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Evaluation Of The Use Of Mdi And Dpi Inhaler Preparations In Chronic Obstructive Pulmonary Disease (Copd) Patients At Uns Hospital

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Abstract

Chronic Obstructive Pulmonary Disease (COPD) is a chronic lung disease characterized by progressive and not fully reversible airflow limitation. One of the main therapies for COPD is inhaled medication delivered through Metered Dose Inhalers (MDI) and Dry Powder Inhalers (DPI). The success of therapy is strongly influenced by the correctness of inhaler technique, as improper use can reduce drug deposition in the airways and affect clinical outcomes. This study aimed to evaluate the accuracy of MDI and DPI inhaler use and its relationship with the FEV_1/FVC ratio in COPD patients at RS UNS. This study employed a non-experimental design with a cross-sectional approach. A total of 100 COPD patients who met the inclusion criteria were selected using purposive sampling. Sociodemographic data and inhaler-use accuracy were obtained through direct interviews, while FEV_1/FVC values were collected from medical records. The data were analyzed using the Chi-Square test with a significance level of $\alpha = 0.05$. The results showed that most respondents were over 45 years old (80%) and female (56%). The level of correct inhaler use was low in both MDI users (22.2% correct) and DPI users (13.2% correct). There was no significant relationship between sociodemographic factors and inhaler-use accuracy ($p > 0.05$). However, a highly significant relationship was found between inhaler-use accuracy and achievement of the FEV_1/FVC ratio ($p < 0.001$), in which all patients with correct inhaler technique achieved the target FEV_1/FVC. In conclusion, appropriate inhaler technique plays a crucial role in achieving optimal pulmonary function outcomes in COPD patients. Therefore, continuous education and regular evaluation of inhaler technique are essential to support the success of COPD therapy.

Keywords: Chronic Obstructive Pulmonary Disease (Copd), Dry Powder Inhaler (Dpi), Fev_1/Fvc, Inhaler Technique Accuracy, Metered Dose Inhaler (Mdi).

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a preventable and treatable lung disease characterized by persistent and generally progressive respiratory symptoms and airflow limitation, associated with an excessive chronic inflammatory response in the airways and lung parenchyma to noxious gases or particles. Exacerbations and comorbidities contribute to disease severity. The characteristics of airflow limitation in COPD are caused by a combination of small airway obstruction (obstructive bronchiolitis) and parenchymal damage (emphysema) that varies from individual to individual, due to chronic inflammation that causes loss of communication between the alveoli and small airways and decreased lung recoil elasticity (Ministry of Health, 2019).

Chronic Obstructive Pulmonary Disease (COPD) is a preventable and treatable lung disease characterized by persistent and generally progressive respiratory symptoms and airflow limitation, associated with an excessive chronic inflammatory response in the airways and lung parenchyma to noxious gases or particles. Exacerbations and comorbidities contribute to disease severity. The characteristics of airflow limitation in COPD are caused by a combination of small airway obstruction (obstructive bronchiolitis) and parenchymal damage (emphysema) that varies from individual to individual, due to chronic inflammation that causes loss of communication between the alveoli and small airways and decreased lung recoil elasticity (Ministry of Health, 2019).

According to the Global Adult Tobacco Survey (GATS), 65.5% of men and 3.3% of women currently use tobacco (smoking, smokeless tobacco, or heated tobacco products) (Handayani, 2021). Over the past two decades, Indonesia has experienced a drastic increase in particulate matter concentrations, from 8 µg/m^3 to 22 µg/m^3. According to the Air Quality Life Index (AQLI), 80 percent of Indonesia's population of over 250 million is exposed to air pollution, with average annual

pollution concentrations exceeding WHO guidelines. The country even has the fifth highest loss of life expectancy in the world due to particulate pollution (AQLI, 2019). The high number of smokers in Indonesia and the worsening air quality will increase the number of COPD sufferers in Indonesia. According to the Basic Health Research (Riskesdas, 2013), the death rate due to COPD is ranked 6th out of 10 causes of death in Indonesia and the average prevalence of COPD is 3.7% (Riskesdas, 2013).

Bronchodilators are medications that can help open the airways and are one of the main treatments for COPD. Bronchodilators help keep the airways open and can reduce secretions. Bronchodilators are most often administered as inhalation using a metered-dose inhaler (MDI), dry powder inhaler (DPI), or nebulizer. Correct use of the inhaler is crucial to deliver the correct dose of medication to the lungs. If the inhaler is not used correctly, little or no medication will reach the lungs (Helito, 2019). The advantages of inhalers include fast-acting relief and easy portability. This is the reason for their widespread use in COPD patients (Ulfah, 2020).

