Yogyakarta, and East Java), as well as four other provinces (Bali, West Nusa Tenggara, South Kalimantan, and South Sulawesi). This survey included information collected from individuals, households, and health facilities. The data obtained focused on individual and household health, sociodemographic, socioeconomic, and psychosocial factors.[38] The IFLS sampling strategy was stratified by province and urban/rural location, and then the sample was randomly drawn within those strata.[38] Provinces were selected to maximize population representation, capture Indonesia's cultural and socio-economic diversity, as well as the cost-effectiveness of conducting the survey given the vastness of Indonesia. In each of the 13 provinces, enumeration areas were randomly selected from the nationally representative sampling frame used in the 1993 SUSENAS, a socio-economic survey covering approximately 60,000 households.[38] IFLS randomly selected 321 enumeration areas in the 13 provinces, oversampling EAs in urban areas and EAs in smaller provinces to facilitate urban-rural and Java-non-Java comparisons.[38]

Study Ethics

The IFLS and methodologies passed through extensive review and received approval from the Institutional Review Board (IRB) in both the United States and Indonesia at Universitas Gadjah Mada (UGM) for IFLS-3, IFLS-4, and IFLS-5. Therefore, all consent protocols for adults and children were fulfilled and sanctioned by the IRB before the survey procedures commenced, with written informed consent being secured from all subjects prior to data collection.[40] The IFLS study received approval from the RAND Human Subjects Protection Committee (s0064-06-01-CR01). Per the 2022 Standard Operating Procedures (SOP) of the Research Ethics Committee of Universitas Padjadjaran ((No. POB/08/KEP), research involving existing data, publicly available documents, pathological specimens, or diagnostic specimens managed to protect participants' identities is deemed exempt from ethical review requirements.[41]

Study Population

The total number of observations that filled out the family health questionnaire was 34,257 subjects.[42] The inclusion criteria were subjects aged 15 years with self-reported COPD diagnosis data from doctors, nurses, or midwives. These subjects were determined by the response to the question "Has a doctor/paramedic/nurse/midwife ever told you that you have a chronic lung condition or disease?" if the response was "Yes" the subject was considered to have a diagnosis of COPD.[42] The question did not specifically ask about COPD but could be used as a proxy for COPD. This was because other chronic lung diseases, such as asthma, tuberculosis, and lung cancer were specifically asked in this IFLS-5 questionnaire. Nonetheless, considering COPD is a chronic disease that requires long-term care,[43,44] the reports from the subjects of this study are considered representative of their condition.

Checking Missing Data

Little's test statistic was used to analyze when there was incomplete data. This statistic was conducted to determine whether the incomplete data fell under the category of Missing Completely at Random (MCAR). Previous studies define MCAR as missing data unrelated to the subjects under study.[45] Data were considered MCAR when the p-value was greater than 0.005.

Outcome Measure

Medication awareness is defined by knowledge and acceptance of the disease and its medication.[46] Based on that understanding, we categorize the subjects into the aware category when they answer this question. "Are you currently taking prescription medication from a doctor/paramedic/nurse/midwife that must be taken at least once a week to manage a chronic lung condition?".[42] If he/she responds with Yes, he/she accepts the medication. Conversely, a No indicates he/she does not accept it, categorizing the subject as having low medication awareness.[46,47] Medication awareness includes all types of medications prescribed by a healthcare professional to manage a COPD subject condition.

Potential Factors Related to COPD Medication Awareness

Several basic factors related to COPD medication awareness were obtained.[24,25] Subsequently, two main factors were identified, comprising psychosocial and sociodemographic, which were categorized into modifiable and non-modifiable.

