

Impact of Pharmacist-led Interventions on Medication Adherence and Inhalation Technique in Adult Patients with COPD and Asthma

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ABSTRACT

Introduction: Inhalation technique and medication adherence are essential prerequisites for achieving optimal therapeutic effects in patients with chronic obstructive pulmonary disease (COPD) and asthma. Although there are various effective treatments for respiratory disorders, disease control in these patients is still sub-optimal because of incorrect inhalation techniques and poor medication adherence. Pharmacist-led interventions have demonstrated a positive impact on improving inhalation technique, better medication adherence, and thus subsequently improving the quality of life of patients.

Methods: Search engines such as PubMed, Google Scholar, and Science Direct were used to identify the relevant information using keywords: Chronic Obstructive Pulmonary Disease, Asthma, Pharmaceutical care, Pharmacist Intervention, Medication Adherence and Inhalation Technique. The relevant articles that were published between 2005 to 2021 were included and reviewed for the Pharmacist-led interventions to improve medication adherence, inhalation technique, and quality of life of patients with COPD and asthma.

Results: Of the 300 articles screened, a total of 14 articles met the inclusion criteria and were included for review. Pharmacist-led interventions help to improve the medication adherence, inhalation technique, and quality of life of patients with COPD and asthma. Similarly, the articles mentioned in this review found that the interventions provided by the pharmacist to COPD and asthma patients were cost-effective in terms of reducing hospitalization rates and severe exacerbation rates.

Conclusion: Our review concluded that the pharmacists' interventions have a significant improvement in medication adherence and inhalation techniques with the enhancement of therapeutic effects in adult patients with COPD and asthma.

Keywords: *Asthma, Chronic Obstructive pulmonary disease, Health-related quality of Life, Inhalation Technique, Medication Adherence, Pharmacist-led Intervention*

INTRODUCTION

Chronic respiratory diseases (CRDs) are the chronic diseases of the airways and other structures of the lung(s), the most common CRDs are; chronic obstructive pulmonary disease (COPD), asthma, occupational lung diseases, and pulmonary hypertension and possible causes of these diseases are air pollution, tobacco smoke, occupational chemicals and dust, and frequent lower respiratory infections during childhood.¹ COPD is an airway disease, characterized by a persistent reduction of airflow which may progressively be worsening and persistent breathlessness on exertion, eventually leading to breathlessness at rest and can be life-threatening. Globally, COPD is the third leading cause of death, causing 3.23 million deaths in 2019 and over 80% of these deaths occurred in low- and middle-income countries

(LMIC).² Asthma is an inflammatory respiratory disease, characterized by the inflammation and narrowing of the small airways in the lungs and occurs both in children and adults. Worldwide an estimated 262 million people were affected by asthma and caused 461000 deaths in 2019.³

In chronic respiratory disease patients, non-adherence to medication is high, some studies show that the adherence rates of inhaled and oral medications in COPD patients is between 34% to 58.2%⁴⁻⁶ and the adherence rate of medicines in asthma is be

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tween 19% to 67.7% and the adherence rate is low in an inhalation dosage form.^{4,7} Factors associated with non-adherence of the treatments include both intentional (such as, negative attitudes to medication-taking behavior, side effects, cost, does not feel sick, etc.) and unintentional, due to reasons related to forgetting, misunderstanding, problems remembering, failure to plan, others factors are patients age, current smoking status, number of respiratory drugs, number of daily respiratory drug doses and Health Related Quality of Life(HRQoL).^{4,6,8}

The sub-therapeutic outcome in the management of COPD and asthma may occur due to the incorrect inhalation technique and medication non-adherence.⁹ it is evident that better medication adherence is associated with decrease in emergency department visit, hospital re admission, length of hospital stay, reducing costs and increase in Health-Related Quality of Life (HRQoL) of the patient.¹⁰⁻¹² The pharmacist plays vital role in improving the inhalation technique as well as patients' compliance, which leads to positive outcomes and increase in patient's quality of life.¹³

Our review aims to describe the effect of pharmacist-led interventions on COPD and asthma treatment in adult patients, focusing mainly on medication adherence inhalation techniques and their health related quality of life.