Clinical outcomes in patients with chronic obstructive pulmonary disease (COPD) can be seen from lung function after bronchodilator use. The ratio between FEV_1 and forced vital capacity (FVC) is a visual index to measure lung function. An FEV_1/FVC ratio <0.70 after bronchodilator administration indicates persistent airflow obstruction (GOLD, 2025).

Previous research conducted by Afifah, et al. (2020) with the title of the level of knowledge of asthma and COPD outpatients at Mitra Sehat Pandaan Hospital regarding how to use inhalers, showed that 68% of patients did not hold their breath for 10 seconds, and 55% of patients did not clean the tip of the inhaler after use (Afifah and Susanto, 2020).

Based on the above data, considering the importance of knowledge of COPD patients in the correct use of inhalers and to determine the relationship with FEV1/FVC values, the researcher is interested in conducting research to evaluate the use of MDI and DPI inhaler preparations on FEV1/FVC values in COPD patients at UNS Hospital.

RESEARCH METHODS

Types and Methods of Research

This is a prospective, non-experimental study with a cross-sectional approach. The aim was to evaluate the relationship between inhaler type (MDI and DPI) and clinical outcomes in COPD patients, as assessed by pulmonary function parameters (FEV_1/FVC) over a specific period. This approach was used because data collection was conducted at a specific point in time without any intervention on the patients.

Location and Time Period

The study was conducted in the Outpatient and Inpatient Units of Sebelas Maret University Hospital (UNS Hospital), specifically in the Pulmonary Polyclinic. The study was scheduled for December 2025, and included medical record data collection, patient interviews, and data analysis.

Population and Sample

The population of this study was COPD patients using MDI and DPI inhalers and had medical record data on FEV1/FVC values at Sebelas Maret University Hospital during the period of September-November 2025. The sample of this study was calculated using the Slovin formula from population data obtained using a purposive sampling technique. From the calculations that have been done, the sample obtained in this study was 100 patients.

Research Variables

The variables in this study were divided into two categories: independent variables and dependent variables. The independent variable was the analysis of the appropriateness of inhaler use (MDI and DPI) in COPD patients. The dependent variable was the clinical outcome of COPD patients, measured by the Forced Expiratory Volume in 1 Second (FEV_1) or Forced Vital Capacity (FVC) after inhaler use.

Results Analysis

The analysis of the results in this study is divided into two, namely univariate analysis and bivariate analysis. Univariate analysis is an analysis conducted on each variable and research results and analyzed to determine the distribution and percentage of each variable. In univariate analysis using data from SPSS. The data to be studied uses medical record data based on medical record number, gender, age, smoking status, and experience using inhalers. Next, the data is analyzed by adjusting the use of inhaler preparations (MDI and DPI) with FEV1/FVC values in COPD patients adjusted to GOLD 2025. Data are processed using SPSS using statistical tests to obtain data by each variable. Bivariate analysis is an analysis conducted on two variables that are suspected to be related or correlated Sugiyono (2017). This study examines the accuracy of the use of MDI and DPI inhaler preparations with FEV1/FVC values in COPD at Sebelas Maret University Hospital. The test used in this bivariate analysis uses the chi square test (2x2), with the provision that if the calculated chi square price is greater than the table (X2 calculated > X2 table) then the relationship is significant, which means that HO (there is no relationship between the accuracy of the use of inhaler preparations with FEV1 / FVC values) is rejected and Ha (there is a relationship between the accuracy of the use of inhaler preparations with FEV1 / FVC values) is accepted. According to (Santoso, 2014) the guidelines or basis for decision making in the chi square test are guided by two things, namely comparing the Asymptotic Significance value with the critical limit of 0.05 or it can also be done by comparing the calculated chi square value with the chi square table value at 5% significance.

RESULTS AND DISCUSSION

Sociodemographic Characteristics of COPD Patients at UNS Hospital

Kirinyuh leaves (Chromolaena odorata L.) were carried out at the Functional Implementation Unit of Dr. Sardjito Tawangmangu Regional Hospital, Karanganyar, Central Java. The purpose of the determination was to determine the truth of the kirinyuh leaf sample (Chromolaena odorata L.) which would be used for research in order to avoid errors and mixing of materials with other plants in sample collection. After the determination was carried out, the results obtained were the plants used in this study were kirinyuh leaves (Chromolaena odorata L.).

