Journal of Molecular Science

Journal of Molecular Science
Volume 36 Issue 1, Year of Publication 2026, Page 19-23
DoI-10.004687/1000-9035.2026.003

Journal of Molecular Science
www.jmolecularsci.com ISSN:1000-9035

Associated with Non-Adherence among Asthma Patients in a Tertiary Care Hospital: A Cross-Sectional Study

Jasi Muhammed K[1], N. Senthilkumar[1*], Arya. M. S[1]
[1]Department of pharmacy practice, J.K.K. Munirajah Medical Research Foundation's, Annai JKK Sampoorani Ammal College of Pharmacy, Ethirmedu, Valayakaranoor Post, komarapalayam-638 183, Tamilnadu, India

Article Information
Received: 15-12-2025
Revised: 30-12-2025
Accepted: 15-01-2026
Published: 28-02-2026

Keywords
Asthma, Inhaled corticosteroids, Medication adherence, Asthma control, TAI, ACT.

ABSTRACT
Background: Medication adherence is a cornerstone of effective asthma management, yet real-world adherence to inhaled corticosteroids (ICS) remains suboptimal, leading to poor disease control and increased healthcare utilization.
Objective: To assess adherence to inhaled corticosteroids, evaluate asthma control, and identify factors associated with non-adherence among adult asthma patients.
Methods: A cross-sectional observational study was conducted over six months in the pulmonology department of a tertiary care hospital. A total of 112 adult asthma patients were included. Adherence was measured using the Test of Adherence to Inhalers (TAI), and asthma control was assessed using the Asthma Control Test (ACT). Sociodemographic and clinical variables were analyzed using descriptive statistics, independent t-test, ANOVA, and logistic regression.
Results: Among 112 patients, 75% were female, and the majority were aged 46-60 years. Poor adherence was observed in 54.9% of patients, intermediate adherence in 30.3%, and good adherence in 14.8%. Uncontrolled asthma was present in 62.4% of participants. Significant predictors of adherence included sex (p=0.002), duration of inhaler use (p=0.001), and affordability (p=0.016). A statistically significant association was found between inhaler adherence and asthma control.
Conclusion: Non-adherence to inhaled corticosteroids is highly prevalent and strongly associated with poor asthma control. Interventions focusing on patient education, affordability, and adherence monitoring are essential to improve outcomes.

INTRODUCTION:

Asthma is a chronic inflammatory airway disease characterized by variable airflow obstruction and recurrent respiratory symptoms such as wheezing, breathlessness, and cough. It represents a significant global public health burden and contributes substantially to morbidity and reduced quality of life. In India, asthma prevalence remains high, with millions affected and many experiencing inadequate disease control. Inhaled corticosteroids (ICS) are the cornerstone of long-term asthma management due to their potent anti-inflammatory effects and ability to reduce exacerbations. However, their effectiveness depends heavily on consistent adherence. Medication adherence is defined as the extent to which patient behavior corresponds with prescribed treatment recommendations [1-4]. Poor adherence has been associated with increased exacerbations, hospitalizations, and healthcare costs.

ICS therapy has been shown to reduce airway inflammation, prevent exacerbations, and improve overall asthma control. However, despite the proven efficacy of these medications, adherence among patients remains a persistent challenge,

Journal of Molecular Science
Journal of Molecular Science
Volume 36 Issue 1, Year of Publication 2026, Page 19-23
DoI-10.004687/1000-9035.2026.003

leading to poor disease control, increased risk of hospitalizations, and decreased quality of life [5]. Understanding the patterns of adherence and the factors contributing to non-adherence is crucial to inform strategies that can enhance therapeutic outcomes.

