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ORIGINAL RESEARCH

Impact of Pharmacist-Led Intervention on Adherence to Inhalers, Inhalation Technique, and Disease Control Among Asthma/COPD Patients in a Resource Limited Center: An Interventional Study

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Background: Asthma and Chronic obstructive pulmonary disease (COPD) are chronic respiratory conditions characterized by airflow obstruction and respiratory symptoms. Adherence to prescribed inhaler therapy and correct inhalation technique are essential for effective disease management and optimal disease control. However, non-adherence and incorrect inhalation technique are common challenges faced by patients with asthma and COPD, leading to suboptimal treatment outcomes and increased healthcare burden.

Purpose: To study the impact of a pharmacist-led intervention on inhaler adherence, inhalation technique, and disease control among patients with asthma and COPD.

Patients and Methods: A pre-post interventional design assessed the effects of pharmacist-led intervention on inhaler adherence, inhalation techniques, and disease control in asthma and COPD patients at Dhulikhel Hospital in Nepal. Inclusion criteria: adult patient clinically diagnosed with asthma or COPD patients of all genders. The intervention comprised counseling patients with aids like videos, and informational leaflets. Impact was measured using checklist method for inhalation technique, the Test of Adherence to Inhaler (TAI) questionnaire for adherence to inhaler, and "Asthma Control Test (ACT)" or "COPD Assessment Test (CAT)" for disease control.

Results: The pharmacist-led intervention significantly increased adherence to inhalers, evidenced by a notable rise in the proportion of patients with good adherence ($P<0.001$). Sporadic, deliberate, and unwitting noncompliance pattern also improved significantly after the intervention ($P<0.001$, $P<0.001$ and $P=0.001$). Inhalation technique exhibited substantial improvement after intervention ($P<0.001$). The analysis indicated significant moderate negative correlations between "TIA" and "CAT" [$\rho=-0.31$; P=0.01], and between "inhalation technique score" and "CAT score" [$\rho=-0.31$; $P=0.01$] suggesting that as adherence to inhaler usage and inhalation technique improve, CAT scores tend to decrease, indicating reduced disease impact on the patient.

Conclusion: This study shows the potential efficacy of pharmacist-led intervention in enhancing adherence to inhaler, inhalation technique, and disease control in respiratory conditions such as asthma and COPD.

Keywords: adherence to inhalers, asthma, COPD, disease control, inhalation technique, pharmacist-led intervention

Introduction

Asthma and chronic obstructive pulmonary disease (COPD) impose substantial clinical and economic burdens globally.[1] With asthma being more prevalent but COPD associated with a significantly higher mortality rate, these conditions are on the rise due to an increasing global population.[1] In the management of both Asthma and COPD, inhaled medications play a pivotal role, being delivered directly to the lungs through devices such as dry powder inhalers (DPI), pressurized metered-dose inhalers (pMDI), and soft mist inhalers (SMI).[2,3] The efficacy of these inhaled medications is intricately linked to the correct execution of the inhalation technique, a process influenced by the complexity of the devices, aerosol formulation, and patient's proficiency.[4,5] Meta-analyses have shown that when patients adhere to the inhalation technique as advised by the manufacturer, all types of inhalers can be equally effective and produce the same therapeutic benefits,

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albeit with potential variations in required dosage levels.[6–8] Despite the availability of various inhalers, studies have revealed a high prevalence of incorrect inhalation techniques among patients, stemming from inadequate education or modifications to the recommended technique.[9,10] Poor adherence to optimal treatment regimens is a common issue in respiratory conditions, with studies indicating suboptimal adherence leading to increased mortality, morbidity, and healthcare resource utilization.[11,12] Errors in medication administration not only decrease efficacy but also contribute to increased adversities, with a significant percentage of COPD and asthmatic patients known to misuse their medications, particularly inhalers.[13,14] The lack of understanding among patients about the correct usage of inhalers further compounds these issues, jeopardizing the intended therapeutic outcomes.[15]