Table 1. Sociodemographic Characteristics of COPD Patients at UNS Hospital

Sociodemographic Characteristics	Category	Frequency	Percentage
Gender	Man	44	44%
	Woman	56	56%
Age	Teenagers (15-25 years)	5	5%
	Early adulthood (26-35 years)	6	6%
	Late Adulthood (36-45 years)	9	9%
	Elderly (45> years)	80	80%
Smoking Status	Smoke	28	28%
	Do not smoke	72	72%
Experience Using Inhaler	First Time Using	38	38%
	Second Time Use	32	32%
	More Than Two Times Used	30	30%

Based on Table 1 of the gender characteristics, the study results show that female respondents constituted the largest group, with 56 patients (56%), while male respondents comprised 44 patients (44%). This distribution indicates that Chronic Obstructive Pulmonary Disease (COPD) patients at the study location and period were more female. This finding may be influenced by various factors, such as increased exposure of women to household air pollution, biomass fuel fumes, and other environmental factors that could potentially contribute to COPD, particularly in the elderly.

Based on the age characteristics of Table 1 above, the majority of respondents were in the elderly age group (>45 years), namely 80 people (80%). Meanwhile, the late adult age group (36–45 years) numbered 9 people (9%), the early adult age group (26–35 years) numbered 6 people (6%), and the adolescent age group (15–25 years) numbered 5 people (5%). The dominance of the elderly age group in this study indicates that COPD is a chronic disease that develops slowly and progressively, so that clinical symptoms and diagnoses are generally more often found in the elderly. With increasing age, lung function experiences a physiological decline, which can exacerbate the impact of exposure to risk factors and increase susceptibility to COPD.

Based on smoking status in Table 1, the study results show that the majority of respondents (72 people) did not have a smoking habit, while 28 respondents (28%) had a smoking history. These findings indicate that although smoking is the primary risk factor for COPD, the disease can also be influenced by other risk factors beyond smoking. These factors include exposure to secondhand smoke, environmental air pollution, long-term exposure to biomass smoke, as well as age and comorbid conditions. Therefore, these results reinforce the understanding that COPD is multifactorial and does not occur only in active smokers.

Based on the experience of using inhalers, it was found that 38 respondents (38%) were using an inhaler for the first time. 32 respondents (32%) were using an inhaler for the second time, while 30 respondents (30%) had used an inhaler more than twice. This distribution indicates that most respondents still have limited experience in using inhalers. This condition has the potential to affect the accuracy of inhaler use techniques, especially in elderly patients who may experience limitations in coordination, understanding, and inhalation strength. Inaccurate inhaler use techniques can have an impact on reducing the effectiveness of therapy, because the drug is not optimally deposited in the respiratory tract. Therefore, the characteristics of inhaler use experience are important factors that need to be considered in evaluating the clinical outcomes of COPD patients.

Evaluation of the Use of MDI Inhaler Preparations in COPD Patients at UNS Hospital

Table 2. Evaluation of the Use of MDI Inhaler Preparations in COPD Patients at UNS Hospital

MDI Inhaler		
Evaluation	**Frequency**	**Presentation**
Appropriate	2	22.2%
Not exactly	7	77.8%
Amount	9	100%

Based on Table 2, the results of the evaluation of the accuracy of Metered Dose Inhaler (MDI) use among the study respondents, it is clear that of the nine respondents who used MDI inhalers, only a small proportion were able to use the inhaler with the correct technique. The results showed that two respondents (22.2%) used the MDI inhaler according to the correct usage steps.

Meanwhile, the majority of respondents using MDI inhalers demonstrated incorrect usage techniques. Seven respondents (77.8%) were recorded as using their MDI inhalers using techniques that did not comply with recommended usage procedures. Therefore, the number of respondents using MDI inhalers incorrectly was greater than the number using MDI inhalers correctly.

Overall, these results indicate that the majority of MDI inhaler users in this study were not using their inhalers with the correct technique. These data provide a quantitative overview of the level of accuracy of MDI inhaler use among the study respondents, based on the evaluation results.