Previous studies have highlighted that non-adherence to ICS is influenced by a combination of patient-related, therapy-related, and healthcare system-related factors. Patient-related factors include forgetfulness, misconceptions about medication necessity, fear of side effects, and low health literacy[6]. Therapy-related factors encompass complex dosing schedules, perceived inefficacy, and inhaler technique errors, while healthcare system factors include inadequate counseling, lack of follow-up, and limited access to medications. Despite this, there is limited data from tertiary care hospital settings regarding the adherence patterns and associated determinants among asthma patients. This cross-sectional study aims to fill this gap by assessing adherence to ICS, evaluating the level of asthma control, and identifying key factors associated with non-adherence, thereby providing insights to guide targeted interventions and improve patient outcomes in clinical practice [7-8].

Despite the availability of effective therapies, adherence rates remain suboptimal worldwide, particularly in developing countries where socioeconomic and healthcare system factors play a significant role [9]. Understanding local determinants of adherence is essential for designing targeted interventions. This study was conducted to evaluate adherence to inhaled corticosteroids, assess asthma control, and identify factors contributing to non-adherence among asthma patients in a tertiary care setting [9-10].

2. MATERIAL AND METHODS:

This cross-sectional study was conducted among asthma patients attending the outpatient department of a tertiary care hospital to evaluate adherence to inhaled corticosteroids (ICS), assess asthma control, and identify factors associated with non-adherence. The study population included adult patients diagnosed with asthma according to Global Initiative for Asthma (GINA) guidelines, who had been on ICS therapy for at least three months prior to enrollment. Data were collected using a structured questionnaire comprising socio-demographic characteristics, clinical history, medication adherence assessment, and the Asthma Control Test (ACT) to determine the level of asthma control. Ethical approval was obtained from the Institutional Ethics Committee, and written informed consent was secured from all participants prior to data collection [12-14].

2.1 Study Design and Setting

A cross-sectional observational study was conducted over six months in the outpatient and inpatient pulmonology departments of a tertiary care hospital.

2.2 Participants

Adult patients aged 18–60 years with a confirmed diagnosis of bronchial asthma and using inhaler therapy for at least three months were included. Patients with other obstructive lung diseases were excluded.

2.3 Sample Size

The calculated minimum sample size was 112 participants based on adherence prevalence estimates.

2.4 Data Collection

Data were collected using a structured data entry form including demographic details, clinical characteristics, comorbidities, and treatment information [15-16].

2.5 Outcome Measures

Table 1. Baseline Characteristics of Study Participants (n = 112)
Adherence: Assessed using the Test of Adherence to Inhalers (TAI).
Good: 50
Intermediate: 46–49
Poor: <45
Asthma Control: Measured using the Asthma Control Test (ACT).
Well controlled: 25
Partly controlled: 20–24
Uncontrolled: <20

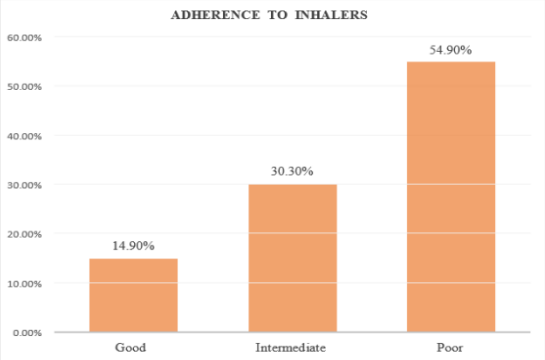

Figure.1 Distribution of Inhaler Adherence Status

2.6 Statistical Analysis:

Data were analyzed using SPSS software. Continuous variables were expressed as mean ± SD and categorical variables as frequencies and percentages. Independent t-test, ANOVA, and logistic regression were used to identify factors associated with adherence.

Journal of Molecular Science

Journal of Molecular Science
Volume 36 Issue 1, Year of Publication 2026, Page 19-23
DoI-10.004687/1000-9035.2026.003

2.7 Ethical Considerations

Institutional ethics approval was obtained prior to study initiation, and patient confidentiality was maintained.

