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Education on Inhaler Technique by Pharmacists To Improve The Quality of Life of COPD Patients.: A Systematic Review

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Abstract ← Arial 10pt, bold, justify

Background: This systematic review aimed to analyze the importance of education on using inhalers by pharmacists in improving quality of life, correct inhaler use steps, and medication adherence in patients with Chronic Obstructive Pulmonary Disease (COPD).

Methods: The databases used to search for articles in this systematic review include Scopus, ScienceDirect, and Pubmed. The articles submitted were published between 2009 and 2022, with the most recent search being conducted in December 2022. This review included a randomized controlled trial evaluating education on inhaler use techniques by pharmacists in improving the quality of life of COPD patients in inpatient and outpatient settings. This systematic review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) writing guidelines.

Results: This systematic review used six articles from five different countries. The articles involved share similar characteristics so that analysis can be carried out. The total number of research subjects included was 913 subjects. Most studies show that there is an increase in the quality of life among COPD patients who are given education on how to use inhalers by pharmacists using print or digital media. Furthermore, two articles reported that education on the technique of using inhalers by pharmacists can also increase the accuracy of using inhalers and three articles reported increasing medication adherence.

Conclusion: Interventions such as education on the technique of using inhalers by pharmacists in inpatient and outpatient settings can improve the quality of life of COPD patients, the accuracy of the steps in using inhalers, and medication adherence.

Keywords: Inhaler Technique Education, COPD, Hospital Pharmacist

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INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a heterogeneous lung condition characterized by chronic respiratory symptoms (shortness of breath, coughing, sputum production), caused by abnormalities of the respiratory tract (bronchitis/bronchiolitis) and/or alveoli (emphysema), resulting in persistent, progressive, and airway obstruction¹. COPD is a leading cause of death and disability worldwide. According to The Global Burden of Disease Study 2019, COPD is the sixth leading cause of death, up from 11th in the previous ranking². COPD prevalence reached 212.3 million in 2019, with 3.3 million deaths and 74.4 disability-adjusted life years (DALYs)³. The rise in COPD cases worldwide

can be attributed to a variety of risk factors, including smoking status, cigarette smoke exposure, occupational exposure to particulates, gases, and smoke, household air pollution from solid fuels, ambient ozone pollution, and low and high temperatures⁴. COPD prevalence is expected to rise in the coming years, and the World Health Organization predicts that COPD will be the third leading cause of death in the world by 2030^{5,6}. Based on this, effective COPD management in the form of lifestyle changes and long-term commitment to treatment in patients who are already receiving treatment is required to prevent increased morbidity^{5,7}.



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According to the Global Initiative for Chronic Obstructive Lung Disease (GOLD), the main treatment recommended to improve symptoms in COPD is inhalation therapy. Several studies have found that poor adherence to inhaler use is caused by inappropriate use of inhalers and poor inhalation techniques. Non-compliance with inhalation therapy results in decreased lung function, more exacerbations, and an increased risk of hospitalization⁸⁹. According to one study, data on non-adherence to therapy in COPD patients reached 79.4% of a total of 504 patients and only 6.3% of 765 patients can use inhalers properly^{10 11}. Therefore, education in inhaler use plays a vital role in managing COPD patients. It should be emphasized that patient education about inhaler use is carried out when prescribing inhaler devices, and it is recommended that inhaler use be assessed at each visit. Repeated education and assessments are required to regularly maintain proper inhalation technique and patient compliance.^{9 12}

There was only one systematic review with a randomized controlled trial study that reported that the pharmacist's role in the hospital has contributed to various aspects of COPD management, both inpatient and outpatient¹³. Therefore, this systematic review aimed to evaluate specifically the impact of providing education on the technique of using inhalers by hospital pharmacists in improving the quality of life of inpatient and outpatient COPD patients. The purpose of selecting inpatients and outpatients is to assist patients to improve treatment safety, patient outcomes, drug quality over time, and to prevent readmissions in inpatient settings^{14 15}

METHODS

1. Search Strategy

Search databases such as Pubmed, ScienceDirect, and Scopus were used to perform a literature search. The articles involved in this search

were those published in 2009-2022, with the last search taking place in December 2022. The combination of keywords used in the search in this article were Pharmacy, COPD, Inhaler, Hospital, Outpatient, Quality of life, with more information available in Supplementary Table 1.