Modifiable Psychosocial Factors

Modifiable factors included smoking status, insomnia, depression symptoms, happiness status, general health check status, and satisfaction with health services. To determine the insomnia status of COPD subjects, data were obtained from IFLS-5 in Book 3B, section TDR (sleep).[42] The Patient-Reported Outcomes Measurement Information System (PROMIS) questionnaire was used to measure insomnia status. To assess sleep quality, 10 questions were posed, consisting of two about sleep quality and eight about sleep disorders. These questions were retrospective over the past 7 days. A 5-point ordinal scale was used in this questionnaire assessment (0 = never, 1 = rarely, 2 = sometimes, 3 = often, 4 = always). This questionnaire has undergone validity and reliability testing. Subsequently, the Survey Meter staff performed an initial translation into Indonesian. After that, two independent translators from outside were commissioned to translate it back into English. This re-translation into English was then approved by PROMIS English.[38]

Data on depression symptoms were taken from Book 3B Household IFLS-5 in section KP (mental health). The IFLS-5 survey used the Center for Epidemiologic Studies Depression Scale (CES-D) questionnaire. CES-D is the scale used for a brief self-report to measure depression symptoms,[38] consisting of 10 questions that are part of the main international scale for assessing depression symptoms.[38] The CES-D evaluates the feelings experienced by subjects over the last week.[42] It consists of eight questions about negative feelings, three about feelings of depression, five on somatic symptoms), and two on positive feelings.[48] Furthermore, subjects were asked to indicate how often the feelings occurred in the last week.[42] For each question about the feelings, there are four scales, namely 1 = rarely or never (<1 day), 2 = some days (1–2 days), 3 = occasionally (3–4 days), 4 = most of the time (5–7 days).[42] The final score was calculated by summing the total score from all items obtained. When the total score is ≥10, it is considered that the subjects have depression symptoms.[49]

For data on subjects "happiness status", information was obtained from IFLS-5 in Book 3A, section SW (subjective wellbeing), specifically question SW12. The questions asked to the subjects were "Taken all things together how would you say things are these days, would you say you were very happy, happy, unhappy, or very unhappy?".[50] Those who answered "very happy" or "happy" were categorized as happy, while subjects with 'unhappy' or 'very unhappy' answers were considered unhappy. General medical check-up data was obtained from subjects answers to the question, "Have you had a general medical check-up performed in the last 5 years?". Those who answered "no" were categorized as never had a general medical check-up, while subjects with "yes" were categorized as ever having a general medical check-up.

Health service satisfaction status data obtained from Book 3A section SW in question sw05 of IFLS-5 ("Concerning your healthcare, which of the following is true?").[50] Satisfaction with healthcare services is categorized as less satisfactory when the subjects answers "It is less than adequate for my needs". Answer is considered sufficient when the response is "It is just adequate for my needs or more than adequate for my needs.

Non-Modifiable Sociodemographic Factors

Non-modifiable factors included gender, age, education level, marital status, income, insurance ownership, religiosity, comorbidity, and place of residence. Data on sociodemographic and other related factors were obtained from Book K, 3B, and 3A. The data collected were gender, age which was categorized into five groups, namely 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 was categorized as no schooling, primary/elementary school, junior high school/equivalent, senior high school/equivalent, and higher education. Marital status data was divided into two, namely married and unmarried. Furthermore, economic status was obtained from income data over the last 12 months, where total family income in rupiah was divided by the number of family members per capita income, which was classified per quintile. Insurance data was divided into two categories, namely "No" and "Yes". Religious data was grouped into two, consisting of non-religious and religious. Comorbidity data was grouped into three, namely no comorbidities, 1–2 comorbidities, and ≥3 comorbidities. Residential data was categorized into two, comprising rural and urban.