Effective inhaler use necessitates proper inhalation techniques, and errors in using both traditional meter dose inhalers (MDIs) and newer dry powder inhalers (DPIs) have been observed in clinical practice.[16] Despite DPIs being introduced as user-friendly alternatives, real-world usage has shown frequent misuse, emphasizing the need for patient education tailored to specific devices.[16,17] Assessing patients' inhaler techniques and adherence is crucial before making changes to prescriptions, as highlighted in treatment guidelines, underscoring the pivotal role of skilled healthcare professionals in teaching and evaluating inhaler techniques.[8,18]

In resource-limited settings like Nepal, poverty and lack of education compound the challenges, making patient education about medication less accessible.[19] This study aims to evaluate the impact of counseling on the use of MDIs and DPIs, providing essential baseline data on patients' knowledge and practices regarding inhaler use. In the context of Nepal, where there is limited research on patient compliance, inhalation techniques, and disease control in Asthma/COPD patients,[20–23] this research assumes significance. Focusing on the pharmacist-led intervention at Dhulikhel Hospital, the study aims to contribute insights into adherence to inhalers, enhance inhalation techniques, and improve disease control, ultimately aiming to achieve the best possible quality of life for patients with chronic respiratory conditions.

Patients and Methods

Study Design

This study employed a pre-post interventional design to assess the impact of pharmacist led intervention on adherence to inhaler, inhalation technique, and disease control among asthma or COPD patient. The sample size of 74 was calculated using the G*Power Version 3.0.5 software,[24] incorporating a 10% loss on follow-up. The value of effect size 0.35 was adopted from literature,[23] with alpha as 0.05, and power of study as 0.80. The study population comprised patients of all genders with clinical diagnoses of asthma or COPD. Inclusion criteria included a. individuals aged 18 years or older, those who had been diagnosed with COPD or asthma at least three months prior to enrollment, b. those using at least one inhaler (MDI, DPI) daily. Exclusion criteria involved patients, a. who were unwilling to participate or provide consent, b. those exhibiting symptoms of infection within five days before the study began (to avoid confounding factors as symptoms of infection could interfere with disease control), and c. those with comorbidities that could prevent proper inhaler use, such as advanced cognitive disorders, mental illnesses, or significant neurological, vision, or hearing disorders. The study adhered to the principles outlined in the Declaration of Helsinki and received ethical approval from the Institutional Review Committee (IRC) of Kathmandu University School of Medical Sciences (KUSMS), under approval number 02/23. Written consent was obtained from patients or their caregivers by pharmacists. Additionally, sublicenses for assessment tools were acquired to ensure compliance with copyright and permissions requirements.

Intervention

The Intervention included face-to-face counseling sessions conducted by a pharmacist, supported by video aids and informational leaflet. These sessions took place in outpatient department of the Pulmonology Department at Dhulikhel Hospital – Kathmandu University Teaching Hospital, a 475-bedded tertiary care hospital, spanning from January to July 2023. Pharmacist provided instructions on the correct use of inhalers, assessed patients' inhalation techniques, and offered feedback and reinforcement as needed. The pharmacist also conveyed important information about disease control and its significance. Each patient received one tailored session during their routine clinic visits, lasting approximately 20–30 minutes. The intervention was customized to address individual patient needs based on their initial

levels of inhaler adherence, inhalation technique, and disease control. Baseline characteristics of patient including adherence to inhaler, inhalation technique and disease control was recorded by pharmacist before intervention. Patient follow-up was conducted after 4 weeks, with post-interventional information recorded using the same tools.