2. Inclusion and Exclusion Criteria

The inclusion criteria used in this review were the PICO criteria as follows:

- Participation / Population

COPD inpatients and outpatients

- Intervention / Exposure

Education on the inhaler use technique by pharmacists using media, in the form of leaflets or videos

- Comparator / Control

Education on inhaler use technique by pharmacists without using media, in the form of leaflets or videos

- Outcome

The primary outcome is an assessment of the quality of life of COPD patients assessed using the COPD Assessment Test (CAT) and St. George Respiratory Question (SGRQ). The secondary outcomes in this systematic review are correct inhaler technique and medication adherence.

The exclusion criteria set in this review were non-English speaking articles, non-open access articles, non-original research articles, and non-randomized controlled trial (RCT) articles.

3. Data Extraction

All research articles were extracted by two reviewers (SA and VP) using Microsoft Excel and Mendeley. The reviewers screened the articles that met the inclusion and exclusion criteria set by agreement with a kappa value of 0.86 (listed in Supplementary Table 2). The data extraction process was then depicted in the flowchart of The Preferred Reporting Items for Systematic Reviews and Meta-Analysis, as listed in Supplementary Table 3 (PRISMA).

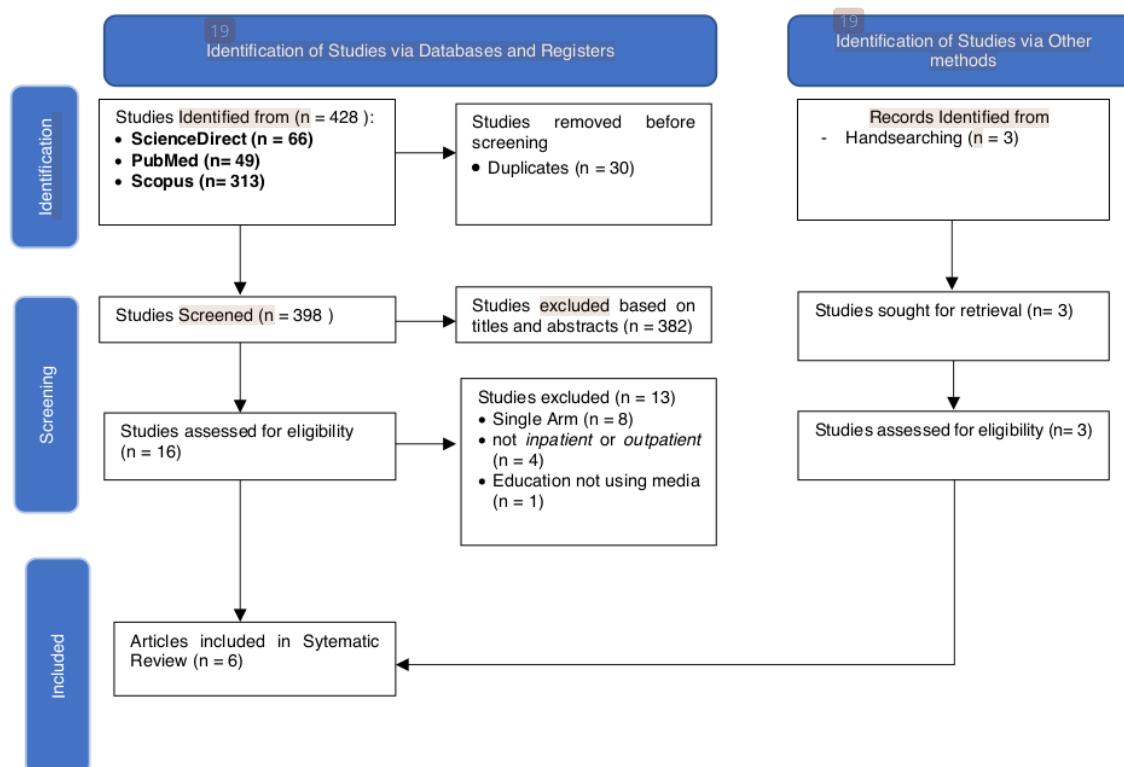


Figure 1. PRISMA Flowchart

4. Quality Assessment and Risk of Bias

To reduce the risk of bias, the stages of article screening are carried out by two independent reviewers using The Medical Education Research Study Quality Instrument (MERSQI) Score¹⁶. The Medical Education Research Study Quality Instrument (MERSQI) can be used to assess the quality of experimental studies. It consists of ten items with 6 domains of study quality. The domain of study quality encompasses study design, sampling, data type (subjective or objective), validity, data analysis, and results. The maximum score for each domain is 3, with a maximum score of 18, and the possible scores range from 5 to 18¹⁷.