Statistical Analysis

Univariate data analysis was conducted by presenting the characteristics of subjects with categorical data as numbers and percentages for each data point. Little's test statistics were used to determine the type of missing data, which were identified as MCAR when the p-value was greater than 0.005. Chi-square test was used for bivariate analysis to assess univariate association between characteristics and outcomes of subjects. Factors potentially associated with outcomes, identified with a significance level of p-value less than 0.25 on bivariate analysis, were included in the initial multivariate test to obtain Odds ratios. Subsequently, adjusted Odds Ratio (aOR) was determined using multivariate binary logistic regression with 95% Confidence Interval (CI) and manual backward elimination. For factors included in the final model, a p-value of 0.05 set by the Hosmer-Lemeshow test was used to assess model fit. The Pseudo R-square value, which was the default value reported by Stata, was obtained as an equivalent value to the R-square reported in regression. The R-square value ranged from 0 to 1,[51] indicating the extent to which the combination of independent variables simultaneously affected the value of the dependent variable. Statistical analysis in this study was conducted using Stata software version 17.0 for Windows.

Results

Characteristics of COPD Subjects

In this study, Little's test statistic result was 0.000, indicating that missing data was not classified as MCAR, therefore, this study used multiple imputation to address the missing data. A total of 34,257 subjects completed the household health questionnaire in IFLS-5. We identified 618 of these subjects as having COPD with 84.30% of the subjects showing a low level of medication awareness. Approximately 53.40% of subjects were male, 24.43% were 26–35 years old, and elementary school/equivalent education level comprised 32.04%. The majority of COPD subjects were married (66.50%), had economic status in quintile 1 (22.82%), living in urban areas (67.31%), and had health insurance (55.02%). A total of 62.30% had a religious status, 57.44% had 1–2 comorbid diseases, and 58.58% were non-smokers. The majority of subjects did not have a general medical check-up (75.40%), felt quite satisfied with the health services (65.05%), with a happiness status of "happy" (75.57%), had no insomnia problems (75.08%), and did not have symptoms of depression (61.97%) (Table 1).

Table 1 Characteristics of COPD Subjects (N= 618)

Subject Characteristics	Number	Percentage (%)
COPD Medication Awareness		
Low Awareness	521	84.30
High Awareness	97	15.70
Non-Modifiable Sociodemographic Factors		
1. Gender		
Male	330	53.40
Female	288	46.60
2. Age (in years)		
15–25	132	21.36
26–35	151	24.43
36–45	118	19.09
46–55	83	13.43
56–65	67	10.84
>65	67	10.84

(*Continued*)

 https://doi.org/10.2147/COPD.S498302

Table 1 (Continued).

Subject Characteristics	Number	Percentage (%)
3. 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
4. Marital Status		
Unmarried	207	33.50
Married	411	66.50
5. 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
6. Residence		
Rural	202	32.69
Urban	416	67.31
7. Health Insurance Ownership		
No	277	44.82
Yes	340	55.02
Missing	1	0.16
8. Religiosity		
Non-religious	166	28.86
Religious	385	62.30
Missing	67	10.84
9. Comorbid Status		
No Comorbidities	249	40.29
1–2 Comorbidities	355	57.44
≥3 Comorbidities	14	2.27

(*Continued*)

Table 1 (Continued).

Subject Characteristics	Number	Percentage (%)
Modifiable Psychosocial Factors		
1. Smoking Status		
Not Smoker	362	58.58
Smoker	256	41.42
2. General Medical Check-up Status		
Never Had a General medical check-up	466	75.40
Ever Having a General medical check-up	87	14.08
Missing	65	10.52
3. Health Service Satisfaction		
Less Satisfactory	150	24.27
Sufficient	402	65.05
Missing	66	10.68
4. Happiness Status		
Unhappy	87	14.08
Happy	467	75.57
Missing	64	10.36
5. Insomnia		
No Insomnia	464	75.08
Insomnia	90	14.56
Missing	64	10.36
6. Depression Symptoms Status		
No Depression Disorder	383	61.97
Depression Disorder Present	171	27.67
Missing	64	10.36

Study Outcome

In the bivariate test, the factors of age, education level, economic status, place of residence, health service satisfaction, insomnia, comorbid status, smoking status, general medical check-up, and happy status, had a p-value <0.25. Therefore, these factors were included in the initial multivariate model analysis, as shown in Table 2.

