

Assessment of Adherence and Common Non-adherence Factors for Inhaled Medications in Asthma and Chronic Obstructive Pulmonary Disease (COPD) Patients

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ABSTRACT

Background: Inhaled medications are the cornerstone for the treatment of asthma and chronic obstructive pulmonary disease (COPD). Adherence of inhaled medications can be influenced by many factors such as patient preferences, education and awareness. Therefore, it is fundamental to identify and address the factors that helps to improve adherence to inhaled medications. Hence, this study aims to assess the adherence and common non-adherence factors for inhaled medications in asthma and COPD patients. **Materials and Methods:** A prospective observational study was conducted at the department of respiratory medicine for 6 months in a tertiary care teaching hospital. A total of 150 patients who were diagnosed with asthma and COPD, and used inhaled medications were enrolled. Patients were interviewed and administered with Inhaled Medication Adherence Questionnaire (IMAQ). The identified factors for non-adherence were classified based on the five dimensions of adherence instrumented by the World Health Organization (WHO). **Results:** A total of 97/150 (64.7%) patients [asthma: 42 (64.2%) and COPD: 55 (68.7%)] were found non-adherent to inhaled medications. Between them, 54% were attributable to socioeconomic reasons, 38% were patient-related, 4.6% therapy-related and 3.3% healthcare system-related. According to the study results majority of patients showed non-adherence due to socioeconomic-related factors followed by patient-related factors. **Conclusion:** This study concluded that non-adherence to inhaled medication was high in asthma and COPD patients. Low economic status, social stigma, lack of knowledge, inappropriate usage technique and complexity of treatment were the most common factors influencing non-adherence to inhaled medications in asthma and COPD.

Keywords: Asthma, Chronic obstructive pulmonary disease (COPD), Medication adherence, Medication adherence questionnaire, Non-adherence factors.

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INTRODUCTION

According to World Health Organization (WHO), chronic respiratory disorders account for 5% disease burden globally, resulting in more than 4 million deaths per year.¹ Asthma and COPD are two most common prevalent chronic respiratory disorders with increased morbidity, mortality and economic burden globally.² According to the disability adjusted life years (DALY), asthma was 16th leading cause of disability. It affected around 300 million people worldwide and expects an additional 100 million to be affected by 2025. Prevalence of asthma is high in developed countries while mortality was high in developing countries.³ In case of chronic obstructive pulmonary disease (COPD), it is the 3rd leading cause of death that accounted

for 3.23 million death by 2019.¹ Asthma and COPD are the non-communicable diseases that can lead to episodic or persistent damaged airways resulting in shortness of breath, chest pain, wheezing, crackles, airway thickening and restricted or limited airflow.^{2,4} Both diseases pose complex mechanism and heterogeneous pathophysiology, progression triggered by various risk factors such as genetic predisposition, age, allergic rhinitis, smoking, exposure to environmental hazards, obesity and other respiratory infections like tuberculosis and pneumonia infections.^{5,6} Asthma and COPD exacerbations are known as major causes of mortality, morbidity, increased treatment cost and loss of lung function. The frequency of exacerbation has been decreased in asthma or can be fully prevented while in patients' with COPD exacerbation has still not decreased due to irreversible and has progressed with time resulting in higher mortality than asthma.^{7,8}

Over the past decades, inhaled bronchodilators, glucocorticosteroids, antibiotics, mucolytic agents and



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antitussives are commonly prescribed for the treatment of asthma and COPD. The single use or fixed-dose combination of inhaled bronchodilators and glucocorticosteroids are the mainstay in the reduction of airway inflammation and enhancing the airway follow.^{9,10} However, due to the chronic nature of the diseases, patients may require complex drug regimens for longer duration that increases the risk of non-adherence to medications. Especially, medication non-adherence associated with poor disease control, exacerbate the disease, increases the risk of emergency department visit, hospitalization, economic burden and decreased patients' quality of life.^{11,12} Previous studies have shown 22-78% of medication adherence rates in patients with asthma and COPD.^{13,14} However, limited studies are published on the assessment of non-adherence to inhaled medications. This study shows poor adherence to the use of inhaled medications.^{15,16} The use of multiple inhalers presented a higher non-adherence rate compared to the single inhaler in asthma and COPD patients. The complexity of inhaled medication regimen increases the chances of non-adherence. The non-adherence to inhaled medications has been dependent mainly on a poor understanding of techniques to use inhaler devices, disease characteristics (such as age, breathing pattern, disease severity and airway diameter), aerosol characteristics (characteristics of inhaled drugs), pharmacokinetics and pharmacodynamics characteristics and patient behavior towards inhaled medications. Further, various type of inhalers introduced in markets increases the risk of poor knowledge about new inhalers and also increases the risk for poor adherence.¹⁷⁻¹⁹ Therefore, to enhance patients' inhaled medications adherence, patients' may be prescribed with friendly inhaler and provided with adequate education about their usage. The frequent assessment of adherence rate of inhaled medications during patient care process become essential to avoid non-adherence. To measure non-adherence various techniques can be used such as maintaining self-report/asthma diaries, self-report questionnaires, semi-structured interviews and medication measurement.²⁰ However, literature search reveals that the limited studies were published in the assessment of medication adherence and factors associated with non-adherence of inhaled medications among asthma and COPD patients.^{15,16} Hence, we developed a medication adherence questionnaire to assess medication adherence specific to inhaled medications, validated and administered to the patients.