5. Data Synthesis and Analysis

The studies included in this review were summarized using the narrative description method. The results of this review were focused on improving the quality of life in COPD patients who receive education on using inhalers via media such as

leaflets or videos. The quality of life assessment instruments used were the St-George Respiratory Questionnaire (SGRQ) and the COPD Assessment Test (CAT). In the CAT and SGRQ assessment instruments, COPD patients are said to have a good quality of life if their CAT and SGRQ scores are low, with a maximum CAT score limit of 40 points and an SGRQ score limit of 100 points.

RESULTS

1. Article Research Results

Based on article searches through database searches, a total of 428 articles were obtained and three were obtained through other search methods. The search for these articles yielded six articles that met the PICO criteria established in this review. The articles included in this study had good agreement reached by both reviewers (SA and VP) with a kappa value of 0.86. The flowchart of the article search is presented in Figure 1.

2. Study Quality

The study quality was examined using The Medical Education Research Study Quality Instrument (MERSQI) Score and is presented in Supplementary Table 3. Based on the assessment of study quality using the MERSQI score, six studies included in this review received an average score of 14. This score falls within the MERSQI's potential range of 5-18. ¹⁷.

3. Study Characteristics

The studies listed in this review were conducted in a variety of countries, including India, Ireland, Jordan, Norway, and China. All of the studies used a

randomized study design with two groups. All subjects in the study had been diagnosed with COPD using the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria and were over 45 years old. The COPD Assessment Test (CAT) and St. George's Respiratory Questionnaire (SGRQ) were used in all studies to assess COPD patients' quality of life. Data on study characteristics are listed in Supplementary Table 4.

Table 1 displays data from the articles used in this review on the characteristics of COPD patients. According to the table, several articles are missing economic conditions, education level, type/level of work, and smoking status.

Tabel. 1. Characteristics of COPD Patients

Authors	Location	Setting	Faktor Pemicu PPOK (selain usia)			
			Education (%)	Type/Level of Work (%)	Economic Conditions (%)	Smoking Status (%)
Khdour, et al. 2009 ¹⁸	Northern Ireland	Outpatient	Moderate (71,70)	Lower (63,55)	n/a	Ex-Smokers (65,30)
Jarab, et al. 2012 ¹⁹	Jordan	Outpatient	Lower (90,20)	Lower (60,15)	n/a	Current Smokers (56,55)
Suhaj, et al. 2015 ²⁰	India	Outpatient	n/a	n/a	Lower (36,6)	Current Smokers (55,35)
Xin, et al. 2016 ²¹	China	Outpatient	Lower (70,45)	n/a	n/a	Current Smokers (74,40)
Wang, et al. 2020 ²²	China	Outpatient	Lower (47)	n/a	n/a	n/a
Kebede, et al. 2022 ²³	Norway	Inpatient	n/a	n/a	n/a	n/a

Table 1. The Outcome of Quality of Life Using St. George Respiratory Questionnaire (SGRQ)

Authors	Type of Intervention	Time	Control Group [*]	Intervention Group [*]	p-value
Khdour, et al. 2009 ¹⁸	Booklet regarding the use of inhalers and COPD management	Baseline	64.20	63.60	0.690
		6 months	64.20	59.20	0.040
		12 months	65.30	61.80	0.170
Jarab, et al. 2012 ¹⁹	Booklets regarding the use of inhalers and knowledge about COPD	Baseline	44.80	45.20	0.760
		6 months	42.70	42.30	0.510
Suhaj, et al. 2015 ²⁰	Patient Information Leaflets (PILs)	Baseline	50.60	50.90	0.949
		6 months	49.20	47.20	0.618
		12 months	52.40	42.70	0.024
	Inhaler use educational leaflet	Baseline	68.40	68.50	0.913
	Face to face COPD related education	6 months	68.30	61.70	0.001
Xin, et al. 2016 ²¹		12 months	67.80	61.62	0.001
		18 months	68.50	61.31	0.001
		24 months	68.50	60.40	0.001