Data Collection Tools

Measure of Adherence

The 12 item Test of Adherence to Inhalers (TIA)[25] assessed adherence level and pattern of non-compliance. It consist of 12 questions (Patient domain 10 and Healthcare professional domain 2), patient domain questionnaire is scored from 1 to 5, where 1 represents the worst compliance and 5 represent the best compliance. The total score for the patient domain is calculated by summing up the scores for the 10 items, resulting in a score ranging from 10 (minimum) to 50 (maximum). Adherence levels are categorized as follows: "Good adherence" - score of 50; Intermediate adherence - A score between 46 and 49; Poor adherence – A score less than or equal to 45. Questions 11 and 12 fall under the "Healthcare professional's domain". These questions are filled in by pharmacists, and they are scored with either 1 or 2 points, representing poor or good knowledge of the regimen and/or inhalation technique.

To assess the type or pattern of non-compliance, the scores obtained from different sets of questions are considered: For Items 1 to 5, if the score is less than 25 – "sporadic" non-compliance; For Items 6 to 10, if the score is less than 25 – "deliberate" non-compliance and for Items 11 to 12, if the score is less than 4 – "unwitting" non-compliance.

Measure of Disease Control

Asthma Control Test (ACT)[26] questionnaire consists of five questions, and each question is scored from 1 (least control) to 5 (well control). The scores from all five questions are summed, resulting in a total score. A score of 16 or less indicates "poorly controlled asthma"; a score between 16 and 19 indicates "partially controlled asthma"; a score between 20 and 25 indicates "well-controlled asthma".

COPD Assessment Test (CAT)[27] questionnaire consists of eight conditions, and each condition is scored from 1 (well-controlled) to 5 (poorly controlled). The scores from all eight conditions are summed to obtain a total score. A score less than or equal to 9 indicates "well-controlled" COPD; A score between 10 and 20 indicates "mild to moderate" control; A score between 21 and 30 indicates a "moderate to severe" impact; A score between 31 and 40 indicates a "severe" impact.

Checklist of Inhalation Techniques

A checklist[28] provided by the National Asthma Council Australia & World Health Organization for the assessment of correct inhalation techniques among Asthma & COPD patients. The checklist consisted of three sections, each focusing on different aspects of inhaler use. The first section assessed the condition of the device through a questionnaire. It included three questions related to the functionality and cleanliness of the inhaler. The second section focused on the preparation of the inhaler for inhalation. It included three questionnaire items that evaluated the patient's knowledge and actions related to preparing the inhaler before use. The third section of the checklist assessed the critical steps of inhalation. It consisted of nine questionnaire items that evaluated the patient's technique during inhalation. A pharmacist observed how the patient used the device and scored each step as either correct (score of 1) or incorrect (score of 0). The scores for each step were then added up to determine the overall score for the patient. The patients' knowledge of the inhalation technique was classified into three categories. A score of less than 45% indicated poor knowledge, score between 45% and 75% indicated adequate knowledge, and score greater than 75% indicated good knowledge.

Data Processing and Analysis

Data underwent thorough cleaning, coding, and entry in Microsoft Excel. SPSS version 16 was used for analysis. Descriptive indices, such as mean (SD), median (IQR), frequency, and percentage, were employed to succinctly summarize the dataset. The Man-Whitney *U*-test compared knowledge levels between MDIs and DPIs users. Pre-post intervention changes were evaluated using the Wilcoxon signed-rank test and McNemar change test. Correlation analyses were conducted using the Spearman rank test to unveil relationships between adherence, and inhalation technique, with disease control. A 5% level of significance was adopted for the entire study.

Results

Baseline Characteristics

A cohort of 74 patients was initially selected, but six (one asthmatic and five COPD) patients were lost during follow-up, resulting in a final sample size of 68 for post-interventional analysis. The baseline characteristics of patient is presented in Table 1.