METHODS

Literature Search Methodology

An electronic search was conducted in PubMed, Google Scholar, and Science Direct to identify the relevant study in this topic using keywords: Chronic Obstructive Pulmonary Disease, Asthma, Pharmaceutical care, Pharmacist led Intervention, Medication Adherence and Inhalation Technique. and collected the relevant articles published between 2005 to 2021. The inclusion criteria for this review; randomized control trials (RCTs), pre and post-interventional study, pharmacist-led interventional study on an adult patient (≥18yrs) diagnosed with COPD and/or asthma, outcomes based on medication adherence and inhalation technique and studies published in the English language.

The study of medication adherence on a specific medicine (specific brand and/orgeneric) was excluded.

Data Screening and Extraction

The article selection process for review is in the following follow-chart

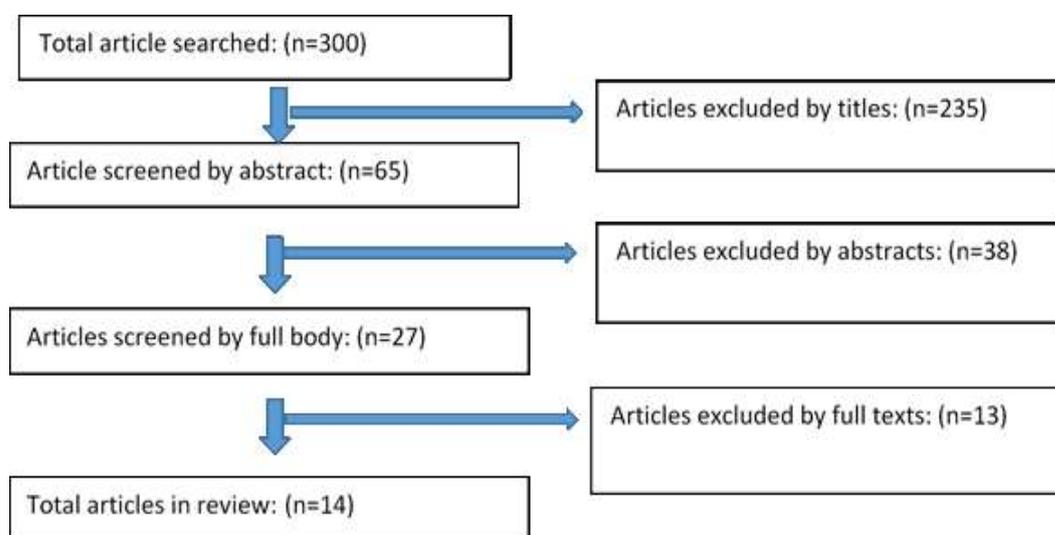


Figure 1: Selection of articles for review

RESULTS

In this review, a total of 14 studies were included. The study designs used were randomized controlled study and pre-and post-intervention study. The intervention methods used were individualized education and a series of telephone counseling, Inhaler technique training, Step-by-step demonstration of

correct inhalation technique, verbal instructions as well as practical exercises, Information leaflets on COPD. The outcome measurement tools were Morisky Medication Adherence Scale-8, Morisky Medication Adherence Scale-4, Dose or pill count method, Medication Refill Adherence Scores, (for medication adherence measurement), St. George's

Respiratory Questionnaire SGRQ, EuroQol-5 dimensions-5 levels (EQ-5D-5L) (for health-related quality of life), Inhaler technique score, the correctness of inhaler usage, score, Asthma Control Test (ACT), and COPD assessment test CAT, beliefs about medicines questionnaire (BMQ), following Spanish Society of pulmonary and Thoracic surgery(SEPAR) guideline, pre-defined checklists for each inhaler type, Rotahaler specific

GINA guideline checklist, beliefs about medicines questionnaire (BMQ) score, assessed with a 21-items checklist(for inhalation technique study). The time duration for follow-up for assessment of medication adherence and HRQoL was 1 month to 12 months whereas for inhalation technique it was 2-8 weeks. The summary of the studies is in the table below (Table 1).