The results of multivariate logistic regression analysis in COPD subjects showed that age 15–25 years (aOR: 2.531; 95% CI 1.024–6.253; p-value 0.044) and age 26–35 years (aOR: 3.418; 95% CI 1.444–8.091; p-value 0. 005) had significant association (Table 3). Furthermore, health service satisfaction with "sufficient" category (aOR: 2.510;

Table 2 Bivariate Analysis Results of Subjects Characteristics with Awareness of COPD Medication

Characteristic	Awareness of COPD Medication				p-value
	Low		High		
	n	%	n	%	
Gender					
Male	283	54.32	47	48.45	0.288
Female	238	45.68	50	51.55	
Age (in years)					
15–25	119	22.84	13	13.40	0.000*
26–35	138	26.49	13	23.7	
36–45	103	19.77	15	15.46	
46–55	67	12.86	16	16.49	
56–65	48	9.21	19	19.59	
>65	46	8.83	21	21.65	
Education Level					
No/ Not Yet in School	23	4.41	15	15.46	0.000*
Elementary/equivalent	157	30.13	45	46.39	
Junior High School/equivalent	82	15.74	19	19.59	
Senior High School/ equivalent	181	34.74	9	9.28	
College/University	78	14.97	9	9.28	
Marital Status					
Unmarried	173	33.21	34	35.05	0.724
Married	348	66.79	63	64.95	
Economic Status					
Quintile 1	110	21.11	31	31.96	0.007*
Quintile 2	99	19.00	22	22.68	
Quintile 3	105	20.15	24	24.74	
Quintile 4	101	19.39	8	8.25	
Quintile 5	106	20.35	12	12.37	
Residence					
Rural	162	31.09	40	41.24	0.051*
Urban	359	68.91	57	58.76	
Health Insurance Ownership					
No	234	44.91	44	45.36	0.907
Yes	287	55.09	53	54.64	

(*Continued*)

Table 2 (Continued).

Characteristic	Awareness of COPD Medication				p-value
	Low		High		
	n	%	n	%	
Religiosity					
Non-religious	158	30.33	23	23.71	0.336
Religious	363	69.67	74	76.29	
Comorbid Status					
No Comorbidities	297	57.01	38	39.18	0.003*
1–2 Comorbidities	198	38	49	50.52	
≥3 Comorbidities	26	4.99	10	10.31	
Smoking Status					
Not Smoker	297	57.01	65	67.01	0.066*
Smoker	224	42.99	32	32.99	
General Medical Check-up Status					
Never	439	84.26	78	80.41	0.147*
Ever	82	15.74	19	19.59	
Health Service Satisfaction					
Less Satisfactory	130	24.95	52	53.61	0.000*
Sufficient	391	75.05	45	46.39	
Happiness Status					
Unhappy	83	15.93	29	29.90	0.016*
Happy	438	84.07	68	70.10	
Insomnia					
No Insomnia	441	84.64	70	72.16	0.033*
Insomnia	80	15.36	27	27.84	
Depression Symptoms Status					
No Depression Disorder	358	68.71	73	75.26	0.547
Depression Disorder Present	163	31.29	24	24.74	

Note: *p-value <0.25 was included in the initial multivariate analysis.

95% CI 1.508–4.176; p-value 0.000), subjects who smoked (aOR: 1.894; 95% CI 1.147–3.127; p-value 0.013), and high school education level (aOR: 4.870; 95% CI 1.685–14.078; p-value 0.003), were significantly associated with low COPD medication awareness (Table 3). The result of goodness-of-fit test was p-value of 0.2195 and a pseudo R-square of 13.17%.

 https://doi.org/10.2147/COPD.S498302

Table 3 Multivariate Logistic Regression Analysis of Factors Influencing Low Awareness of COPD Medication