Evaluation of the Use of DPI Inhaler Preparations in COPD Patients at UNS Hospital

Table 3. Evaluation of the Use of DPI Inhaler Preparations in COPD Patients at UNS Hospital

DPI inhaler		
Evaluation	**Frequency**	**Presentation**
Appropriate	12	13.2%
Not exactly	79	86.8%
Amount	91	100%

Based on Table 3, the results of the evaluation of the accuracy of DPI inhaler use among the study respondents, a distribution of the level of accuracy of inhaler use was obtained among all respondents evaluated. Of the 91 respondents who used DPI inhalers, 12 respondents (13.2%) were recorded as using the inhaler with the correct technique according to the steps for using the inhaler specified in the assessment instrument. Respondents in this group were assessed as having completed all stages of inhaler use correctly at the time of the evaluation.

Meanwhile, 79 respondents (86.8%) were recorded as using their inhalers with incorrect technique. Respondents in this group indicated one or more errors in the inhaler usage steps assessed, resulting in their inhaler technique not meeting the established accuracy criteria. The number of respondents using their inhalers incorrectly was significantly higher than the number of respondents using their inhalers with correct technique.

Overall, the evaluation results indicated that the majority of respondents in this study were in the category of inappropriate inhaler use. This data distribution provides an overview of the level of appropriateness of inhaler use among the study respondents, indicating that the majority of respondents did not meet the criteria for appropriate inhaler use based on the assessment results.

The Relationship Between Sociodemographics and the Appropriateness of Inhaler Use (MDI and DPI) in COPD Patients at UNS Hospital

Table 4. Relationship between Sociodemographics and the Accuracy of Inhaler Use (MDI and DPI) in COPD Patients at UNS Hospital

Gender With Inhaler Accuracy					**Pearson Chi Square value**
		Inhaler Accuracy			
		Appropriate	**Not exactly**	**Total**	
Gender	Man	5	39	44	0.501
	Woman	9	47	57	
Total		14	86	100	
Age With Inhaler Accuracy					**Pearson Chi Square value**
		Inhaler Accuracy			
		Appropriate	**Not exactly**	**Total**	
Age	Teenager	0	5	5	0.058
	Early Adulthood	3	3	6	
	Late Adulthood	1	8	9	
	Elderly	10	70	80	
Total		14	86	100	
Smoking Status With Inhaler Accuracy					**Pearson Chi Square value**
		Inhaler Accuracy			

		Appropriate	Not exactly	Total	
Smoking Status	Smoke	1	27	28	
	Do not smoke	13	59	72	0.061
Total		14	86	100	

Experience Using Inhalers With Inhaler Accuracy					Pearson Chi Square value
		Inhaler Accuracy			
		Appropriate	Not exactly	Total	
Experience Using Inhalers	First time use	4	34	38	
	Second time use	4	28	32	0.512
	Third time use	6	24	30	
Total		14	86	100	

Based on Table 4, the results of the analysis of the relationship between gender and the accuracy of inhaler use show that there is no statistically significant relationship between the two variables (p value = 0.501). Of the total of 100 respondents, the male group numbered 44 people, with only 5 respondents being able to use the inhaler correctly, while the other 39 respondents still made errors in inhaler use techniques. In the female group, which numbered 57 people, there were 9 respondents who used the inhaler with the correct technique, while the other 47 respondents still showed incorrect use. In general, these findings illustrate that both men and women have a high level of inaccuracy in inhaler use, so that gender differences cannot be considered a factor that influences patients' skills in using inhalers correctly.

Furthermore, in the analysis of the relationship between age and the accuracy of inhaler use, a p-value of 0.058 was obtained, indicating that there was no statistically significant relationship between age group and the accuracy of inhaler technique. The elderly age group was the largest group in this study, namely 80 respondents, with only 10 respondents being able to use the inhaler correctly and the other 70 respondents still not correctly. In the early adult group of 6 respondents, there were 3 respondents who used the inhaler with the correct technique and 3 respondents who did not correctly. Meanwhile, in the adolescent group of 5 respondents, all respondents still used the inhaler incorrectly. These results indicate that across all age ranges, incorrect inhaler technique is still common, so age is not the only factor that determines a patient's ability to use the inhaler correctly.

In the variables of smoking status and inhaler use accuracy, the results of the Chi-Square test showed (p value = 0.061) which also indicated no significant relationship between smoking status and inhaler use accuracy. Of the 28 respondents who had a smoking habit, only 1 respondent used the inhaler with the correct technique, while the other 27 respondents still used the inhaler incorrectly. In the group of 72 non-smoking respondents, there were 13 respondents who used the inhaler correctly and the other 59 respondents incorrectly. This shows that both in the smoker and non-smoker groups, the level of inaccuracy in inhaler use is still very high, so that smoking habits cannot be considered a factor that directly influences technical skills in using inhalers.

