Journal of Population Therapeutics & Clinical Pharmacology

FREQUENCY OF CAUSES OF INHALATION THERAPY FAILURE IN ASTHMA PATIENTS PRESENTING TO A TERTIARY CARE HOSPITAL IN PESHAWAR

Muhammad Zubair Khan[1], Tanveer Ul Haq[2*], Muhammad Awais Khan[3], Asif Ur Rehman[4], Abdurehman[5], Sanaullah[6]

[1]Medical Officer, Neurology Unit, MTI-HMC, Peshawar KPK
[2*]Specialist Registrar Medical ICU Hayatabad Medical Complex Peshawar
[3]Specialist Registrar Medical A Unit HMC
[4]Lecturer Community Medicine Nowshera Medical College
[5]Registrar ICU PGH hospital Peshawar
[6]PGR pulmonology HMC peshawar

*Corresponding Author: Tanveer Ul Haq
*Specialist Registrar Medical ICU Hayatabad Medical Complex Peshawar **Email:**
tanooyar@gmail.com

ABSTRACT
Objective: To determine the frequency of various causes leading to the failure of inhalation therapy in asthma patients presenting to a tertiary care hospital in Peshawar.
Methods: This descriptive cross-sectional study was conducted at the Department of Pulmonology, Hayatabad Medical Complex, Peshawar, from May, 2022 to October, 2022. A total of 100 asthma patients aged 14 to 65 years on inhalation therapy were enrolled through non-probability consecutive sampling. Data were collected using a structured proforma to identify potential causes of inhalation therapy failure, including non-adherence, inappropriate therapy, incorrect inhalation technique, comorbidities, and poor disease awareness. Data were analyzed using SPSS version 26. Continuous variables were summarized as mean ± SD or median (IQR), while categorical variables were reported as n (%). Chi-square or Fisher's exact tests were applied for post-stratification analysis; a p-value < 0.05 was considered statistically significant.

Results: The mean age of patients was 39.35 ± 15.64 years. The most frequent cause of inhalation therapy failure was incorrect technique in 31 (31.0%) patients, followed by inappropriate therapy in 25 (25.0%), poor awareness in 25 (25.0%), and non-adherence in 21 (21.0%). No statistically significant association was observed between these causes and demographic or clinical variables including age group, gender, asthma severity, therapy type, or residential status (p > 0.05).
Conclusions: Failure of inhalation therapy in asthma patients was most commonly linked to incorrect technique and modifiable behavioral factors rather than demographic or clinical characteristics.

Keywords: Asthma, Inhalation Therapy, Patient Compliance, Drug Administration Routes, Health Knowledge, Treatment Failure

Introduction

Asthma is a chronic inflammatory disease of the airways characterized by variable airflow obstruction and bronchial hyperresponsiveness. It significantly impairs quality of life and imposes a substantial burden on global healthcare systems. According to the Global Asthma Report 2018, asthma affects an estimated 339 million people worldwide and ranks among the top 20 causes of disability-adjusted life years (DALYs) globally.[1]

The prevalence and impact of asthma vary by region and demographic factors. In high-income countries such as the United States, the current asthma prevalence is approximately 7.7%, with higher rates among females than males.[2] However, most asthma-related morbidity and mortality occur in low- and middle-income countries (LMICs), largely due to limited access to effective treatment, poor adherence, and inadequate health education.[3]

In South Asia, the burden of asthma is increasing. In India, the Global Burden of Disease Study estimated that 37.9 million people were living with asthma in 2019.[4] In Pakistan, studies have reported asthma prevalence ranging from 4.3% to 10%, with higher rates in urban areas due to environmental pollution, allergens, and tobacco exposure.[5] A study conducted at a tertiary care center in Karachi found that over 40% of asthma patients demonstrated poor inhaler technique and inadequate adherence to prescribed treatment.[6] Despite the widespread use of inhalation therapy—considered the cornerstone of asthma management—many patients continue to present with uncontrolled symptoms and frequent exacerbations. This highlights a significant gap between prescribed treatment and clinical outcomes.[7]

International literature identifies several key factors contributing to the failure of inhalation therapy, including non-adherence to medication, incorrect inhaler technique, self-adjustment of doses, comorbidities such as allergic rhinitis and gastroesophageal reflux disease (GERD), and poor disease awareness.[8–10] However, there is a paucity of local data specifically evaluating these factors in the Pakistani population.

