

## The role of the pharmacy in the accurate use of inhalation devices on the success of clinical outcome

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### Abstract

Asthma is the top ten causes of morbidity and mortality in Indonesia. The correct use of inhalers is expected to control and reduce asthma attacks, but there are still many who do not understand the treatment of asthma in the use of proper inhalers. The role of the pharmacist in the application of pharmaceutical care has been shown to improve the outcome of clinical asthma patients in a pharmacy. This study aims to determine the effect of the application of pharmaceutical care on the use of inhalers and outcome of clinical asthma patients. This study used a comparative experimental method with a research design cohort-study prospectively before and after the intervention of 84 Asthma patients who met the inclusion criteria at the Pharmacy in June-August 2022. The data were then analyzed statistically using the wilcoxon. The results of research on the application of pharmaceutical care can increase the accuracy of using the MDI *Inhaler*, DPI *Turbohaler* and DPI *Accuhaler*, and improvement *Outcome* Clinically based on the APE value of  $60.4 \pm 26.2$  to  $91.9 \pm 10.4$ . The results of the assessment of these two parameters from pretest and posttest showed that the changes that occurred were significant ( $P < 0.05$ ). Based on the results of the study it was concluded that the application of pharmaceutical care can increase the use of inhalation devices and increase *Outcome* Clinical Asthma patient in Pharmacy.

**Keywords:** Inhalation therapy; Inhalers; Pharmaceutical Care; Clinical Outcomes

### 1. Introduction

The prevalence of asthma in the world is around 235 million people. It is hereby known that more than 80% of asthma sufferers die in developing countries. Asthma is a chronic respiratory disease characterized by inflammation, increased reactivity to various stimuli and airway obstruction which cannot occur spontaneously or with appropriate treatment. Asthma is characterized by reversible airway obstruction, airway inflammation, and airway hyper responsiveness to stimuli [18]. The treatment of asthma has developed by changing the route of drug administration orally to inhalation, namely with aerosol dosage forms, namely in MDI and DPI. *Metered Dose Inhaler* (MDI) can deliver drugs directly in smaller and more effective doses, reduce side effects and with a quicker onset of bronchodilators. *Dry Powder Inhaler* (DPI) is a portable device that delivers formulations in the form of dry powders through drug inhalation into the lungs [6].

Skills in using an inhaler are closely related to coordination when inhaling and holding your breath, as well as removing the dose of medicine from the inhaler correctly. This is the background for researchers to conduct further research to find out the description of the proper use of inhalers in asthma patients at pharmacies [28]. This inhalation device has the advantage that the drug is used in small doses, which is 10% of the oral dose but has a high concentration in the lungs and allows for minimal systemic effects. Administration of drugs by inhalation compared to oral administration

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of drugs has 2 disadvantages, namely, the amount of drug reaching the lungs is difficult to determine and inhalation of drugs into the airways can be a coordination problem [25].

Monitoring the degree of asthma can be done by examining using a tool *PeakFlow Meter* namely by measuring the Peak Expiratory Flow (PEF). Asthmatic patients often have difficulty breathing due to narrowing of the airways. Measurements with this tool can be known how severe the asthma condition is so that exacerbations can be controlled by comparing the measurement results *Peak Flow Meter* with a predefined standard value based on sex, age and height [23].

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## 2. Material and methods

This study used a comparative experimental method with a prospective cohort-study study design before and after intervention in 84 Asthma patients who met the inclusion criteria at the Pharmacy in June-August 2022. The data collection method was based on observation, interviews and filling out a questionnaire by the patients. Data collection consisted of initial data collection called the pretest, then continued to follow-up stages 1 and 2 with a 1-week time process that aims to evaluate the effect after being given education and up to the posttest stage to see the latest data in the form of results. The role of pharmacists in implementing pharmaceutical care has been shown to improve clinical outcomes for asthma patients at pharmacies. This study aims to determine the effect of the application of pharmaceutical care on the use of inhalation devices and the clinical outcomes of asthma patients.