Data obtained were systematically compiled and analyzed using appropriate statistical methods to identify adherence patterns and associated factors. Descriptive statistics summarized patient characteristics, adherence levels, and asthma control status, while inferential statistics, including chi-square tests and logistic regression analyses, were applied to evaluate the relationship between non-adherence and potential predictive factors [17]. All procedures were conducted in accordance with ethical guidelines, ensuring participant confidentiality and data integrity throughout the study. The methodology employed in this study provides a robust framework for understanding adherence behaviors and offers insights for developing targeted interventions to improve asthma management in clinical practice [17-18].

3. RESULTS & DISCUSSION:

Most patients had been on inhaled corticosteroid therapy for more than several months/years, highlighting the chronicity of asthma management in this population. Socioeconomic and educational factors varied across the cohort, suggesting potential influences on medication adherence and disease control.

Assessment of adherence using structured questionnaires indicated that a significant proportion of patients exhibited suboptimal adherence to ICS therapy. Specifically, 81% of participants were classified as non-adherent, with common reasons including forgetfulness, fear of side effects, and lack of awareness regarding the importance of daily inhaler use. These findings are consistent with previous studies demonstrating that patient-related behavioral factors are major contributors to non-adherence.

Asthma control, evaluated using the Asthma Control Test (ACT), showed that [81%] of patients had uncontrolled asthma, correlating strongly with low adherence to ICS. Statistical analysis revealed that patients with higher adherence scores were significantly more likely to achieve good asthma control ($p < 0.05$). This aligns with existing evidence indicating that regular ICS use effectively reduces airway inflammation and improves clinical outcomes.

3.1 Baseline Characteristics:

Variable	Category	n (%)
Sex	Male	28 (25.0)
	Female	84 (75.0)
Age group (years)	≤30	19 (17.3)
	31–45	45 (40.1)
	46–60	48 (42.6)
Education level	Primary	28 (24.7)
	Matriculate	40 (35.2)
	Higher secondary	20 (17.9)
	Graduate	24 (22.2)
Income	Low	25 (22.2)
	Middle	79 (70.4)
	High	8 (7.4)
Duration of asthma	≤3 years	19 (16.9)
	>3 years	93 (83.0)
Duration of inhaler use	≤2 years	15 (13.4)
	>2 years	97 (86.6)
Comorbidities	None	53 (47.3)
	Present	59 (52.7)

Among 112 participants, 75% were female and the majority belonged to the 46–60-year age group. Most patients had asthma duration greater than three years and belonged to middle-income households.

3.2 Adherence to Inhalers

Poor adherence was observed in 54.9% of patients, intermediate adherence in 30.3%, and good adherence in 14.8%.

3.3 Asthma Control

Uncontrolled asthma was seen in 62.4% of patients, while only 8.6% achieved well-controlled status.

3.4 Factors Associated with Adherence

Significant predictors included:
Female sex ($p=0.002$)
Shorter duration of inhaler use ($p=0.001$)
Treatment affordability ($p=0.016$)
No significant association was observed with duration of asthma, fear of side effects, or inhaler difficulty.

3.5 Association Between Adherence and Asthma Control

Higher adherence levels were significantly associated with better asthma control outcomes.

Further analysis identified several factors associated with non-adherence, including younger age, lower educational level, complex inhaler regimens, and inadequate counseling by healthcare providers. These findings suggest that both patient- and healthcare system-related factors play a critical role in determining adherence behavior. Interventions such as patient education, simplified dosing schedules, reminder systems, and reinforced counseling may therefore improve adherence and optimize asthma control. Overall, the results highlight the persistent challenge of ICS non-adherence and its direct impact on asthma outcomes. Addressing the multifactorial barriers to adherence can lead to improved disease management, reduced exacerbations, and enhanced

Journal of Molecular Science
Volume 36 Issue 1, Year of Publication 2026, Page 19-23
DoI-10.004687/1000-9035.2026.003

quality of life for asthma patients. The integration of these findings into clinical practice and policy can inform targeted strategies for adherence promotion in similar tertiary care settings.