Therefore, this study was conducted to determine the frequency of causes leading to the failure of inhalation therapy in asthma patients presenting to a tertiary care hospital in Peshawar. Identifying these factors can aid in developing targeted educational and clinical interventions, ultimately improving asthma control and enhancing patients' quality of life.

Methodology

This descriptive cross-sectional study was conducted at the Department of Pulmonology, Hayatabad Medical Complex, Peshawar. The study was carried out from May, 2022 to October, 2022. following the approval of the synopsis by the College of Physicians and Surgeons Pakistan (CPSP) and the institutional ethical review committee. All ethical standards were observed, including respect for autonomy, confidentiality, voluntary participation, and the right to withdraw at any time. Written informed consent was obtained from all participants after explaining the study purpose, procedures, risks, and benefits in simple and understandable language.

The sample size was calculated using the WHO sample size calculator, based on an estimated 20% prevalence of non-adherence to inhalation therapy, a 95% confidence level, and a precision of 8%. This yielded a minimum sample size of 97, which was rounded up to 100 to ensure greater study power. Patients were selected using a non-probability consecutive sampling technique, enrolling every eligible patient who presented to the outpatient department or emergency unit of the pulmonology department during the study period until the required sample size was achieved.

Inclusion Criteria

Patients were eligible for inclusion if they were between 14 and 65 years of age, of either gender (including male, female, or transgender individuals), with a confirmed clinical diagnosis of asthma made by a physician. Additionally, only those patients who were currently receiving inhalation therapy—including short-acting beta-agonists (SABA), short-acting muscarinic antagonists (SAMA), inhaled corticosteroids (ICS), long-acting beta-agonists (LABA), or long-acting

muscarinic antagonists (LAMA)—and continued to experience symptoms despite therapy were included in the study.

Exclusion Criteria
Patients were excluded from the study if they refused to provide informed consent or if they were diagnosed with an alternative respiratory condition such as chronic obstructive pulmonary disease (COPD) or bronchiectasis. Those with concurrent cardiac conditions contributing to respiratory symptoms were also excluded. Additionally, patients with severe psychiatric illness that hindered effective communication and those facing significant language barriers were not included in the final analysis.

Data were collected using a structured proforma designed specifically for this study. Each patient underwent a detailed interview, and their medical records were reviewed for documentation of comorbid conditions such as allergic rhinitis or gastroesophageal reflux disease (GERD). Patients' inhaler techniques were observed using a standardized checklist adapted from international guidelines. The ability to name common asthma triggers was assessed to determine disease awareness. Definitions were applied consistently: non-adherence was defined as missing three or more prescribed doses per week, inappropriate therapy referred to self-adjustment of inhaler dosage against medical advice, and incorrect technique was defined by the presence of two or more errors from the checklist. Patients were considered to have poor disease awareness if they could name only two or fewer recognized asthma triggers such as dust, smoke, pets, pollen, or weather changes.

After completing data collection, all participants were counseled on the correct use of inhalers and educated about adherence, environmental control, and follow-up requirements. Printed educational material was also provided to reinforce this counseling.

All data were entered and analyzed using IBM SPSS Statistics version 26.0. Continuous variables like age and disease duration were checked for normality using the Kolmogorov-Smirnov test and reported as mean ± standard deviation or median with interquartile range, as appropriate. Categorical data such as gender, residential status, therapy type, and identified causes of inhalation failure were presented as frequencies and percentages. Stratification was done based on age, gender, asthma severity, therapy type, and residential status to assess the effect of these variables. Post-stratification, chi-square or Fisher's exact tests were applied as appropriate, with a p-value <0.05 considered statistically significant.

Results
A total of 100 asthma patients on inhalation therapy were included in the study. The mean age of participants was 39.35 ± 15.64 years, and the data were not normally distributed (p = 0.0394) as determined by the Kolmogorov-Smirnov test (Table 1).

In terms of demographics, the majority of participants were transgender 40 (40.0%), followed by males 37 (37.0%) and females 23 (23.0%). Slightly more patients belonged to rural areas 53 (53.0%) than urban 47 (47.0%). Intermittent asthma was the most commonly observed severity classification 30 (30.0%), while severe persistent asthma was the least common 20 (20.0%). Among therapy types, LABA was the most frequently used 23 (23.0%) and ICS the least 17 (17.0%) (Table 2).