Characteristics	Odds Ratio (95% CI)	p-value
Age (in years)		
15–25	2.531 (1.024–6.253)	0.044
26–35	3.418 (1.444–8.091)	0.005
36–45	2.071 (0.902–4.752)	0.086
46–55	1.914 (0.856–4.282)	0.114
56–65	1.162 (0.527–2.560)	0.709
>65	Reference	
Health Service Satisfaction		
Less Satisfactory	Reference	
Sufficient	2.510 (1.508–4.176)	0.000
Smoking Status		
Not Smoker	Reference	
Smoker	1.894 (1.147–3.127)	0.013
Education Level		
No/ Not Yet in School	Reference	
Elementary/equivalent	1.646 (0.753–3.596)	0.211
Junior High School/equivalent	1.146 (0.446–2.943)	0.776
Senior High School/ equivalent	4.870 (1.685–14.078)	0.003
College/University	2.159 (0.746–6.243)	0.155

Note: Goodness-of-fit-test p-value:0.2195; pseudo R-square: 13.17%.

Discussion

This study found that 84.30% of subjects with COPD had a low level of medication awareness. Based on multivariate analysis, factors such as age 15–35 years, including subjects with sufficient health service satisfaction category, smoking status, and high school education level had a significant association with low COPD medication awareness. Age 15–35 years had a significant association compared to COPD subjects aged >65 years, which was similar to a previous study.[24] Subjects aged 15–35 years perceived their COPD to have mild symptoms,[5] leading to a lack of concern for medication. COPD is a progressive condition, those affected may not have significant symptoms until their late 40s or 50s.[5,7] Similarly, Tudorache et al (2017) showed that COPD subjects at old age experienced decreased physical capacity, cognitive function, and high inflammation.[52] The factor that was found to have a significant association with low awareness of COPD medication was health service satisfaction in the sufficient category. This showed that even though the level of health service satisfaction reached the sufficient category, there was no significant increase in awareness. Consequently, health care satisfaction is essential since it serves as an indicator of the quality of health services.[53] Subjects' satisfaction with health services may also influence their ability to achieve favorable clinical results.[54] The level of satisfaction with healthcare services plays a role in encouraging patients to visit healthcare facilities as well as to follow recommendations from medical personnel in adhering to the prescribed treatment.[55,56] Effective communication among healthcare personnel in medical service facilities is a key factor in improving patients' understanding and knowledge of their disease conditions and the treatments they are undergoing.[57,58] This contributes to increasing patient

awareness in undergoing therapy for COPD. The results showed that smoking status had a significant relationship with low awareness of COPD medication, as obtained in previous studies.[25,59] However, it was reported that subjects who smoked considered COPD as a non-serious disease.[60] Several studies have shown that the high awareness of medication in subjects who smoke was influenced by their knowledge of COPD.[25,61,62]

In general, developed countries tend to have better access to health education and patient support programs,[63] which contribute to higher medication awareness. However, this condition is contrasted in developing countries.[64] This study shows that COPD subjects with high school education have a significant relationship with lower awareness of treatment compared to subjects who are uneducated. Previous research in Saudi Arabia showed results that differ from the findings of our study.[24] However, the study did not clarify why there is no relationship between medication awareness and education level.[24] The differences in the settings of the countries can be one of the factors that influence the variations in the results of this research. Additionally, there may be other factors that are more significant in determining the level of awareness of COPD medication in that country. This is supported by a scoping review conducted in Saudi Arabia, which indicates that certain aspects remain challenging, including ineffective communication between doctors and patients, limited access to healthcare services in rural areas, and low patient involvement in disease management.[65]

The possible reason for the relationship identified in this study is that individuals with lower education levels or those who did not attend school tend to trust the advice of doctors or health professionals more, leading to higher compliance with the recommended medication. Research by Lin et al is supported by showing that people with low educational levels tend to trust doctors' advice more.[66] Additionally, low education levels frequently correlate with low health literacy, resulting in challenges when accessing, understanding, and utilizing health information.[67] This creates challenges for them in understanding intricate medical terms or assessing the reliability of online health resources.[67] Consequently, people with low health literacy might prefer to directly communicate their symptoms and concerns to healthcare providers instead of searching for information online.[68] Therefore, this may explain why, in this study, subjects with a high school education have a lower awareness compared to those who are uneducated or possess low education levels. The 95% CI range in the group of subjects with high school education or equivalent was very large, which showed a high variability in the data.[69] The wide range indicated that the actual estimate of the effect may differ significantly.[69]