4. DISCUSSION

This study demonstrated a high prevalence of poor adherence (54.9%), consistent with findings from previous studies conducted in developing countries. Poor adherence remains a major barrier to optimal asthma control and is associated with increased disease burden.

The strong association between adherence and asthma control highlights the importance of behavioral and educational interventions. Sociodemographic factors such as income and education may influence adherence through access to healthcare and understanding of disease management. Interestingly, female patients showed better adherence, which may reflect differences in health-seeking behavior. Duration of inhaler use also influenced adherence, suggesting that long-term users may develop complacency or treatment fatigue.

These findings emphasize the need for structured asthma education programs, regular adherence monitoring, and improved patient-provider communication.

5. LIMITATIONS

Single-center study, Self-reported adherence may introduce bias and cross-sectional design limits causal inference Despite the valuable insights provided by this study, several limitations must be acknowledged. First, the cross-sectional design restricts the ability to establish causal relationships between inhaled corticosteroid adherence and asthma control. The findings reflect adherence patterns and associated factors at a single point in time, which may not capture changes in behavior or asthma management over a longer period. Second, the study relied on self-reported adherence measures, which are subject to recall bias and social desirability bias, potentially leading to overestimation of medication adherence. Objective measures such as pharmacy refill records or electronic monitoring devices were not used, which may have provided more precise adherence data. Third, the study was conducted in a single tertiary care hospital, which may limit the generalizability of the findings to broader populations, including patients in primary care settings or rural areas. Socioeconomic, cultural, and healthcare system differences may influence adherence patterns differently across other regions.

Finally, potential confounding factors such as comorbidities, concurrent medications, or environmental triggers were not exhaustively controlled, which may affect the observed associations between non-adherence and asthma control. Future studies employing longitudinal designs, objective adherence measures, and multicenter participation are warranted to overcome these limitations and provide a more comprehensive understanding of adherence behaviors among asthma patients.

CONCLUSION

In conclusion, this study demonstrates that adherence to inhaled corticosteroids among asthma patients in a tertiary care hospital is suboptimal, which substantially affects asthma control and the overall well-being of patients. The findings indicate that non-adherence is multifactorial, arising from patient-related factors such as forgetfulness, misconceptions about the necessity of daily use, fear of side effects, and limited understanding of disease management. Additionally, treatment-related factors, including the complexity of inhaler regimens and perceived inefficacy, alongside healthcare system-related challenges such as inadequate follow-up and limited patient counseling, further contribute to poor adherence. The study emphasizes the critical role of healthcare providers in addressing these barriers through comprehensive patient education, regular reinforcement of proper inhaler techniques, and individualized counseling to enhance awareness of the importance of consistent therapy. Implementation of adherence monitoring tools, reminder systems, and supportive interventions can help patients overcome behavioral and cognitive barriers, ensuring better disease management. Furthermore, integrating multidisciplinary strategies involving pharmacists, nurses, and respiratory therapists can optimize asthma care and empower patients to actively participate in self-management. Ultimately, improving adherence to inhaled corticosteroids not only enhances asthma control but also reduces the frequency of exacerbations, hospital visits, and long-term complications. These measures are essential for improving patient quality of life, reducing healthcare costs, and achieving favorable clinical outcomes. Future studies should focus on longitudinal assessments of adherence interventions, exploring socio-cultural influences, and evaluating cost-effective strategies to promote sustained adherence in diverse patient populations.