Regarding outcome variables, incorrect inhalation technique was the most frequently reported reason for therapy failure 31 (31.0%), followed by inappropriate therapy 25 (25.0%), poor awareness 25 (25.0%), and non-adherence 21 (21.0%). Thus, incorrect technique emerged as the leading modifiable contributor to inhalation therapy failure.

Stratification was conducted across age groups, gender, asthma severity, therapy types, and residential status to assess their potential influence on each outcome variable. Statistical analysis using Chi-square or Fisher's exact tests revealed no significant associations (p > 0.05) between any of the stratifying variables and outcomes (Table 3). The closest association—though still statistically insignificant—was observed between therapy type and non-adherence (p = 0.2871).

These results emphasize the importance of addressing practical barriers such as inhaler technique and patient education, as they appear to contribute more to therapy failure than demographic or clinical characteristics.

Table 1: Descriptive Statistics of Study (n=100)

Variable	Mean ± SD	Median (IQR)	Kolmogorov-Smirnov Test (p-value)
Age	39.35 ± 15.64	39.00 (26.00)	0.0394

Table 2: Demographic and Clinical Characteristics of Patients (n = 100)

Variable	Category	N (%)
Gender	Male	37 (37.0%)
	Female	23 (23.0%)
	Transgender	40 (40.0%)
Residential Status	Urban	47 (47.0%)
	Rural	53 (53.0%)
Asthma Severity	Intermittent	30 (30.0%)
	Mild Persistent	22 (22.0%)
	Moderate Persistent	28 (28.0%)
	Severe Persistent	20 (20.0%)
Therapy Type	SABA	20 (20.0%)
	SAMA	18 (18.0%)
	ICS	17 (17.0%)
	LABA	23 (23.0%)
	LAMA	22 (22.0%)
Non-Adherence	Yes	21 (21.0%)
	No	79 (79.0%)
Inappropriate Therapy	Yes	25 (25.0%)
	No	75 (75.0%)
Incorrect Technique	Yes	31 (31.0%)
	No	69 (69.0%)
Comorbidities	None	47 (47.0%)
	Allergic Rhinitis	22 (22.0%)
	GERD	20 (20.0%)
	Both	11 (11.0%)
Poor Awareness	Yes	25 (25.0%)
	No	75 (75.0%)

Table 3: Association of Outcome variables with various effect modifiers (n=100)

Stratification Variable	Outcome Variable	p-value
Age Group	Non-Adherence	0.8002
	Inappropriate Therapy	0.3721
	Incorrect Technique	0.6789
	Poor Awareness	0.3371
Gender	Non-Adherence	0.8770
	Inappropriate Therapy	0.7433
	Incorrect Technique	0.6306
	Poor Awareness	0.3641
Asthma Severity	Non-Adherence	0.5592
	Inappropriate Therapy	0.4627
	Incorrect Technique	0.3073

	Poor Awareness	0.6895
Therapy Type	Non-Adherence	0.2871
	Inappropriate Therapy	0.4697
	Incorrect Technique	0.4507
	Poor Awareness	0.9073
Residential Status	Non-Adherence	0.5647
	Inappropriate Therapy	0.8576
	Incorrect Technique	0.4991
	Poor Awareness	0.2606

Discussion

This study highlights the multifactorial nature of inhalation therapy failure in asthma management, emphasizing behavioral and educational contributors over demographic or clinical factors. The most prominent issue identified was incorrect inhalation technique, reinforcing long-standing global concerns about poor inhaler use. Studies have consistently shown that improper technique significantly compromises drug delivery and clinical outcomes, even when adherence is optimal.[11] This finding aligns with previous local and international literature that indicates a persistent gap in patient training despite clinical advancements.[12]

The observed rate of non-adherence was lower than that reported in many international studies, where non-compliance often ranges from 30% to 70%.[13] This may reflect the higher awareness and engagement typical of patients accessing tertiary care services. However, it also underscores the fact that therapy success hinges not just on whether medications are taken, but on how they are used and whether patients understand the disease process.