^{*}SGRQ Total Score

Table 2. The Outcome of Quality of Life Using COPD Assessment Test (CAT)

Authors	Type of Intervention	Control Group [*]			Intervention Group [*]		
		Pre	Post	p-value	Pre	Post	p-value
Wang, et al. 2020 ²²	Brochures regarding COPD and how to use inhalers Video of inhaler use is sent to the patient's cell phone	19.39	18.44	0.461	19.81	15.67	0.021
Kebede, et al. 2022 ²³	Information sheet regarding inhalers, such as effects (reliever/controller), onset, side effects that often arise, and techniques for using inhalers	24.00	24.00	>0.05	29.00	25.50	0.290

CAT Total Score

Research conducted by Jarab, et al., Khmour et.al., Suhaj et.al., and Xin et.al showed an improvement in quality of life based on an assessment using the SGRQ instrument, although the increase in quality of life in the study conducted by Jarab et.al. was not significant. Other studies conducted by Wang et.al. 2020 and Kebede, et.al. 2022 reported that providing education on the use of inhalers using videos or information sheets can improve the quality of life in COPD patients as assessed by the CAT instrument. Kebede et.al. 2022 reported a decrease in the median CAT value of the intervention group between baseline and two months following discharge by 3.5 points. However, this result was not statistically significant when compared to the control group at 2 months after discharge ($p > 0.05$). Meanwhile, Wang et.al. 2020 reported a significant decrease in the average CAT score in the intervention group of 4.15 points ($p < 0.05$) compared to the control group which showed no significant differences between the pre-and post-intervention periods ($p > 0.05$).

4. Inhaler Use Technique Accuracy

In this systematic review, two studies reported data related to the inhaler use technique accuracy in

COPD patients, with the full details shown in Table 4.

Table 3. Inhaler Use Technique Accuracy

Authors	Control Group (p-value) [*]	Intervention Group (p-value) [*]
Wang, et al. 2020 ²²	<0.01	<0.01
Kebede, et al. 2022 ²³	>0.05	>0.05

^{*}Comparison of pre and post-intervention in each group

5. Medication Adherence

A total of three studies reported medication adherence data on COPD patients, which is presented in full in Table 5. There are 2 methods used to measure medication adherence, including the medication refill adherence method, which was used in one study, and the Morisky Scale method, which has been used in two studies^{18,19,21}.

Table 4. Medication Adherence

Authors	Method of medication adherence	Baseline (p-value)	Follow-up (p-value)
Khmour et al. 2009 ¹⁸	Morisky Scale	0.840	0.019 [*]
Jarab et al. 2012 ¹⁹	Morisky Scale	0.680	0.017 [*]
Xin et al. 2016 ²¹	Medication Refill Adherence	0.798	0.003 [*]

DISCUSSION

A. Discussion

Six articles met the criteria for inclusion and exclusion based on the systematic review's inclusion and exclusion rules. The studies included in this systematic review share similar results, even though they were conducted at six different locations. This is in accordance with data from The Global Burden of

Disease Study 2019, which states that the risk factors for COPD include smoking, exposure to cigarette smoke, household air pollution from solid fuels, ambient particulate matter, ozone, and occupational particles⁴.

Four studies used the SGRQ instrument to measure the quality of life of COPD patients¹⁸⁻²¹ and 2 studies used the CAT instrument to evaluate COPD patients' quality of life^{22,23}. Both of these instruments¹¹ are recommended by GOLD in measuring the quality of life of COPD patients. Compared to the CAT, which only has 8 question items, the SGRQ instrument has 50 more complex question items. Although the question items from the two instruments differ, they both have a strong correlation ($r = 0.73-0.80$)^{24,25}. One study using the CAT instrument showed a non-significant improvement in QoL at the 2-month follow-up period ($p > 0.01$)²³. A total of 3 studies measuring the quality of life using the SGRQ instrument showed insignificant results at a specific follow-up period^{18,19,21}. The occurrence of an insignificant improvement in quality of life could be caused by several factors, including small sample size, short follow-up duration, repeated education during the follow-up period, whether or not additional educational materials were provided in addition to inhaler use techniques, the level of education, and socioeconomic conditions^{18,19,26,27}.