List of Abbreviations

ICS – Inhaled Corticosteroids
ACT – Asthma Control Test
CI – Confidence Interval

Journal of Molecular Science
Volume 36 Issue 1, Year of Publication 2026, Page 19-23
DoI-10.004687/1000-9035.2026.003

OR – Odds Ratio
SD – Standard Deviation
SPSS – Statistical Package for the Social Sciences

AUTHOR CONTRIBUTIONS

Jasi Muhammed K1 – Conceptualization of the study, data collection, and manuscript drafting, **N. Senthilkumar1*** – Supervision, study design, methodology, data analysis, and critical revision of the manuscript and **Arya M. S1** – Assistance in data collection, literature review, and preparation of tables and figures. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest related to this study.

FUNDING

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

ETHICAL CONSIDERATION

The study protocol was reviewed and approved by the Institutional Ethics Committe. Written informed consent was obtained from all participants prior to enrollment. All procedures were conducted in accordance with the ethical standards of the Declaration of Helsinki and relevant national guidelines.

DATA AVAILABILITY

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

REFERENCES

1. Global Initiative for Asthma. Global strategy for asthma management and prevention.
2. World Health Organization. Adherence to long-term therapies: evidence for action.
3. Rand CS, Wise RA. Measuring adherence to asthma medication regimens. Am J Respir Crit Care Med.
4. Shayo GA, Omary A, Mugusi F. Inhaler non-adherence and asthma control. East Afr Health Res J.
5. Rafi MA, et al. Adherence to inhalers among adult asthma patients. Asthma Res Pract.
6. Dua R, et al. Reasons for lack of asthma control in India. Int J Community Med Public Health.
7. Mohd Isa NA, et al. Asthma control and treatment adherence. Med J Malaysia.
8. Lycett HJ, et al. Beliefs about medication and adherence
9. Vähätalo I, Kankaanranta H, Tuomisto LE, Niemelä O, Lehtimäki L, Ilmarinen P. Long-term adherence to inhaled corticosteroids and asthma control in adult-onset asthma. ERJ Open Res. 2021;7(1):00715-2020. doi:10.1183/23120541.00715-2020.
10. Belachew EA, Netere AK, Sendekie AK. Adherence to inhaled corticosteroid therapy and its clinical impact on asthma control in adults living with asthma in Northwestern Ethiopian hospitals. Patient Prefer Adherence. 2022; doi:10.2147/PPA.S365222.
11. Vasbinder EC, Belitser SV, Souverein PC, van Dijk L, Vulto AG, van den Bemt PM. Non-adherence to inhaled corticosteroids and the risk of asthma exacerbations in children. Patient Prefer Adherence. 2016;10:531-538. doi:10.2147/PPA.S92824.
12. Taylor A, Chen LC, Smith MD. Adherence to inhaled corticosteroids by asthmatic patients: measurement and modelling. Int J Clin Pharm. 2014;36(1):112-119. doi:10.1007/s11096-013-9862-0.
13. Belachew EA, et al. Adherence to inhaled corticosteroids and asthma control in adults: cross-sectional study. Patient Prefer Adherence. 2022. (Dovepress)
14. Determinants of ICS therapy adherence in patients with asthma. Am J Manag Care. 2019;25(12 Suppl):S?-S?. (Study of determinants and predictors of non-adherence).
15. Trousseau E, et al. Factors associated with adherence to asthma treatment with inhaled corticosteroids: a cross-sectional exploratory study. Respir Med. 2017;131:210-218. doi:10.1016/j.rmed.2017.08.012.
16. Lasmar L, Camargos P, Bousquet J, et al. Factors related to lower adherence rates to inhaled corticosteroids in children and adolescents: A prospective cohort study. J Trop Pediatr. 2009;55(1):20-25. doi:10.1093/tropej/fmn067.
17. Global and national evidence on asthma adherence and outcomes: systematic review and future directions. J Asthma Allergy. 2020;?–?. (Systematic evidence on adherence rates worldwide).
18. Determinants of non-adherence to inhaled steroids in adult asthmatic patients on follow up in referral hospital, Ethiopia: cross-sectional study. Asthma Res Pract. 2019;5:3. doi:10.1186/s40733-019-0053-1.