In this study, the majority of the non-modifiable and modifiable factors, including gender, had no statistically significant association. This result was different from the study conducted by Mahmood et al (2023). COPD symptoms in women are generally more severe than in men. As a result, women tend to recognize COPD earlier than men.[70] Severe symptoms prompt women to understand that COPD treatment is essential for managing the condition.[70] Additionally, particularly in Indonesia, since most men are employed,[71] their limited interaction with health professionals may be a factor contributing to men's lower awareness of medication.[72] While some studies suggest various factors influencing low awareness based on gender, it is possible that no significant relationship exist between gender and medication awareness. This may be attributed to several elements, including the fact that COPD is a progressive disease, worsening in symptoms with age and duration.[5,7] Therefore, individuals suffering from COPD may be slower to recognize their condition, impacting their awareness of the required treatment. Other factors may include those with low economic status; in Indonesia, approximately 25.22 million people live below the poverty line,[73]. The study indicated that most COPD subjects fell within the lower quintiles, suggesting that even if they are feeling the disease's symptoms, economic constraints pose a barrier to accessing healthcare services.[74] Therefore, these factors might explain the lack of a significant association between gender and low awareness of COPD medication.

Marital status was also found to have no statistically significant relationship in multivariate statistics. Similar results were obtained Baiardini et al (2019). However, this result was different from the findings in the previous study.[24] Married individuals tend to exhibit better health awareness, influenced by having a partner with a higher level of education, which enables a better understanding of health matters.[75] Therefore, the lack of a significant association between marital status and low awareness of COPD treatment might be explained by the fact that marital status does not directly correlate with treatment awareness.

Differences in urban and rural residence were not found to be associated with COPD medication awareness. The difference between living in rural and urban areas is closely related to an individual's ability to access healthcare facilities.[28,29] Those residing in rural areas generally face greater difficulties in reaching healthcare services, while urban

residents tend to have better opportunities to access such facilities for monitoring their health.[28,29] Consequently, individuals who frequently visit healthcare facilities are more likely to acquire knowledge and develop a good understanding of diseases and their treatments, which encourages greater awareness of their own treatment.[76] The possible reason for the lack of a significant relationship between living location and the treatment awareness of COPD subjects in this study is that both those living in the city and those in rural areas face barriers to accessing healthcare facilities, such as transportation issues, patients avoiding care from healthcare professionals, and the long distance to healthcare services.[29,77,78]

Furthermore, the insurance ownership factor and economic status had no relationship with medication awareness. Individuals who have health insurance receive a guarantee of medical care costs from the insurance they possess, and individuals with higher economic status have the financial means to consistently consult health professionals for examinations.[79,80] Meanwhile, those who do not have insurance tend to consider various aspects before visiting healthcare facilities because they must bear the costs of examinations themselves.[81] Although the cost of care is the main factor in a person's decision to seek medical services, In reality, both the insured and uninsured, as well as people from different economic levels, still face other barriers to accessing healthcare.[82] For example, in Indonesia, the government has made efforts to ensure access to healthcare services for the entire population through health insurance programs. However, those who receive health coverage from the government still face various obstacles, including the suboptimal implementation of healthcare services.[83] Medical professionals play an important role in enhancing patients' understanding of treatments and encouraging behavioral changes to promote greater awareness and adherence to the prescribed therapy.[23] Therefore, the lack of a significant relationship between insurance ownership and economic status with low awareness of COPD medication is likely due to all groups facing barriers in accessing healthcare services from health professionals. Interaction with health professionals is one of the key factors in determining awareness and adherence to COPD medication.[23,84]

Religious factors showed no statistical association in multivariate statistics with the low awareness of COPD medication. However, this varied significantly as religious or spiritual beliefs influenced medical decisions in severe diseases.[85,86] Therefore, religious beliefs are highly variable and depend on each person, which may influence an individual's decision to seek medical attention.

