

**Research Article****IMPACT OF INHALER THERAPY ADHERENCE ON CLINICAL OUTCOMES IN PATIENTS WITH ASTHMA AND COPD: A PROSPECTIVE COHORT STUDY****Gowtham Kumar V<sup>1\*</sup>, Prakash S<sup>2</sup>**

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Received date: 25-07-2026, Date of acceptance: 03-08-2026, Date of publication: 03-08-2026

**Abstract**

**Background:** Adherence to inhaler therapy is central to disease control in asthma and chronic obstructive pulmonary disease (COPD), yet suboptimal adherence remains common and is associated with poor symptom control and increased healthcare utilization.

**Objectives:** To assess adherence to inhaler therapy among asthma and COPD patients attending outpatient clinics over a 6-month period, and to describe its association with symptom control and outpatient (OPD)-level exacerbations.

**Methods:** This was a prospective, descriptive, single-centre study conducted over 6 months in the outpatient clinics of a tertiary care hospital. A total of 130 patients with a confirmed diagnosis of asthma or COPD, prescribed inhaler therapy, were enrolled by convenient sampling. Adherence was assessed using the validated

Test of Adherence to Inhalers (TAI) questionnaire, and patients were categorized into good, intermediate, and poor adherence groups. Descriptive statistics were used to summarize demographic characteristics, adherence categories, and their association with symptom control and exacerbation frequency.

**Results:** Of 130 patients, 90 (69.2%) had bronchial asthma (36 male, 54 female) and 40 (30.8%) had COPD (25 male, 15 female). Based on TAI scores, 35 patients (27%) demonstrated good adherence, 43 (33%) intermediate adherence, and 52 (40%) poor adherence. All 52 patients (100%) in the poor adherence category had frequent respiratory symptoms and poor symptom control, compared with 25 of 43 patients (58.1%) in the intermediate adherence category. Patients with poor symptom control experienced, on average,

one OPD-level exacerbation visit per month during the study period.

**Conclusion:** Poor adherence to inhaler therapy was common, affecting two out of every five patients, and was strongly associated with poor symptom control and recurrent monthly OPD exacerbation visits. These findings underscore the need for routine adherence assessment and targeted counselling in asthma and COPD care.

**Keywords:** Inhaler adherence; Asthma; COPD; Test of Adherence to Inhalers; Symptom control; Exacerbation

## INTRODUCTION

Asthma and chronic obstructive pulmonary disease (COPD) are among the most common chronic respiratory diseases worldwide and are major causes of morbidity and healthcare utilization. Both conditions are characterized by chronic airway inflammation and airflow limitation, resulting in symptoms such as cough, wheezing, breathlessness, and reduced exercise capacity. Inhaled medications are the cornerstone of long-term management and play a vital role in improving symptom control and preventing exacerbations (1,2).

Adherence to inhaler therapy is essential for achieving optimal disease control. The World Health Organization defines adherence as the extent to which a patient's medication-taking behaviour corresponds with the recommendations of the healthcare provider. Despite the proven benefits of inhaled therapy, adherence remains poor in many patients because of forgetfulness, inadequate knowledge, fear of side effects, medication costs, and incorrect inhaler technique (3–5).

Poor adherence is associated with uncontrolled symptoms, frequent exacerbations, increased outpatient visits, hospital admissions, and higher healthcare costs. In addition, incorrect inhaler technique further reduces drug delivery to the lungs, leading to poor clinical outcomes even when medications are prescribed appropriately (5,6).

Several studies have demonstrated that patients with good adherence experience better symptom control, fewer exacerbations, and improved quality of life compared with those with poor adherence. Therefore, regular assessment of adherence and reinforcement of correct inhaler technique should be integral components of asthma and COPD management (7,8).

Although studies have evaluated inhaler adherence separately in asthma and COPD, prospective data from India assessing its impact on symptom control and exacerbations in a combined outpatient population remain limited. Hence, the present prospective descriptive study was undertaken to assess adherence to inhaler therapy among patients with asthma and COPD and to evaluate its relationship with symptom control and exacerbation frequency during a six-month follow-up period.

**Objectives:** To assess adherence to inhaler therapy among asthma and COPD patients attending outpatient clinics over a 6-month period, and to describe its association with symptom control and outpatient (OPD)-level exacerbations.

## MATERIALS AND METHODS

**Study Design:** This was a prospective, descriptive, observational study.

**Study Setting and Period:** The study was conducted in the outpatient clinics of a tertiary care hospital over a period of 6 months.