Table 1 Baseline Characteristics of Patients (n = 74)

Characteristics		Frequency	%
Disease	Asthma	5	6.8%
	COPD	69	93.2%
Age Group	18–30 years	5	6.8%
	31–50 years	2	2.7%
	51–65 years	23	31.1%
	66–80 years	42	56.8%
	> 80 years	2	2.7%
Gender	Male	36	48.6%
	Female	38	51.4%
Marital status	Single	6	8.1%
	Married	68	91.9%
Family	Single	24	32.4%
	Joint	50	67.6%
Education level	Illiterate	22	29.7%
	Literate	21	28.4%
	Primary level	16	21.6%
	SLC	6	8.1%
	High school	4	5.4%
	University level	5	6.8%
Smoking habit	Yes	22	29.7%
	No	27	36.5%
	Quitted	25	33.8%
Duration of disease	Less than 1 year	0	0.0%
	1–3 year	8	10.8%
	4–5 years	43	58.1%
	5–8 year	12	16.2%
	8–10 year	0	0.0%
	10 + years	11	14.9%

(*Continued*)

Table 1 (Continued).

Characteristics		Frequency	%
Previous instruction session	None	65	87.8%
	Single session	1	1.4%
	Two session	1	1.4%
	Three session	1	1.4%
	3+ session	6	8.1%
Types of inhaler prescribed	MDI	23	31.1%
	DPI	51	68.9%

Test of Adherence to Inhalers

Level of Adherence

Patient adherence levels were assessed before and after the intervention using the same tool, revealing varying adherence levels; Figure 1 illustrates the comparison of adherence level between pre and post intervention. The pharmacist-led intervention demonstrated a statistically significant impact ($P<0.001$) on enhancing adherence to inhalers (Table 2).

Pattern of Adherence

The intervention led to substantial declines in sporadic, deliberate and unwitting noncompliance. A McNemar test at 5% level of significance revealed statistical significant difference in sporadic ($P<0.001$), deliberate ($P<0.001$), and unwitting ($P=0.002$) noncompliance (Table 2).

Practice of Patient Inhalation Technique

Condition of Device & Preparation of Inhalation

The study revealed notable improvements in the functionality, component fitting, and cleanliness of devices following the intervention. The Results suggest a positive impact on patients' ability to prepare inhalation which is crucial for effective respiratory treatment. (Figure 2).

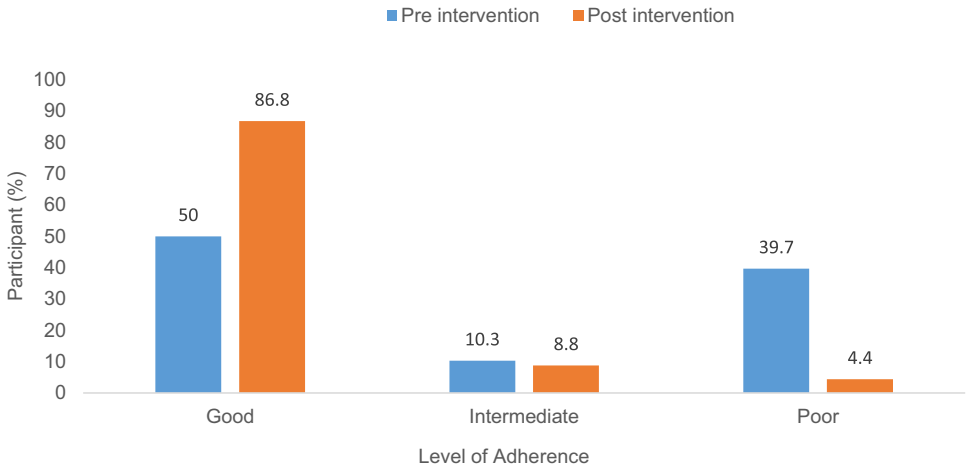

Figure 1 Comparison of inhaler adherence levels among patients before and after pharmacist-led intervention. The x-axis represents the level of knowledge, while the y-axis shows the percentage of participants (n = 68) before and after the intervention.