Comorbid factors in this study did not show a significant relationship in multivariate statistics COPD subjects develop comorbid diseases due to a lack of medication control.[87] This phenomenon can be associated with the limited information regarding the complexity of COPD medication.[88] Therefore, an individual's knowledge and understanding of the disease conditions and the therapy being undergone become factors that more directly influence medication awareness. Thus, the lack of a relationship between comorbidities and medication awareness in COPD may be due to the fact that comorbidities are not a direct factor influencing awareness in undergoing medication.

General medical check-up were also unrelated to the low awareness of COPD medication. In Indonesia, a general medical check-up is a package of examinations that includes physical, laboratory, and radiological assessments. This examination is commonly conducted for job requirement purposes.[89] However, the cost of this examination is not covered by Indonesia's government health insurance.[90] Therefore, individuals who wish to undergo a general medical check-up for personal reasons must bear the entire cost themselves. Although this examination is recommended to be done at least once a year, financial constraints seem to be the main factor hindering the Indonesian community from undergoing general medical check-ups.[91] As a result, the number of individuals who do not undergo this examination is higher. Generally, individuals undergo a general medical check-up as a preventive measure against disease progression,[92] reflecting their awareness of their health condition and treatment. Therefore, the potential lack of a relationship between general medical check-up status and low medication awareness of COPD may be due to the large disparity in sample proportions, indicating that the actual estimate of the effect may differ significantly.[69]

Furthermore, the factor of happiness in this research also has no relationship with awareness of COPD medication. Happy people tend to demonstrate better disease management.[93,94] Individuals with effective disease management tend to be more aware of their medication. However, this study may not identify a significant relationship between happiness levels and low treatment awareness of COPD due to other more influential factors affecting medication awareness in this

research. For instance, communication between patients and clinicians; a study shows that effective communication fosters patient trust in treatment advice, which, in turn, helps them recognize the importance of their medication.[95]

Previous research has also highlighted that psychological factors can influence a person's health condition and medication use in COPD patients.[36,37,96] However, this study found no significant relationship between depressive symptoms and sleep disorders with low medication awareness. Another study showed that COPD patients with depressive disorders demonstrated good medication awareness and adherence due to the impact of educational interventions provided by healthcare professionals.[97] This indicates that patient education delivered by healthcare professionals is directly linked to medication awareness and adherence levels.

Two of the four factors associated with low medication awareness are modifiable. This provided important insights for health professionals in developing intervention strategies to improve medication awareness among COPD subjects in Indonesia. Modifiable psychosocial factors such as COPD subjects with smoking status, their awareness of COPD medication was low. This showed the need for potential intervention strategies to enhance medication awareness through education aimed at increasing knowledge on the significance of COPD medicine and the hazards associated with smoking.[61,62,98] The health service satisfaction factor with a sufficient category also showed a significant association. This showed that health professionals should increase satisfaction levels by improving the quality of health services.[99] This quality improvement can involve enhancing the quality of medical services and fostering effective communication between healthcare professionals and COPD subjects.[100] Regarding non-modifiable sociodemographic factors, subjects with age groups less than 36 years and senior high school education levels showed a significant association with low adherence.[101,102] Furthermore, the role of health professionals, particularly pharmacists, in increasing knowledge was considered essential to awareness of COPD subjects' medication.[103–105] Personalized counseling can be an effective method for increasing treatment awareness in individuals with COPD by tailoring the counseling materials to the specific needs of each patient.[106,107]

Strategies for intervention plans aimed at enhancing the quality of healthcare and communication between health professionals and COPD patients can be designed with a holistic approach. First, improving the quality of medical services can be done through periodic training for health workers to improve their understanding in COPD management.[97,108] Then, integration of health services is also important to improve interprofessional coordination in managing COPD patients in a multidisciplinary manner.[109] Effective communication between health professionals and patients is also key in improving medication awareness. A patient-centered care approach can be implemented with more empathetic and personalized communication to build patient trust in health workers.[57] Information delivery also needs to be tailored to the patient's educational background to make it easier to understand and accept.