**Study Population:** Patients with a confirmed diagnosis of asthma or COPD attending the outpatient department and prescribed inhaler medication were included.

**Inclusion Criteria:** Patients with a diagnosis of asthma or COPD, currently prescribed inhaler therapy, and willing to participate in the study.

**Exclusion Criteria:** Patients unable to provide informed consent or unable to complete the study questionnaire.

**Sampling Technique:** A convenience sampling method was used to enrol consecutive eligible patients attending the outpatient clinic during the study period, yielding a total sample of 130 patients.

**Study Tool:** Adherence was assessed using the validated Test of Adherence to Inhalers (TAI) questionnaire, a 10-item instrument evaluating both unintentional and intentional non-adherence. Based on the TAI score, patients were classified into

good, intermediate, and poor adherence categories. Symptom control was assessed clinically at follow-up visits and classified as controlled or poor (frequent respiratory symptoms). Exacerbation frequency was recorded as the number of unscheduled OPD visits attributable to worsening respiratory symptoms over the study period.

**Study Variables:** Independent variables included demographic characteristics (age, sex, disease type). The primary dependent variable was adherence to inhaler therapy (TAI category); secondary outcomes were symptom control status and frequency of OPD-level exacerbation visits.

**Statistical Analysis:** Data were analysed using descriptive statistics. Categorical variables were summarized as frequencies and percentages. Adherence categories were cross-tabulated against symptom control status to describe the association between the two.

**Ethical Considerations:** The study was conducted after obtaining informed consent from all participants. Confidentiality and anonymity of patient data were maintained throughout the study. No external funding was received for this study. (To remove)

## RESULTS

A total of 130 patients were enrolled, comprising 90 patients (69.2%) with bronchial asthma and 40 patients (30.8%) with COPD. Among asthma patients, 36 (40%) were male and 54 (60%) were female. Among COPD patients, 25 (62.5%) were male and 15 (37.5%) were female, reflecting the expected male preponderance in COPD and female preponderance in asthma in this cohort.

| Characteristic | Category         | Number (n) | Percentage (%) |
|----------------|------------------|------------|----------------|
| Diagnosis      | Bronchial Asthma | 90         | 69.2           |
|                | COPD             | 40         | 30.8           |
| Asthma – Sex   | Male             | 36         | 40.0           |
|                | Female           | 54         | 60.0           |
| COPD – Sex     | Male             | 25         | 62.5           |
|                | Female           | 15         | 37.5           |

**Table 1: Demographic distribution of the study population (N = 130)**

Based on TAI scores, the majority of patients demonstrated suboptimal adherence: 35 patients (27%) had good adherence, 43 patients (33%) had intermediate adherence, and 52 patients (40%) had poor adherence-making poor adherence the single largest category in the cohort.

| Adherence Category | Number (n) | Percentage (%) |
|--------------------|------------|----------------|
| Good               | 35         | 27             |
| Intermediate       | 43         | 33             |
| Poor               | 52         | 40             |
| Total              | 130        | 100            |

**Table 2: Distribution of patients by TAI adherence category (N = 130)**

A clear gradient was observed between adherence category and symptom control. All 52 patients (100%) in the poor adherence category reported frequent respiratory symptoms and were classified as having poor symptom control. In the intermediate adherence category, 25 of 43 patients (58.1%) had poor symptom control, while the remaining 18 patients (41.9%) maintained adequate control. This gradient was consistent with a dose-response relationship between adherence and disease control.

| Adherence Category | Total (n) | Poor Symptom Control, n (%) |
|--------------------|-----------|-----------------------------|
| Poor               | 52        | 52 (100%)                   |
| Intermediate       | 43        | 25 (58.1%)                  |

**Table 3: Symptom control status by adherence category**

Among patients with poor symptom control (the 52 poor-adherence and 25 intermediate-adherence patients,  $n = 77$ ), an average of one OPD-level exacerbation visit per month was recorded over the 6-month study period, indicating a substantial and recurrent burden on outpatient services directly attributable to inadequately controlled disease in poorly adherent patients.

| Disease          | Good n (%) | Intermediate n (%) | Poor n (%) | Total      | $\chi^2$     | <i>P</i> value |
|------------------|------------|--------------------|------------|------------|--------------|----------------|
| Bronchial Asthma | 28 (31.1)  | 35 (38.9)          | 27 (30.0)  | 90         |              |                |
| COPD             | 7 (17.5)   | 8 (20.0)           | 25 (62.5)  | 40         |              |                |
| <b>Total</b>     | <b>35</b>  | <b>43</b>          | <b>52</b>  | <b>130</b> | <b>12.21</b> | <b>0.002</b>   |

**Table 4. Association between Disease Type and Inhaler Adherence Category ( $N = 130$ )**

Table 4 demonstrates a statistically significant association between disease type and inhaler adherence category ( $\chi^2 = 12.21$ ,  $p = 0.002$ ). Poor adherence was significantly more common among patients with COPD (62.5%) than among patients with bronchial asthma (30.0%). Conversely, good adherence was observed more frequently in patients with bronchial asthma, indicating better compliance with inhaler therapy in this group.