Table 1: Summary Pharmacist-led interventional studies on COPD and asthma

Author	Study objective	Study design and study duration	Intervention method	Study tools	Follow up	Outcome
Lei-va-Fernandez Let.al, 2014 ⁵	To evaluate the effectiveness of a multifactorial intervention on improving the therapeutic adherence in COPD patients with scheduled inhalation therapy and to describe the change in the functional status and HRQoL and the possible modifying factors related to adherence when multifactorial intervention is applied.	Multi-center Randomized Control Trial	Patient education on different aspects: Motivational aspects used to improve adherence, Cognitive aspects related to treatment adherence receive information about disease and Skills development involving training in inhalation techniques according to SEPAR guideline	Medication adherence: Dose or pill count method Inhalation technique: Following SEPAR guideline HRQoL St George's Respiratory Questionnaire (SGRQ) and EuroQol-5 dimensions-5 levels (EQ-5D-5L)	3,6 and 12 months	Multifactorial intervention on patients resulted in an improvement in therapeutic adherence of COPD patients.
Xin C et.al., 2016 ¹⁰	To measure the impact of Pharmacist Managed Clinic (PMC) on medication adherence and HRQoL in COPD patients.	A prospective randomized controlled study January 2015 to December 2015.	Individualized education, and developing a comprehensive pharmaceutical care program telephone or network (e.g.WeChat) counseling	Medication adherence: Medication Refill Adherence (MRA) scores HRQoL: St George's R-respiratory Questionnaire (SGRQ)	12 month	The PMC may result in improvement of medication adherence and the health-related quality of life in patients with COPD. In the PMC group, a significant reduction in exacerbation rate, hospitalization rate, and smoking behavior was observed
Xin C et.al., 2016 ¹⁰	To evaluate the impact of pharmaceutical care intervention, with	A randomized, controlled, prospective clinical trial,	A structured education about COPD and management of	Medication adherence: Morisky Medication Ad	6 months	The pharmaceutical care program enhances patient outcomes and

	a strong focus on self-management, on a range of clinical and humanistic outcomes in patients with COPD.	Patient recruited time: January to April 2011.	its symptoms, motivational interviewing technique.	herence Scale-4HRQoL: St George Respiratory Questionnaire (SGRQ)		demonstrates the value of enhanced clinical pharmacy service in achieving the desired health outcomes.
Poudel S et al., 2016 ¹³	To evaluate the benefit of hospital pharmacy intervention on the current status of rotahaler technique in patients with asthma and COPD and the factors associated with the correct use.	A pre-post interventional study December 2014 to June 2015	Individualized education and training on the correct use of-rother technique	Inhalation technique: Rotahaler-specific GINA guideline checklist (eight Rotahaler-specific checklist items)	2 weeks	Hospital pharmacy intervention can significantly improve the correct use of the technique.
Wei L et.al, 2014 ¹⁶	To investigate whether and how interventions improve the current poor adherence in COPD patients.	A prospecti-verandomized controlled study (2012-2014)	Individualized education and a series of telephone counseling	Medication adherence: Pill counts plus direct patient interview HRQoL: St George's Respiratory Questionnaire (SGRQ), validated Chinese version.	1,6 and 12 months	Medication adherence was significantly improved by pharmaceutical care with a reduction in hospitalization and increasing in HRQoL.
Nguyen T Set.al, 2019 ¹⁷	To evaluate the impact of a pharmaceutical care program led by pharmacists in the improvement of medication adherence and quality of life for COPD patients in Vietnam.	The pre-and post-intervention study January to December 2016	Inhaler technique training as well as individual counseling about COPD and the associated medications	Medication adherence: Morisky Medication Adherence Scale-8 (MMAS) HRQOL: EuroQol-5 dimensions-5 levels (EQ-5D-5L)	3,6 and 12 months	Pharmaceutical care programs led by Pharmacists can significantly improve medication adherence and quality of life for COPD patients.
Unnati P et. al, 2020 ¹⁸	To study the impact in health knowledge and medication adherence of Asthma and chronic	A prospective cross-sectional observational study was conducted over 6 months	Involved in counseling the patient about the disease and their management, types of	Medication adherence: Morisky Medication Adherence Scale-8 (MMAS-8)	6 month	Education and counseling provided by a clinical pharmacist show improvement