MATERIALS AND METHODS

A prospective observational study was conducted at the department of respiratory medicine in a tertiary care teaching hospital for 6 months from September 2021 to February 2022. Patients aged above ≥ 18 years and of either gender who was diagnosed with Asthma and COPD and received at least one inhaled medication was included in this study. The study protocol was approved by Institutional Human Ethics Committee

(JSSMC/IEC/17112021/14 NCT/2021-2022). Inhaled medication adherence questionnaire (IMAQ) a 10-item questionnaire was used to assess medication adherence. The questionnaire was developed, validated and used to assess medication adherence among study patients.

Development of questionnaires

Study researchers developed the questionnaire following an adherence scale like the Medication Adherence rating scale (MARS). A total of 10 questions in English were developed suitable to assess medication adherence for inhaled medications. The response was recorded in 'Yes' and 'No'. Question number eight had 2 subdomains. The total score ranged from 0-11 and the overall response was categorized into low (score: 0-4), medium (5-8), and high (9-11) adherence. Patients falling in low and medium adherence were considered non-adherent towards medications and high were considered adherent. Questionnaire was translated into the local vernacular language.

Validation of questionnaire

Each question content was validated using the content validity index (CVI) with the help of four-point criteria 'relevance', 'clarity', 'simplicity', and 'ambiguity'. Each question was distributed to ten experts including two pulmonologists, one postgraduate student, five pharmacist professionals, and two resident pharmacists. The experts were asked to rate each question based on four-point criteria. Each question scored more than 94%. Overall obtained content validity score and the I-CVI of the prepared questionnaire were 3.8% and 95.5% respectively. Simplicity was high among all the parameters (96.8%) in the scale content validity index (S-CVI). The statistical analysis was done using Microsoft excel and SPSS v 21. Cronbach's alpha was used to estimate the internal consistency/ reliability of the questions in the questionnaire. The reliability test was done using the chi-square test.

Data collection

A suitable data collection form was prepared in two sections. The first section was to collect patient information such as demographic details and medication history while in the second section validated IMAQ was incorporated to record patients' medication adherence status. Clinical pharmacists visited the ambulatory care of the respiratory department on a daily basis to assess patients for study inclusion. Patients who met the study criteria were enrolled and study-relevant data was collected in the data collection form. To assess medication adherence IMAQ was asked to enroll patients after reviewing inhaled medications. The collected data were assessed for medication adherence and categorized into adherence status based on obtained score. Five dimensions of adherence instrumented by the World Health Organization (WHO) were used to identify the determinants for medication non-adherence. It includes socioeconomic factors, patient-related factors, therapy-related factors, healthcare

system-related factors, and condition-related factors. Descriptive statistics were used to analyze the data.

RESULTS

A total of 150 patients [asthma: 70 (46.7%) and COPD: 80 (53.3%)] were enrolled for this study. Mean age of study patients was 54.7 ± 13.5 years [asthma (mean \pm SD): 43.98 ± 17.52 years and COPD (mean \pm SD): 65.53 ± 9.55 years] and 68 (45.3%) [asthma: 27/70 (38.5%) and COPD: 41/80 (51.25%)] patients belonged to age group of 41-60 years. Majority of patients were from upper lower class [$n=32$ (45.2%)] in asthma and upper middle [$n=31$ (38.7%)] in COPD. Demographic details of study patients are presented in Table 1.

Between the 150 patients, who responded to IMAQ questionnaire, majority [$n=42$ (60%)] of patients with asthma answered 'Yes' to Q4 and 'No' to Q8.a. [$n=45$ (64.2%)] while in COPD patients, majority answers for 'Yes' was 55 (68.7%) and 'No' was Q8.b. 62 (77.5%). The details of the patient responses to IMAQ are presented in Table 2.