In the original research reported in this systematic review, three articles reported outcomes in the form of medication adherence^{18,19,21}. Medication Adherence is one of the key factors in suppressing COPD progression, which can also increase mortality and readmission²⁸. Of the three articles, two of them used the Morisky Scale method while another one used medication refill adherence. These three studies showed that interventions provided by pharmacists could significantly increase adherence in COPD patients ($p < 0.05$). This shows similar results to those of Nguyen TS et al. 2019²⁹ that interventions provided by pharmacists can increase adherence over time. Adherence in COPD patients can be influenced by three main factors including medication, unintentional, and intentional. Drug factors are those that are directly related to the drug,

such as drug side effects and the ease of inhalers, as well as the correct inhalation technique, which can be difficult for patients to acquire, and other factors that are essential for achieving the optimal inhalation therapy³⁰. Intentional factors are non-adherence factors caused by patient intent, including patient perceptions that treatment is unnecessary, resistance to treatment, inappropriate expectations, focus on side effects, cultural or religious issues, and costs³¹. Unintentional factors include patient misperceptions of treatment that are unintentional, such as costs, forgetting to take medications, and misinterpreting inhaler usage instructions inhaler³¹.

In this systematic review, two studies reported outcomes in the form of the correct technique of using inhalers. A study conducted by Wang et.al. 2020 showed an improvement in the accuracy of using inhalers in the intervention group after monthly education was carried out during the follow-up period ($p < 0.01$)²². Meanwhile, a study conducted by Kebede et.al. 2022 showed no significant difference between the control and intervention groups in terms of increasing the accuracy of the inhaler technique ($p > 0.05$)²³. Based on the two articles, there is a finding that repeating education at each visit can improve patients' understanding of how to use inhalers correctly. The two articles provide the same results regarding the steps of inhaler use which often lead to inhaler misuse. The steps that often cause mistakes are standing straight before using the inhaler, breathing before using the inhaler, and holding breath after inhaling the inhaler. These errors affect effective drug inhalation and increase the risk of hospitalization or emergency room visits³².

The final results of our systematic review highlight the significance of hospital pharmacists in the administration of COPD treatment, with potential implications for medication adherence, inhaler accuracy, and COPD patients' quality of life. This systematic review updates the previous review by adding a 2022 RCT study. We compare the provision of education by pharmacists in inpatient and outpatient settings to improve quality of life, appropriateness of inhaler use, and treatment adherence in COPD patients. According to our most recent study, there was no discernible difference

between both the control and the intervention groups regarding pharmacist education to reduce readmissions over the 12-month follow-up period ($p=0,30$).²³ This is due to an imbalance in patient characteristics between the control and intervention groups. The intervention group had more study subjects who had readmissions in the last 1 year, a large number of inhalers used, high CAT scores, and many had comorbidities compared to the control group. Some patients had a comorbid disease and the cause of readmission was pneumonia ($n=1$), non-infectious exacerbation of asthma ($n=1$), pleural effusion ($n=1$), scheduled invasive test ($n=4$), congestive heart failure ($n=1$), fall ($n=1$), erysipelas ($n=1$), chest pain ($n=1$), and atherosclerosis ($n=1$).

LIMITATION

The limitations of this systematic review are the limited research on hospital pharmacists or clinical pharmacists regarding education on inhaler use and COPD management in outpatients and inpatients involving two research groups and pre-post intervention assessments. The advantage of this systematic review is that only RCT-based articles are included and provide homogeneous research results.

CONCLUSION

Hospital pharmacists' education on inhaler use can enhance the accuracy of inhaler steps and medication adherence in COPD inpatients and outpatients. Therefore, the quality of life of COPD patients can be improved. Future studies should compare the results of RCTs on inhaler education with clinical outcomes, like testing the lung function of COPD patients in inpatient or outpatient settings.

Acknowledgments

Conflict of Interest

This review has no conflict of interest

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None

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