	obstructive pulmonary disease (COPD) patients from the clinical pharmacist-led intervention		drugs used in the treatment, drug regimen, inhaler use. Pictorial patient information leaflets were designed and distributed			in medication adherence and health knowledge, achieving better therapeutic outcomes.
Khdour MR et. al. 2009 ¹⁹	To focus on self-management in patients with chronic obstructive pulmonary disease (COPD) through disease and medicine management program	Randomized controlled, longitudinal prospective clinical trial October 2006 to May2008	Individual counseling was done by the clinical-pharmacist on COPD, their prescribed medication, inhaler technique (written information was provided) and the management of COPD symptoms	Medication adherence Moriskyadherence scale-4 HRQoL: St George Respiratory Questionnaire (SGRQ) Other: COPD knowledge questionnaire	Followed up at 6 and 12 months	There is improve in adherence, reduction in needs for hospital care and improve an aspect of their HRQoL by the clinical pharmacy-led management program.
Tommelein E et al., 2013 ²⁰	To assess the effectiveness of pharmaceutical care program for patients with COPD.	A single-blind randomized controlled trial December 2010 to April 2011	Information leaflets on COPD, demonstration of inhaler units, and a list of practical solutions to specific non-adherent behavior	Medication adherence: Medication Refill Adherence (MRA)	1 month and 3 months	Pharmaceutical care program helps to improve inhalation technique and medication adherence and thus develop effective and safe pharmacotherapeutic treatment.
Gregoriano C et.al, 2018 ²¹	To present data on inhaler technique and its impact on quality of life and symptom-control in a typical population of patients with chronic lung disease from the adherence-trial	Single-blind randomized control trial January 2014 to March 2017	All patients get training on inhalation techniques. The intervention group receive daily alarm clock and reminder in form of support calls	Inhalation technique: Pre-defined checklists for each inhaler type. HRQoL: St. George Respiratory Questionnaire (SGRQ), Asthma Control Test(ACT), COPD Assessment Test (CAT)	2, 4 and 6 months	Correct inhalation of prescribed medication is associated with improved health status and lung function.

				Lung function assessment: Spirometry to measure Forced Vital Capacity (FVC) and Forced Expiratory Volume in One Second (FEV1)		
Wang W et al., 2020 ²²	To evaluate a multi-dimensional pharmaceutical care intervention on inhaler technique improvement in asthma and COPD patients.	Parallel-group study January 2019 to June 2019.	Verbal instruction of inhaler usage, face-to-face instruction and online consultation, providing an educational brochure and inhaler usage videos.	Inhalation technique: Inhaler technique score, the correctness of inhaler usage Quality of life: Asthma Control Test (ACT), and COPD Assessment Test (CAT) Other: Beliefs about Medicines Questionnaire (BMQ) score	3 months	This study showed that the multidimensional pharmaceutical care for asthma and COPD patients are effective in improving inhalation technique.
Kiser K et al., 2011 ²³	To test the impact of a literacy-sensitive, multi-component self-management intervention on inhaler techniquescores of COPD patients and to determine if its effects differ by literacy.	Randomized controlled trial January 2008 to July 2009.	In a one-on-one education session that utilized a literacy-sensitive handout titled “Living with COPD”, the intervention focused on inhaler technique, smoking cessation, and using a COPD action plan.	Inhaler technique: Using eight-item checklists HRQoL: St. George’s Respiratory Questionnaire (SGRQ) Other: Short Test of Functional Health Literacy in Adults (S-TOFHLA)	2 to 8 weeks	The literacy-sensitive intervention can lead to improvement in inhaler technique, with similar benefits for patients with both low and higher literacy.

Kiser K et al., 2011 ²³	To test the impact of a literacy-sensitive, multi-component self-management intervention on inhaler technique scores of COPD patients and to determine if its effects differ by literacy.	Randomized controlled trial January 2008 to July 2009.	In a one-on-one education session that utilized a literacy-sensitive handout titled "Living with COPD", the intervention focused on inhaler technique, smoking cessation, and using a COPD action plan.	Inhaler technique: Using eight-item checklists HRQoL: St. George's Respiratory Questionnaire (SGRQ) Other: Short Test of Functional Health Literacy in Adults (S-TOFHLA)	2 to 8 weeks	The literacy-sensitive intervention can lead to improvement in inhaler technique, with similar benefits for patients with both low and higher literacy.
Hämmerlein A et al., 2009 ²⁴	To survey the quality and determine the effect of a single intervention on inhalation technique with the patient with asthma or COPD using standardized procedures.	A prospective multi-center intervention study August to October 2007	Step-by-step demonstration of correct inhalation technique, verbal instructions as well as practical exercises	Inhalation technique: Assessed with a 21-items checklist	4–6 weeks	In daily practice, community pharmacy-based pharmacists play an important role in the education of inhalation techniques.
Ruud KW et al., 2018 ²⁵	To investigate whether the Inhalation Technique Assessment Service (ITAS), improves inhalation technique among patients with asthma and chronic obstructive pulmonary disease.	Uncontrolled pre-post study September 2016 to March 2017	Counseling cycle with patient demonstration and pharmacist correction.	Inhalation technique: Use of specific checklist adapted based on manufacturer's product information leaflet and thorough literature search	Immediately after ITAS (follow up 1) and three months after ITAS (follow up 2)	Following ITAS for both new and experienced users, the inhalation technique improved significantly. At follow-up 2, the technique remained significantly improved.