Assessment Outcome Clinical asthma patients, namely by using tools Peak flow meter. Peak flow meter is a tool to measure the value of the highest exhalation force from the lungs that can help describe how severe the asthma condition is so that the exacerbation can be controlled by comparing the measurement results Peak Flow Meter with a benchmark value that has been determined based on gender, age and height. The results of pulmonary function tests in asthmatic patients, can be seen if there is airway obstruction if the VEP ratio1 (First second forced expiratory volume) or forced vital capacity (FVC) <75% or VEP1 <80% predicted value [1-22]. Data later statistically analyzed using test wilcoxon.

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## 3. Results and discussion

### 3.1. Accuracy of Use of Inhalation Devices

Improper use of inhalers will cause asthma not to be controlled properly. The advantage of using inhalation therapy is that it only requires a small dose but the therapeutic effect is felt faster than oral doses and also the use of this inhalation therapy is very easy to carry and use in everyday life [15].

The accuracy of using this inhalation device observed in patients is expected to have special skills. The accuracy of using the inhalation device is said to be correct because it does not miss important steps in using the tool, and it is said to be inappropriate if the patient follows the prescribed guidelines wrong so that a step is skipped. It was acknowledged that the technical mistakes made were due to the fact that they had never received education so that the use of inhalation devices was inappropriate. The assessment carried out by the researcher was in accordance with the guidelines for the steps in using an inhalation device based on *National Asthma Council Australia* [15].

The data below is the result of grouping the accuracy of using an inhalation device, which can be seen in table 1.1

Based on research results, on *pretest* before implementing pharmaceutical care in the initial data collection using the inhalation device from the three tools, namely the DPI device *accuhaler* it was said that it was inappropriate to use the most tools as many as 38 people (80.9%), and from the results that said it was correct it was still a little, namely as many as 9 people (19.1%). Based on the results of previous studies, one of the obstacles encountered in the inaccuracy of using inhalers is the technique or method of administering drugs that are not appropriate, there are many errors in how to use inhalers, and not obeying the rules for use in medication. The technique or method of administering the drug is inappropriate because most patients only learn by reading brochures but do not understand how to use the tool [20]. Based on the technique of using an inhalation device, the errors that occur in patients are that most patients inhale too quickly [18], failure to hold their breath 52.2%, failure to inspire 46.4%. And failure to exhale, incorrect rotation position from inhaler use [2]. Inappropriate use of inhalers causes exacerbations, namely worsening of respiratory symptoms in asthma patients [22].

**Table 1.1** Correct use of inhaler

Accuracy Use of Tools		Pretest (Before Intervention)		Follow Up 1	
Inhalation Tool	Patient n (84)	Appropriate	Not exactly	Appropriate	Not exactly
DPI <i>Accuhaler</i>	47	9 (19.1%)	38 (80.9%)	37 (78.7%)	10 (21.3%)
MDI <i>Inhaler</i>	10	0 (0.0%)	10 (100%)	8 (80%)	2 (20%)
DPI <i>Turbuhaler</i>	27	1 (3.7%)	26 (96.30%)	13 (48.10%)	14 (51.90%)
Accuracy Use of Tools		Follow Up 2		Post test (After Intervention)	
Inhalation Tool	Pasien n (84)	Appropriate	Not exactly	Appropriate	Not exactly
DPI <i>Accuhaler</i>	47	41 (87.2%)	6 (12.8%)	45 (95.70%)	2 (4.3%)
MDI <i>Inhaler</i>	10	8 (80%)	2 (20%)	9 (90%)	1 (10%)
DPI <i>Turbuhaler</i>	27	16 (59.30%)	11 (40.7%)	20 (74.10%)	7 (25.9%)

Patients who receive an MDI type inhaler often miss several steps of use, including using the device in an upright position and not shaking it first when using it. The function of shaking is to equalize the dose, so that the drug that is released gets the maximum dose. Patients receiving DPI devices *accuhaler*, skipping the step of exhaling. Exhalation before inhalation is important for the drug to reach the respiratory tract. Exhaling will reduce the amount of air in the respiratory tract, so that the volume of air when inhaling with the drug can increase and the drug will reach the respiratory tract to the fullest. DPI usage *accuhaler* do not do steps holding breath for 5-10 seconds. Holding your breath will increase the amount of drug particles reaching the respiratory tract. Exhaling too quickly causes the maximum dose not to reach the respiratory tract, this happens because the drug is also wasted when exhaling [24].

