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

Menaka Timilsina¹, Rajib Tiwari¹, Susmita Banstola¹

¹School of Health and Allied Sciences, Faculty of Health Sciences, Pokhara University, Kaski, Nepal

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. 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). 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.

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% and the adherence rate of medicines in asthma is be

Correspondence: Rajib Tiwari, Pharmaceutical Sciences Program, School of Health and Allied Sciences, Faculty of Health Sciences, Pokhara University, Kaski, Nepal. Email: rajibtw20@gmail.com
between 19% to 67.7% and the adherence rate is low in an inhalation dosage form.\(^4\) 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.\(^13\)

**Data Screening and Extraction**

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

![Selection of articles for review](Figure 1)

**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

<table>
<thead>
<tr>
<th>Author</th>
<th>Study objective</th>
<th>Study design and study duration</th>
<th>Intervention method</th>
<th>Study tools</th>
<th>Follow up</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lei-va-Fernandez Let.al, 2014</td>
<td>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.</td>
<td>Multi-center Randomized Control Trial</td>
<td>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</td>
<td>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)</td>
<td>3,6 and 12 months</td>
<td>Multifactorial intervention on patients resulted in an improvement in therapeutic adherence of COPD patients.</td>
</tr>
<tr>
<td>Xin C et.al., 2016</td>
<td>To measure the impact of Pharmacist Managed Clinic (PMC) on medication adherence and HRQoL in COPD patients.</td>
<td>A prospective randomized controlled study January 2015 to December 2015.</td>
<td>Individualized education, and developing a comprehensive pharmaceutical care program telephone or network (e.g. WeChat) counseling</td>
<td>Medication adherence: Medication Refill Adherence (MRA) scores HRQoL: St George’s Respiratory Questionnaire (SGRQ)</td>
<td>12 month</td>
<td>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.</td>
</tr>
<tr>
<td>Xin C et.al., 2016</td>
<td>To evaluate the impact of pharmacist care intervention, with A randomized, controlled, prospective clinical trial, A structured education about COPD and management of Medication adherence: Morisky Medication Ad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The pharmaceutical care program enhances patient outcomes and</td>
</tr>
</tbody>
</table>
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 rotahaler technique as well as individual counseling about COPD and the associated medications

Medication adherence: Morisky Medication Adherence Scale-8 (MMAS-8)

HRQOL: St George’s Respiratory Questionnaire (SGRS) validated Chinese version.

Medication adherence was significantly improved by pharmaceutical care with a reduction in hospitalization and an increase in HRQOL.

Poudel S et al., 2016

To investigate whether and how interventions improve the current poor adherence in COPD patients.

A prospective randomized 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 (SGRS), validated Chinese version.

1,6 and 12 months

Medication adherence was significantly improved by pharmaceutical care.

Nguyen T Set al., 2019

To study the impact of a pharmaceutical care program led by pharmacists in the improvement of medication adherence and chronic disease self-management in Vietnam.

A prospective cross-sectional observational study

Medication adherence: medication adherence scale (MMAS-8)

HRQOL: EuroQol-5 dimensions (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

To evaluate the impact of a post-interventional study in COPD patients in January to December 2016 on the associated medications and quality of life for COPD patients.

The pre-and post-intervention study

Inhaler technique training as well as individual counseling about COPD and the associated medications

HRQOL: St George’s Respiratory Questionnaire (SGRS) validated Chinese version.

3,6 months

HRQOL: St George’s Respiratory Questionnaire (SGRS) validated Chinese version.

Medication adherence was significantly improved by pharmaceutical care.

Wei L et al., 2014

To investigate the value of enhanced clinical pharmacy service in achieving the desired health outcomes in patients with COPD and the factors associated with the correct use of the technique.

A pre-interventional study

Individualized education and a series of telephone counseling

Medication adherence: Morisky Medication Adherence Scale.

HRQOL: St George’s Respiratory Questionnaire (SGRS)

1,6 and 12 months

Pharmaceutical care can significantly improve the correct use of the technique.

Poudel S et al., 2016

To evaluate the impact 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

Individualized education and training on the correct use of rotahaler technique as well as individual counseling about COPD and the associated medications

Medication adherence: Morisky Medication Adherence Scale-8 (MMAS-8)

HRQOL: St George’s Respiratory Questionnaire (SGRS) validated Chinese version.