DISCUSSION

This study was conducted to evaluate the effectiveness of pharmacist-led interventions in improving medication adherence and inhalation technique for adult patients with COPD or asthma. The offered interventions were found to significantly reduce inhalation technique errors or even improve the choice of the inhaler and improve adherence to inhaled medication. Thus our findings show a positive impact of pharmacist-led interventions on medication adherence and inhalation technique in adult asthma and COPD patients. A similar review is done by Jia X et al., on the effect of pharmacist-led interventions on medication adherence and

inhalation technique in adult patients with asthma or COPD which shows a positive impact of pharmacist-led interventions on medication adherence and inhalation techniques in adult asthma and COPD patients.¹⁴ Another review by Hesso I et al., shows that community pharmacists can have a positive impact on the management of COPD especially on medication adherence and inhalation techniques.¹⁵

The medication adherence and inhalation techniques interventions provided by a pharmacist are not only beneficial for patients but also the health-care system. Patients may forget the instructions given to them regarding the inhalation technique

after a certain interval of time. However, there was a disparity within the study under this review about the optimal frequency for inhalation technique and medication adherence re-checking. For medication adherence and HRQoL reassessment, most of the studies recommended reassessment to be done every 6 to 12 months as a minimum,^{5, 10, 11, 16-18, 21} but one of the studies showed that reassessment on medication adherence and inhalation technique can be done after three month gap period.²⁰ Similarly, for rechecking of inhalation technique the time period of 2 to 8 or 4 to 6 weeks were recommended by two studies (Kiser et al and Hammerlein et al) but the study by Poudel et al., 2016 showed that 2 weeks is sufficient to assess the change in inhalation technique used by patients. Medication adherence was significantly improved by pharmaceutical care with a reduction in hospitalization and increasing in HRQoL in the studies where the reassessment was done in 6 to 12 months and this result was quite similar to the results obtained in the studies where reassessment was done in 3 months. Similarly, though the time period was different for rechecking the inhalation technique the result obtained was similar in all studies i.e pharmacist-led intervention was effective in improving the inhalation technique.

This review emphasis on the need to provide patients with repeated instructions on correct inhalation technique by a pharmacist and for ensuring sustainability multiple interventions should be provided.

CONCLUSION

This review concluded that the pharmacist plays a crucial role in the treatment of patients with COPD and asthma as they help to improve medication adherence and inhalation techniques. Similarly, the pharmacist led intervention directly enhance the therapeutic effect by reducing the hospitalization rate and severe exacerbation rate. This highlights that it is not only beneficial for patients but also for healthcare system.

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CONFLICT OF INTEREST

None

REFERENCES

1. WHO. Chronic respiratory diseases [Internet]. 2021 [cited 2021 Jun 21]. Available from: https://www.who.int/health-topics/chronic-respiratory-diseases#tab=tab_1
2. WHO. Chronic obstructive pulmonary disease (COPD) [Internet]. 2021 [cited 2021 Jun 21]. Available from: [https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-\(copd\)](https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-(copd))
3. WHO. Asthma [Internet]. 2021 [cited 2021 Jun 21]. Available from: <https://www.who.int/news-room/fact-sheets/detail/asthma>
4. Brandstetter S, Finger T, Fischer W, et al. Differences in medication adherence are associated with beliefs about medicines in asthma and COPD. *Clin Transl Allergy*. 2017;7(1):1–7.
5. Leiva-Fernández J, Leiva-Fernández F, García-Ruiz, et al. A Prados-Torres D, Barnestein-Fonseca P. Efficacy of a multifactorial intervention on therapeutic adherence in patients with chronic obstructive pulmonary disease (COPD): A randomized controlled trial. *BMC Pulm Med*. 2014;14(1).
6. Agh T, Inotai A, Meszaros A. Factors associated with medication adherence in patients with chronic obstructive pulmonary disease. *Respiration*. 2011;82(4):328–34.
7. Jones C, D NCSM, Boccuzzi SJ, et al. Adherence to Prescribed Treatment for Asthma : Evidence from Pharmacy Benefits Data Adherence to Prescribed Treatment for Asthma : Evidence from Pharmacy Benefits Data. 2016;0903(March)
8. Abdulsalim S, Unnikrishnan MK, Manu MK, et al. Structured pharmacist-led intervention programme to improve medication adherence in COPD patients: A randomized controlled study. *Res Soc Adm Pharm*. 2018;14(10):909–14.
9. Lavorini F, Magnan A, Christophe Dubus J, et al. Effect of incorrect use of dry powder inhalers on management of patients with asthma and COPD. *Respir Med*. 2008;102(4):593–604.
10. Xin C, Xia Z, Jiang C, et al. The impact of pharmacist-managed clinic on medication adherence and health-related quality of life in patients with COPD: A randomized controlled study. *Patient Prefer Adherence*. 2016;10:1197–203.
11. Jarab AS, AlQudah SG, Khmour M, et al. Impact of pharmaceutical care on health outcomes in patients with COPD. *Int J Clin Pharm*. 2012;34(1):53–62.
12. Boven JFM Van, Tommelein E, Boussery K, et al. Improving inhaler adherence in patients