Based on research conducted by Lavorini F. et al. In 2008, most patients made mistakes in the steps of exhaling before inhaling, holding their breath after inhaling, incorrectly positioning the inhaler, and not inhaling strongly and deeply. Poor inhalation technique affects the clinical effect of asthma patients. Providing education about the correct use of inhalers can increase the success of asthma treatment [26]. Based on previous research, the use of budesonide has side effects, namely the incidence of candidiasis and ulceration of the tongue. The use of fluticasone also experienced periodontitis and experienced xerostomia. When using salbutamol, the side effects of the drug are ulceration of the buccal mucosa and gingivitis [25].

The many side effects that occur when using an inhaler can be prevented by educating patients about the side effects that can result from using inhalation therapy, brushing their teeth and rinsing their mouths after using an inhaler [30]. Asthma treatment begins with controlling exacerbations, to get optimal treatment patients routinely use drugs and are able to use inhalers so that the right dose of medication is obtained, so it can be said that asthma is well controlled, in previous researchers patients could be said to be compliant with a treatment value of more than 75 % which means that the patient has complied with the use of inhaled drugs properly [29].

Based on the results of the study after the intervention (*posttest*) in the form of education can run well, patients can follow steps for using an inhaler. Inaccuracy in the use of inhalation devices is reduced so that proper results are obtained from the three tools, namely DPI *accuhaler* 45 people, MDI 9 people and DPI *turbuhaler* as many as 20 people. The accuracy of using the inhaler in the use of the MDI type inhaler is said to be more precise because the tool used is easier for patients to understand, whereas the DPI which consists of *accuhaler* and *turbuhaler* more difficult to use than MDI [2].

According to previous research, there is a program to extract knowledge from health workers, namely doctors and pharmacists about asthma and its management, especially regarding the correct use of inhalers and is focused on self-management and behavior change in asthma patients, therapy adherence and asthma control [3]. Using the right inhaler at the right dose and using it correctly can reduce side effects. Using the wrong inhaler will increase side effects such as fungus/candidiasis in the mouth area and hoarseness. Therefore, knowledge of the technique of using an inhalation device is required which requires training. So that the use of inhalation devices can be better understood and repeated evaluations are also needed to monitor the correct use of inhalation devices by patients [24].

### 3.2. Outcome Klinis

Monitoring Outcomeclinically can be seen from the degree of asthma which can be done by examination using *Peak Flow Meter* namely by measuring *Peak Expiratory Flow* (APE). People with asthma often experience difficulty breathing due to narrowing of the airways. The data below is the result of asthma levels based on the % APE value, which can be seen in table 1.1

**Table 2** The results of assessing the level of asthma patient classification based on the APE value

Tingkat Asma Nilai % AP E	Pre test (Before Intervention) n (84)	Follow Up 1 n (84)	Follow Up 2 n (84)	Post test (After Intervention) n (84)
Heavy (< 60%)	41(48.8%)	6 (7.1%)	2 (2.4%)	0 (0.0%)
Moderate (60-80%)	15 (17.9%)	31 (36.9%)	24 (28.6%)	18 (21.4%)
Mild (≥80%)	28 (33.3%)	47 (56.0%)	58 (69.0%)	66 (78.6%)

Based on the research results in table 1.2, the data obtained before the intervention (*pretest*) on the level of asthma obtained from the % APE value, it can be concluded that the condition of severe asthma is as many as 41 people (48%), in this case it can be seen that the % APE value has not been said to be improved or normal because the value is still  $\leq 60\%$ , while the normal value % APE is expected  $\geq 80\%$ . After the intervention proceeds until (*posttest*) experienced a change in the % APE value, the level of asthma became mild due to changes in lung function improvement in 66 people (78.6%). Monitoring *Outcome Clinical* causes of uncontrolled asthma are smoking habits, wrong drug use, genetics, recurrence of asthma in doing daily work, experiencing shortness of breath, waking up at night, inappropriate medication, and lack of knowledge about asthma. Asthma relapse and exacerbation is a process of repeated attacks due to hyperresponsiveness of the body's immune cells such as *asthma mast*, *eosinophil* and *T lymphocyte*, this *mast*, macrophages, cells dendritic, and myofibroblast to certain stimuli causing symptoms of shortness of breath, *wheezing* and cough that is the result of airway narrowing [9-10].