A total of 97/150 (64.7%) patients [asthma: 42 (64.2%) and COPD: 55 (68.7%)] were found non-adherent to inhaled medications and 53/150 (35.3%) patients [asthma: 28 patients and COPD: 25 patients] were found adherent to inhaled medications. Of the 70 asthma patients, majority [$n=28$ (40%)] of patients were high adherent to inhaled medications followed by low adherent [$n=24$ (34.3%)] and medium adherent [18 (25.7%)] while in

COPD patients, majority were medium adherent [$n=37$ (46.2%)] followed by high adherent [25 (31.2%)] and low [$n=18$ (22.5%)]. The details of the categorization of medication adherence of inhaled medication are presented in Table 3.

Among all the dimensions, Socioeconomic factors were reported as the most common non-adherent factor (54%) followed by patient-related factors (38%). In socioeconomic factors, the lower socioeconomic class was the most prevalent factor for non-adherence while in patient-related factors and therapy-related factors, social stigma (14%) and complexity of treatment (2.8%) were the most common factors for non-adherence respectively. The details of common non-adherence factors of inhaled medication based on WHO is presented in Table 4.

DISCUSSION

In this study, we observed 64.7% (asthma: 64.2% and COPD: 68.7%) patients were found to be non-adherent to inhaled medications. A similar study conducted in asthmatic patients by Ayele AA *et al.*, reported 50.6% patients were non-adherent to inhaled medications.²¹ The prevalence of non-adherence was comparatively high since majority of patients had poor economic status and low literacy rate. Another study conducted in COPD patients by Davis JR *et al.*, reported 71.7% non-adherence to the inhaled corticosteroids and long acting β_2 adrenergic agonists.²² These findings indicate that the non-adherence is high for inhaled medications mostly due to lack of adequate

Table 1: Demographic details of study patients.

Categories	Variables	Asthma [($n=70$ (%))]	COPD [($n=80$ (%))]
Gender	Male	28 (40%)	50 (62.5%)
	Female	42 (60%)	30 (37.5%)
Age group distribution (In years)	≤ 20	7 (10%)	0 (00%)
	21-40	24 (34.2%)	2 (2.5%)
	41-60	27 (38.5%)	41 (51.25%)
	61-80	11 (15.7%)	28 (35%)
	≥ 81	1 (1.4%)	9 (11.25%)
Residency	Urban	46 (65.7%)	25 (45.4%)
	Rural	24 (34.2%)	30 (54.5%)
Social History	Smokers	28 (40%)	25 (45.4%)
	Alcoholic	9 (12.8%)	11 (20%)
Socio-economic Class	Upper	7 (10%)	12 (15%)
	Upper- Middle	10 (14.2%)	18 (22.5%)
	Lower- Middle	20 (28.5%)	15 (18.7%)
	Upper-Lower	18 (25.7%)	20 (25%)
	Lower	15 (21.4%)	15 (18.7%)
Educational Status	Literate	32 (45.7%)	32 (40%)
	Illiterate	38 (54.2%)	48 (60%)

Table 2: Patient responses to IMAQ.

Questionnaires	Items	Asthma [n=70 (%)]		COPD [n=80 (%)]	
		Yes	No	Yes	No
Q1	Do you take your inhaled medication regularly?	27 (38.5%)	43 (61.4%)	24 (30%)	56 (70%)
Q2	Do you take your inhaled medication only when you have symptoms?	40 (57.1%)	30 (42.8%)	54 (67.5%)	26 (32.5%)
Q3	When you use DPI/MDI/MDI with a spacer do you feel difficulty remembering the steps?	41 (58.5%)	29 (41.4%)	55 (68.7%)	25 (31.2%)
Q4	Have you ever stopped taking your inhaled medication because of fear of side effects?	42 (60%)	28 (40%)	51 (63.7%)	29 (36.2%)
Q5	Do you have difficulty remembering the name/dosage/frequency of your inhaled medications?	40 (57.1%)	30 (42.8%)	50 (62.5%)	30 (37.5%)
Q6	Do you forget to carry your medication when you travel?	38 (54.2%)	32 (45.7%)	49 (61.2%)	31 (38.7%)
Q7	Do you stop taking your inhaled medications because you have difficulties buying them?	36 (51.4%)	34 (48.5%)	58 (72.5%)	22 (27.5%)
Q8	a. Do you follow your physician's advice	25 (35.7%)	45 (64.2%)	20 (25%)	60 (75%)
	b. Visit your healthcare professional as per the schedule	27 (38.5%)	43 (61.4%)	18 (22.5%)	62 (77.5%)
Q9	Do you know the difference between? a. Reliever b. Preventer	26 (37.1%)	44 (62.8%)	24 (30%)	56 (70%)
Q10	Are you involved in self-medication?	37 (52.8%)	33 (47.1%)	54 (67.5%)	26 (32.5%)

Table 3: Categorization of medication adherence of inhaled medication based on obtained IMAQ assessment score.