In addressing sociodemographic factors, patients under 36 years of age and patients with high school education who tend to have low awareness of medication can be provided with more engaging education, such as short videos on social media, interactive webinars, or gamification of health education.[110,111] Meanwhile, for elderly patients, community-based education such as support groups and in-person counseling at health facilities can be a more effective solution.[112] The use of simple and easy-to-understand educational materials also needs to be considered so that information can be well received by this group.

The role of pharmacists in raising awareness of COPD medication is crucial, especially through personal counseling to ensure patients understand the correct use of medication, including proper inhalation technique.[113,114] This approach can be strengthened by providing educational leaflets as well as digital reminders via SMS or health apps to encourage patient discipline.[115,116] In addition, the implementation of personalized counseling is also an effective strategy in increasing patient awareness of medication.[106,107] By integrating these strategies, it is expected that patient awareness of COPD medication will increase, thereby contributing to better health outcomes and a more optimal quality of life for patients.

Strength and Limitations

This study is the first to analyze modifiable and non-modifiable underlying factors of low COPD medication awareness in Indonesia. The strength is the use of the IFLS database, which contains health survey results representing 83% of the population in Indonesia, with a total of 34,271 observations on household health questionnaires. However, this study had

several limitations, including a low R-squared value, which suggests that other factors may have a stronger association with awareness of COPD medication, such as the subject's lack of knowledge about the importance of treatment for their condition and health literacy.[33,117–119] Due to its cross-sectional design, this study could not establish a causal relationship between psychosocial and sociodemographic factors affecting the low awareness of COPD medication. Additionally, the diagnostic data depended on self-reported information, introducing the potential for recall bias or the inclination to provide socially desirable responses. Self-diagnosis data from COPD subjects could not be confirmed with objective results such as lung function measurements, as the IFLS-5 questionnaire does not include such supporting examination data. Nonetheless, considering COPD is a chronic disease that requires long-term care,[43,44] the reports from the subjects of this study are considered representative of their condition. We acknowledge that participants' responses to the questionnaire may be influenced by their cultural background. Nevertheless, the direct impact of cultural influence was not considered in this study. The findings of this study should not be generalized to countries with different characteristics from Indonesia.

Suggestions for Future Studies

In future studies, considering the use of longitudinal data to confirm the associations identified in our study would enhance the understanding of these relationships and aid in establishing causal inferences. This method would enable the monitoring of changes over time and more effectively capture the dynamics driving the observed associations. We acknowledge the significance of this perspective as a crucial focus for future research efforts.

Conclusion

This study shows that most subjects with COPD had low medication awareness, which is influenced by factors such as age, education level, smoking habits, and satisfaction with health services. This highlights the need for targeted interventions for high-risk groups. Limitations of this study include reliance on self-reported diagnostic data, which may lead to recall bias. In addition, this study was unable to provide evidence of a causal relationship.

Acknowledgments

We would like to express our sincere gratitude to Universitas Padjadjaran for generously funding the publication of this journal. Wj received support from the Beasiswa Unggulan Pascasarjana Padjadjaran (BUPP) scholarship provided by Universitas Padjadjaran.

Funding

This research was funded by a grant-in-aid from Universitas Padjadjaran. WJ received support from the Beasiswa Unggulan Pascasarjana Padjadjaran (BUPP) scholarship provided by Universitas Padjadjaran. Grant number: 4269/UN6.3.1/PT.00/2023.

Disclosure

The authors declare that there are no competing interests in this work.

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