People with asthma often do not realize that busy activities and other distractions can make their condition worse and even recur at unexpected times, so they need regular checkups. Often the cost factor is expensive and time becomes an obstacle for someone to carry out intensive treatment due to asthma that they suffer. In connection with this, a tool has been developed that can measure the peak expiratory flow called *Peak flow meter* (PFM). PFM is a tool to measure the amount of airflow in the airways of asthmatics as a respiratory disease screening test [29].

The use of this tool only displays PEF values without any information regarding normal or abnormal PEF values, so it must be refined using 3 parameters, namely age, height and gender so that patients know for sure the condition of their PEF value regarding their condition. Measuring peak flow using this meter is an important part of managing human asthma symptoms and preventing asthma attacks, and will form part of a person's personal asthma care plan. Assessment of the level of severe asthma can be assessed by pulmonary function tests, namely by examining the forced expiratory peak flow. The results of pulmonary function tests in asthmatic patients, can be seen if there is airway obstruction if the VEP ratio<sub>1</sub> (First second forced expiratory volume) or forced vital capacity (FVC) <75% or VEP<sub>1</sub> <80% predicted value. To get an accurate value, the highest value is taken from 2-3 values reproducible and acceptable.[1-22].

Management that can be done to avoid worsening conditions in asthma patients is to improve ventilation, strengthen respiratory muscles, and prevent complications so as to increase forced expiratory volume in 1 second (FEV<sub>1</sub>). Asthma attacks occur when trigger factors bind to IgE antibodies which will increase in large numbers. The Ig E antibodies will bind to specific antigens attached to cells *mast* found in the pulmonary interstitium in close contact with the bronchioles and small bronchi. Cell *mast* will experience degranulation resulting in the release of chemical mediators for example histamine, anaphylactic substances low-acting, eosinophilic chemotactic factors, and bradykinin, the combined effect of all these factors, especially slow-acting anaphylactic substances, will produce local edema of the small bronchial walls as well as thick mucus secretion into the bronchial lumen, and muscle spasms bronchial smooth. So that the airway resistance becomes greatly increased [25,14].

### 3.3. Correlation between Accurate Use of Inhalation Devices and Outcome Clinical

According to research conducted by Choy et al regarding the evaluation of asthma education programs in Hong Kong, there are also many patients with moderate to severe conditions of asthma who are able to improve lung function by

increasing their knowledge of inhalation techniques so that they can control asthma conditions by routinely measuring FEV1 values using a tool. *Peak Flow Meter* [30]. The association with the use of an inhalation device that is not appropriate can cause treatment failure due to reduced concentrations of the drug in the airways, making it difficult to control asthma [28]. According to this study, it can be concluded that inhaling the prescribed medication properly and correctly using the inhalation technique is associated with an increase in lung function and health status [14].

From the research conducted by Gregoriano et al in 2018 regarding the technique used, it was found that asthma patients used the inhaler correctly so that the APE value > 80% was said to have improved normal lung function, when compared to patients who could not use the inhaler incorrectly. In line with Sven's 2017 study, the results showed that educational interventions in the technique of using inhalation devices were considered effective, with an improvement in lung function of 95% and then follow-up was carried out within five months [14-10].

Asthma management aims to achieve normal or near normal lung function. During the management process, the use of tools *Peak Flow Meter is performed* routinely by patients for optimal treatment. The patient is said to have well-controlled asthma, which can be seen from his lung function, whether it has returned to normal. Treatment of asthma in the use of inhalers that are not appropriate can cause therapy failure with reduced drug concentrations in the respiratory tract and is also associated with non-compliance in drug use so that asthma is difficult controlled [8-1].

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#### 4. Conclusion

Based on the results of the research, it can be concluded that in general it has been said to be correct, after being given education. The accuracy of the use of inhalation improves then the result of clinical improvement can also be seen in asthma patients who have controlled asthma with regular use of inhalers, so there are no more breathing difficulties caused by narrowing of the airways.

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#### Compliance with ethical standards

##### *Disclosure of conflict of interest*

No conflict of interest.

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