- with Chronic Obstructive Pulmonary Disease : a cost-effectiveness analysis. 2014;1-11.
13. Poudel RS, Piryani RM, Shrestha S, Prajapati A. Benefit of hospital pharmacy intervention on the current status of dry powder inhaler technique in patients with asthma and COPD: a study from the Central Development Region, Nepal. *Integrated Pharmacy Research and Practice*. 2016 Dec 20:7-13. Available from: <http://dx.doi.org/10.2147/IPRPS119202>
 14. Jia X, Zhou S, Zhou Y, et al. Effect of pharmacist-led interventions on medication adherence and inhalation technique in adult patients with asthma or COPD : A systematic review and meta-analysis. 2020;(January):904-17.
 15. Hesso I, Gebara SN, Kayyali R. Impact of community pharmacists in COPD management: Inhalation technique and medication adherence. *Respir Med [Internet]*. 2016;118:22-30. Available from: <http://dx.doi.org/10.1016/j.rmed.2016.07.010>
 16. Wei L, Yang X, Li J, et al. Effect of pharmaceutical care on medication adherence and hospital admission in patients with chronic obstructive pulmonary disease (COPD): a randomized controlled study. 2014;6(6):656-62.
 17. Nguyen T, Lien T, Nguyen H, et al. Impact of pharmaceutical care in the improvement of medication adherence and quality of life for COPD patients in Vietnam. *Respir Med [Internet]*. 2019;153(January):31-7. Available from: <https://doi.org/10.1016/j.rmed.2019.05.006>
 18. Unnati P, Anushreya S, Keerthana G,et al. Impact of Patient Counseling on Health Knowledge and Medication Adherence in Asthma and Chronic Obstructive Pulmonary Disease Patients. *Asian J Pharm Clin Res*. 2020;13(5):183-6.
 19. Khmour MR, Kidney JC, Smyth BM,et al. Clinical pharmacy-led disease and medicine management programme for patients with COPD. *Br J Clin Pharmacol*. 2009;68(4):588-98.
 20. Tommelein E, Mehuys E, Van Hees T, et al. Effectiveness of pharmaceutical care for patients with chronic obstructive pulmonary disease (PHARMACOP): A randomized controlled trial. *Br J Clin Pharmacol*. 2014;77(5):756-66.
 21. Gregoriano C, Dieterle T, Breitenstein AL, et al. Use and inhalation technique of inhaled medication in patients with asthma and COPD: Data from a randomized controlled trial. *Respir Res*. 2018;19(1):1-15. 22. Wang W, Xu T, Qin Q, et al. Effect of a Multidimensional Pharmaceutical Care Intervention on Inhalation Technique in Patients with Asthma and COPD. *Can Respir J*. 2020;2020.
 23. Kiser K, Jonas D, Warner Z,et al. A randomized controlled trial of a literacy-sensitive self-management intervention for chronic obstructive pulmonary disease patients. *J Gen Intern Med*. 2012;27(2):190-5.
 25. Hämmerlein A, Müller U, Schulz M. Pharmacist-led intervention study to improve inhalation technique in asthma and COPD patients. *J Eval Clin Pract*. 2011;17(1):61-70.
 25. Ruud KW, Rønningen SW, Faksvåg PK,et al. Evaluation of a structured pharmacist-led inhalation technique assessment service for patients with asthma and COPD in Norwegian pharmacies. *Patient Educ Couns [Internet]*. 2018;101(10):1828-37. Available from: <http://dx.doi.org/10.1016/j.pec.2018.05.018>