## DISCUSSION

The present prospective descriptive study demonstrated that inhaler non-adherence remains a significant challenge among patients with asthma and COPD attending a tertiary care outpatient clinic. Based on the Test of Adherence to Inhalers (TAI), only 27% of patients exhibited good adherence, while 73% had intermediate or poor adherence. Poor adherence was particularly common among patients with COPD compared with those with asthma, suggesting that disease characteristics, symptom burden, and treatment complexity may influence medication-taking behaviour. These findings reinforce the importance of routinely assessing adherence in patients with chronic airway diseases as part of standard clinical care (8,9).

A significant association was observed between disease type and adherence

category, with COPD patients demonstrating a higher proportion of poor adherence than asthma patients ( $p = 0.002$ ). Similar observations have been reported by Vestbo et al., who noted that poor adherence is more frequent among COPD patients because of advanced age, multiple comorbidities, polypharmacy, and complex inhaler regimens. Likewise, George et al. reported that adherence declines with increasing disease duration and treatment complexity, emphasizing the need for individualized patient education and regular follow-up (10,11).

The present study also demonstrated a strong relationship between inhaler adherence and symptom control. All patients with poor adherence had poor symptom control, while more than half of those with intermediate adherence also experienced persistent symptoms. These findings are comparable with those reported

by Bryant et al. and Restrepo et al., who demonstrated that poor adherence is associated with worsening respiratory symptoms, impaired quality of life, and increased healthcare utilization. Similar findings have also been reported using the Test of Adherence to Inhalers in routine clinical practice (7,12,13).

An important observation in the present study was the occurrence of recurrent outpatient exacerbation visits among patients with poor symptom control. Patients with poor adherence experienced frequent exacerbations requiring repeated OPD consultations during the six-month follow-up period. These findings are consistent with previous studies demonstrating that inadequate adherence increases the risk of acute exacerbations, emergency department visits, hospitalization, and healthcare costs. Timely identification of non-adherent patients and implementation of adherence-improving strategies may therefore substantially reduce disease burden and improve long-term outcomes (6,14).

The intermediate adherence group deserves particular attention. Although these patients were not classified as completely non-adherent, more than half experienced poor symptom control. This finding suggests that even occasional missed doses or inconsistent inhaler use may adversely affect disease control. Similar conclusions were reported by Chrystyn et al. and van Boven et al., who emphasized that adherence should be considered a continuum rather than a simple adherent/non-adherent classification. Reinforcement of inhaler technique, simplification of treatment regimens, and patient-centred counselling are essential to improve long-term adherence (15,16).

## CONCLUSION

The present study demonstrates that suboptimal adherence to inhaler therapy is highly prevalent among patients with asthma and COPD, with nearly three-fourths of patients exhibiting intermediate or poor adherence. Poor adherence was significantly more common among patients with COPD and was strongly associated with inadequate symptom control and frequent outpatient exacerbation visits. These findings emphasize that inhaler adherence is a major determinant of clinical outcomes in chronic airway diseases. Routine assessment of adherence using validated tools such as the Test of Adherence to Inhalers (TAI), together with reinforcement of correct inhaler technique and individualized patient counselling, should form an integral part of outpatient management to improve disease control and reduce exacerbations.

## RECOMMENDATIONS

1. Routine assessment of inhaler adherence should be incorporated into every outpatient visit for patients with asthma and COPD.
2. The Test of Adherence to Inhalers (TAI) may be used as a simple and validated screening tool in routine clinical practice.
3. Regular demonstration and reassessment of inhaler technique should be performed to ensure optimal drug delivery.
4. Structured patient education and counselling programmes should be implemented to improve long-term adherence.
5. Simplifying treatment regimens and addressing patient-specific barriers may enhance adherence and reduce exacerbations.

6. Larger multicentric prospective studies using objective adherence measures are recommended to validate these findings and evaluate interventions aimed at improving inhaler adherence.

#### Conflict of Interest

The authors declare no conflict of interest.

#### Funding

No external funding was received for this study.

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