1,6 and 12 months

Pharmaceutical care can significantly improve the correct use of the technique.

Poudel S et al., 2016

To investigate whether and how interventions improve the current poor adherence in COPD patients.

A prospective randomized 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 (SGRS), validated Chinese version.

1,6 and 12 months

Medication adherence was significantly improved by pharmaceutical care.

Nguyen T Set al., 2019

To study the impact of a pharmaceutical care program led by pharmacists in the improvement of medication adherence and chronic disease self-management in Vietnam.

A prospective cross-sectional observational study

Medication adherence: medication adherence scale (MMAS-8)

HRQOL: EuroQol-5 dimensions (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

To evaluate the impact of a post-interventional study in COPD patients in January to December 2016 on the associated medications and quality of life for COPD patients.

The pre-and post-intervention study

Inhaler technique training as well as individual counseling about COPD and the associated medications

HRQOL: St George’s Respiratory Questionnaire (SGRS) validated Chinese version.

3,6 months

HRQOL: St George’s Respiratory Questionnaire (SGRS) validated Chinese version.

Medication adherence was significantly improved by pharmaceutical care.

Wei L et al., 2014

To investigate the value of enhanced clinical pharmacy service in achieving the desired health outcomes in patients with COPD and the factors associated with the correct use of the technique.

A pre-interventional study

Individualized education and a series of telephone counseling

Medication adherence: Morisky Medication Adherence Scale.

HRQOL: St George’s Respiratory Questionnaire (SGRS)

1,6 and 12 months

Pharmaceutical care can significantly improve the correct use of the technique.

Poudel S et al., 2016

To evaluate the impact 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

Individualized education and training on the correct use of rotahaler technique as well as individual counseling about COPD and the associated medications

Medication adherence: Morisky Medication Adherence Scale-8 (MMAS-8)

HRQOL: St George’s Respiratory Questionnaire (SGRS) validated Chinese version.

1,6 and 12 months

Pharmaceutical care can significantly improve the correct use of the technique.
<table>
<thead>
<tr>
<th>Authors</th>
<th>Title</th>
<th>Details</th>
<th>Methods</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khdour MR et al. 2009</td>
<td>To focus on self-management in patients with chronic obstructive pulmonary disease (COPD) through disease and medicine management program</td>
<td>Randomized controlled, longitudinal prospective clinical trial. October 2006 to May 2008</td>
<td>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.</td>
<td>Medication adherence: Morisky adherence scale-4, HRQoL: St George Respiratory Questionnaire (SGRQ), Other: COPD knowledge questionnaire. Followed up at 6 and 12 months. There is improvement in adherence, reduction in needs for hospital care and improvement in quality of life.</td>
</tr>
<tr>
<td>Tommelein E et al., 2013</td>
<td>To assess the effectiveness of pharmaceutical care program for patients with COPD.</td>
<td>A single-blind randomized controlled trial. December 2010 to April 2011.</td>
<td>Information leaflets on COPD, demonstration of inhaler units, and a list of practical solutions to specific non-adherent behavior.</td>
<td>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.</td>
</tr>
<tr>
<td>Gregoriano C et al., 2018</td>
<td>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</td>
<td>Single-blind randomized control trial. January 2014 to March 2017.</td>
<td>All patients get training on inhalation techniques. The intervention group receive daily alarm clock and reminder in form of support calls.</td>
<td>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.</td>
</tr>
</tbody>
</table>
Lung function assessment: Spirometry to measure Forced Vital Capacity (FVC) and Forced Expiratory Volume in One Second (FEV1)

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

The literacy-sensitive intervention can lead to improvement in inhaler technique, with similar benefits for patients with both low and higher literacy.

This study showed that the multidimensional pharmaceutical care for asthma and COPD patients are effective in improving inhalation technique.

Kiser K et al., 2011 To test the impact of a literacy-sensitive, multi-component self-management intervention on inhaler techniques 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.
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 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. 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. The medication adherence and inhalation techniques interventions provided by a pharmacist are not only beneficial for patients but also the healthcare 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, but one of the studies showed that reassessment on medication adherence and inhalation technique can be done after three month gap period. 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.

ACKNOWLEDGEMENT
We acknowledge all the authors of the retrieved original articles.

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