Finally, the analysis of the relationship between experience using inhalers and the accuracy of inhaler use showed (p value = 0.512), which means there is no significant relationship between the two variables. In the group of respondents who were using inhalers for the first time, there were 38 people, with 4 respondents using the inhaler correctly and 34 respondents still using the inhaler incorrectly. In the group of respondents who had used the inhaler for the second time, there were 32 people, with 4 respondents using the inhaler correctly and 28 respondents incorrectly. Meanwhile, in the group of respondents who had used the inhaler for the third time, there were 30 people, with 6 respondents using

the inhaler correctly and 24 respondents still incorrectly. These findings indicate that even though respondents have experience in using inhalers, this experience does not automatically guarantee that the technique used is correct, so education and repeated evaluation of inhaler use techniques are needed.

The Relationship between the Accuracy of Inhaler Use (MDI and DPI) and FEV1/FVC Values in COPD Patients at UNS Hospital

Table 5. Relationship between Accuracy of Inhaler Use (MDI and DPI) and FEV1/FVC Values in COPD Patients at UNS Hospital

		FEV1/FVC value			
		Achieved	Not achieved	Total	Pearson Chi Square value
Inhaler Accuracy	Appropriate	14	0	14	
	Not exactly	33	53	86	<0.001
Total		47	53	100	

Based on Table 5, the cross-tabulation results between the accuracy of inhaler use and the achievement of FEV_1/FVC values, a very clear difference is seen between the groups that used inhalers correctly and those that did not. Of the total of 100 respondents, there were 14 respondents who used inhalers with correct technique, and all (14 respondents) were included in the group that achieved FEV_1/FVC values. Not a single respondent with correct inhaler technique fell into the category of not achieving FEV_1/FVC values.

In contrast, in the group of 86 respondents who used inhalers incorrectly, only 33 respondents managed to achieve FEV_1/FVC values, while the other 53 respondents did not achieve these values. This indicates that most patients who used inhalers incorrectly were in the group where FEV_1/FVC values were not achieved. This cross-tabulation illustrates that the proportion of FEV_1/FVC achieved was much higher in the group who used inhalers correctly compared to the group who used them incorrectly. In other words, correct inhaler usage technique is closely related to patients' success in achieving lung function targets.

Furthermore, to determine the relationship between the accuracy of Metered Dose Inhaler (MDI) and Dry Powder Inhaler (DPI) inhaler use and the achievement of FEV1/FVC values, statistical analysis was performed using the Pearson Chi-Square test. The statistical test results showed a significance value (p-value) of <0.001. This significance value was obtained from the Pearson Chi-Square test calculation based on the data distribution in the cross-table between the accuracy of MDI and DPI inhaler use and the status of FEV1/FVC achievement.

The p-value of <0.001 is smaller than the significance level limit set in this study ($\alpha = 0.05$). Thus, the results of the statistical analysis indicate that there is a statistically significant relationship between the accuracy of MDI and DPI inhaler use and the achievement of FEV1/FVC values in the study respondents. These results indicate that the difference in FEV1/FVC achievement between the groups of respondents with appropriate and inappropriate use of MDI and DPI inhalers did not occur by chance, but rather has a significant relationship based on the results of the statistical tests conducted.

CONCLUSION

This study found that the accuracy of inhaler technique in COPD patients at UNS Hospital was still low, at 22.2% for MDI and 13.2% for DPI, with the majority of respondents aged over 45 years (80%), female (56%), non-smokers (72%), and limited inhaler experience. Sociodemographic factors such as gender (p=0.501), age (p=0.058), smoking status (p=0.061), and experience (p=0.512) were not significantly associated with technique accuracy. However, there was a very strong association between inhaler technique accuracy and FEV_1/FVC achievement (p<0.001), where 100% of patients with correct technique achieved lung function targets. Major limitations include the cross-sectional design that does not allow for causal inference, the small sample size (100 respondents), and reliance

on a single observation without training intervention.

Practical implications require routine education and evaluation of inhaler technique by healthcare professionals in hospitals to improve adherence and clinical outcomes, and reduce COPD exacerbations. Further research recommendations include longitudinal studies or training interventions (e.g., face-to-face or digital applications) to measure long-term impact, as well as comparisons of inhaler devices in larger populations.

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