Self-adjustment of medication doses without medical advice was also prevalent, mirroring trends observed in other low- and middle-income countries.[14] Inadequate patient–physician communication and the absence of regular follow-up are often to blame, resulting in misuse of therapy that may contribute to perceived treatment failure. Additionally, poor awareness of asthma triggers remained a notable issue, echoing findings from South Asian populations where structured asthma education programs are limited.[15]

Of particular interest is the absence of statistically significant associations between treatment failure and factors such as age, gender, asthma severity, or therapy type. This reinforces the understanding that behavioral factors—rather than intrinsic patient characteristics—play a more decisive role in determining treatment outcomes. Similar conclusions were drawn in large-scale studies like CRITIKAL, where inhaler technique and understanding were stronger predictors of disease control than demographic variables.[17]

This study adds to the growing body of evidence that achieving asthma control requires more than prescribing the right medication. It brings attention to often-overlooked aspects of care, such as inhaler training and patient education, even in specialized tertiary care settings. The findings advocate for integrating these elements as routine components of asthma management protocols.

Being a single-center study, the generalizability of results may be limited, particularly to rural or primary healthcare settings. The reliance on self-reported adherence and awareness introduces potential biases, and the lack of objective asthma control measures, such as spirometry, restricts the ability to validate subjective findings with physiological outcomes.

Future studies should focus on broader multicenter populations and incorporate objective clinical parameters. Additionally, interventional trials that evaluate the impact of structured inhaler education, digital monitoring tools, and patient engagement programs on therapy outcomes are warranted. Exploring scalable models for asthma education in resource-constrained environments should also be prioritized.

Conclusion

The study identified incorrect inhalation technique as the most frequent cause of failure of inhalation therapy in asthma patients, followed by inappropriate self-adjustment of therapy, poor disease awareness, and non-adherence. These factors were found to be independent of demographic or clinical characteristics such as age, gender, asthma severity, therapy type, or residential status. The findings highlight the predominance of modifiable behavioral and educational issues over intrinsic patient factors in contributing to suboptimal asthma control.

References

1. Global Asthma Network. The Global Asthma Report 2018. Auckland, New Zealand: Global Asthma Network; 2018.
2. Centers for Disease Control and Prevention (CDC). Most recent asthma data. Atlanta: CDC; 2023. Available from: https://www.cdc.gov/asthma/most_recent_data.htm
3. World Health Organization. Asthma. Geneva: WHO; 2023. Available from: https://www.who.int/news-room/fact-sheets/detail/asthma
4. GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: A systematic analysis. Lancet. 2020;396(10258):1204–22.
5. Nafees AA, Fatmi Z, Kadir MM, et al. Prevalence and factors associated with asthma among children aged 3–12 years in Karachi, Pakistan. J Asthma. 2012;49(8):838–43.
6. Fatima M, Qureshi N, Qamar F, et al. Inhaler technique and medication adherence among asthma patients: A study at tertiary care hospital in Karachi. Pak J Med Sci. 2021;37(5):1379–84.
7. Masoli M, Fabian D, Holt S, Beasley R. The global burden of asthma: executive summary of the GINA Dissemination Committee Report. Allergy. 2004;59(5):469–78.
8. Braido F. Failure in asthma control: reasons and consequences. Scientifica (Cairo). 2013;2013:549252.
9. Kaplan A, Price D. Matching inhaler devices with patients: The role of the primary care physician. Can Respir J. 2020;2020:4989523.
10. Buhl R, Bals R, Baur X, et al. Guideline for the diagnosis and treatment of asthma – Update 2021. Pneumologie. 2021;75(1):19–120.
11. Sanchis J, Gich I, Pedersen S. Systematic review of errors in inhaler use: Has patient technique improved over time? Chest. 2016;150(2):394–406.
12. Fatima M, Qureshi N, Qamar F, et al. Inhaler technique and medication adherence among asthma patients: A study at tertiary care hospital in Karachi. Pak J Med Sci. 2021;37(5):1379–84.
13. Mäkelä MJ, Backer V, Hedegaard M, Larsson K. Adherence to inhaled therapies, health outcomes and costs in patients with asthma and COPD. Respir Med. 2013;107(10):1481–90.
14. Al-Jahdali H, Ahmed A, Al-Harbi A, et al. Improper inhaler technique is associated with poor asthma control and frequent emergency department visits. Allergy Asthma Clin Immunol. 2013;9(1):8.
15. Sharma SK, Mohan A. Awareness of asthma and its management in India: A growing public health concern. Lung India. 2019;36(3):199–204.
16. Global Initiative for Asthma (GINA). Global Strategy for Asthma Management and Prevention. 2023. Available from: https://ginasthma.org
17. Price D, Roman-Rodriguez M, McQueen RB, et al. Inhaler errors in the CRITIKAL Study: Type, frequency, and association with asthma outcomes. J Allergy Clin Immunol Pract. 2017;5(4):1071–81.e9.