Overall medication adherence status	Categories of adherence based on obtained scored	Asthma n (%)	COPD n (%)	Total n (%)
Adherence	High (Score: 9-11)	28 (40%)	25 (31.2%)	53 (35.3%)
Non-adherence	Medium (Score: 5-8)	18 (25.7%)	37 (46.2%)	97 (64.6%)
	Low (Score: 0-4)	24 (34.3%)	18 (22.5%)	
Total patients		70 (100%)	80 (100%)	150 (100%)

knowledge about inhalers and longer duration of disease. Thus, the prescribers, nurses and clinical pharmacists frequently need to assess non-adherence and provide adequate education in the appropriate use of inhaler and related medications.

Further, in this study it was observed that socio-economic factors and patient related factors were the most common determinants for non-adherence of inhaled medications among asthma and COPD patients. In socio-economic factors, the most persistent determinant for non-adherence was lower economic class. This indicates that our study patients were not able to buy the prescribed inhalers and related medications or buy few and/or a single inhaler instead of multiple inhalers prescribed. A cross-sectional study conducted in retroviral therapy by Alvi Y *et al.*, found no association between socioeconomic factors

and non-adherence of retroviral medications.²³ However, these findings suggest the prescribers and pharmacists to look into the possible socio-economic risk factors associated with patients and prescribe pocket-friendly inhalers to patients.

Another most common factor for non-adherence with inhaled medications were patient related factors. Under which, social stigma includes hesitancy in administering inhaled medications in a public setting and fear of side effects. These were most commonly identified risk factors for non-adherence. A study conducted by Simoni AD *et al.*, also revealed that adults and adolescents with asthma presented social stigma – embarrassed using inhalers in public.²⁴ These finding reveals that social stigma need to be addressed and patients need to be educated. Other most observed patient related factors for non-adherence

Table 4: Determinants of non-adherence factors of inhaled medication based on WHO.

Dimensions of WHO	Factors	n = 97 (%)	Total
Socio-economic Factors	Socio-economic class	Upper	4 (4.1%)
		Upper- Middle	4 (4.1%)
		Lower-Middle	9 (9.2%)
		Upper-Lower	15 (15.4%)
		Lower	20 (20.6%)
Patient-related	Social stigma		13 (13.4%)
	Lack of knowledge about inhaled medication		9 (9.2%)
	Inappropriate technique to use inhaled medication		8 (8.2%)
	Lack of follow-up		6 (6.1%)
Therapy-related	Duration of therapy		1 (1%)
	Complexity of treatment		3 (3%)
	Fixing dose		1 (1%)
Healthcare system related	Duration of travel		2 (2%)
	Long waiting hours for the appointment		1 (1%)
	Inadequate time for consultation		1 (1%)
	Doctor-patient relationship		0 (0%)
Condition Related	Acute attacks		0 (0%)
	Comorbidities		0 (0%)

were lack of knowledge about inhaler/inhaled medications and inappropriate techniques to use inhaler/inhaled medications. This indicates that patients need education about proper usage techniques of inhaler/inhaled medication and their importance.

Among therapy related factors, 'complexity of treatment' was the most prominent factor for non-adherence of inhaled medications. Prescribing multiple drug regimens and/or multiple inhalers had higher risk for non-adherence due to complexity of treatment. Thus, prescribers must counsel the patients regarding the appropriate use of inhaled medications and benefits of completion of the therapy.²⁵ The limitation of this study is that it only identified the non-adherent factors influencing inhaled medication adherence but did not resolve it.

CONCLUSION

This study concluded that non-adherence to inhaled medication was high in asthma and COPD patients. Low economic status, social stigma, lack of knowledge, inappropriate technique to use inhaled medications and complexity of treatment have been identified as most common factors for non-adherence of inhaled medications in asthma and COPD. Therefore, frequently measuring medication adherence, promoting appropriate use and educating patients about disease and inhaler use/inhaled medications in each patients helps to enhance medication adherence.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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