Table 2 Impact of Pharmacist-Led Intervention on Adherence to Inhaler and Inhalation Technique

	Pre-Intervention (n-68)	Post-Intervention (n-68)	*P*-value
TAI Score Median (IQR)	49.5 (43–50)	50 (50–50)	<0.001*
Pattern of noncompliance n (%)			
Sporadic noncompliance	33 (48.5%)	8 (11.8%)	<0.001†
Deliberate noncompliance	28 (41.1%)	5 (7.4%)	<0.001†
Unwitting noncompliance	68 (100%)	58 (85.3%)	0.002†
Inhalation technique score Median (IQR)	8 (5–8)	12 (12–13)	<0.001*

Notes: *Related-Samples Wilcoxon Signed Rank Test at a 5% level of significance. †McNemar test at a 5% level of significance. Sporadic non-compliance: patient who forgets to take their medication; Deliberate non-compliance: patient who does not take their medication because they do not want to; Unwitting non-compliance: patient who does not take their medication properly because they do not know the therapeutic regimen and how to use their inhaler.

Critical Steps in Inhalation

The intervention effectively enhanced patients' adherence to various critical steps involved in using both MDIs and DPIs. The positive changes observed in multiple aspects of inhaler technique indicate the intervention's success in improving patients' understanding and proficiency in using these devices for respiratory management. In this study a multifaceted analysis of inhaler users revealed substantial deficiencies, 22.1% holding the device correctly, 72.1% failing to execute the simultaneous spraying and inhaling technique, 98.5% disregarding the recommended slow and deep inhalation, and a 97.1% not adhering to the crucial step of holding their breath for 5–10 seconds after inhalation, thereby underscoring prevalent and critical errors in inhalation techniques prior to intervention. Figure 3 shows the comparison of patient's correct performance on critical step during inhalation. The median inhalation technique score improved from 8 (IQR 5–8) to 12 (IQR 12–13) after intervention (P<0.001). (Table 2)

Level of Knowledge on Inhalation

Before the intervention, a substantial proportion of participants, exhibited poor knowledge of inhalation techniques, which markedly improved post-intervention, resulting in a complete elimination of poor technique. (Figure 4)

Comparison of Level of Knowledge Between MDI & DPI User

Comparison of level of knowledge between patient using MDI and DPI is presented in Figure 5. Independent-samples Mann–Whitney U-test revealed the distribution of inhalation technique score is not significantly different across categories of type of inhaler used (P=0.08).

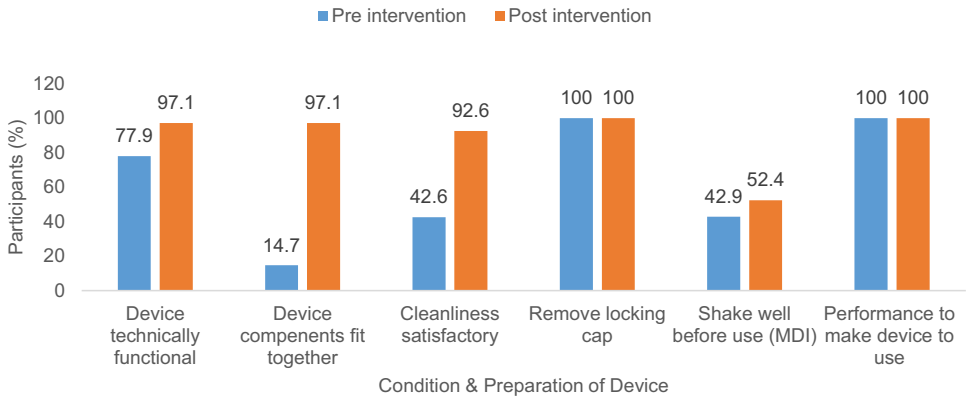

Figure 2 Condition and preparation of device before and after pharmacist-led intervention. The x-axis represents the condition and preparation of the device, while the y-axis shows the percentage of participants. The total number of participants is 68, with 23 being MDI users.

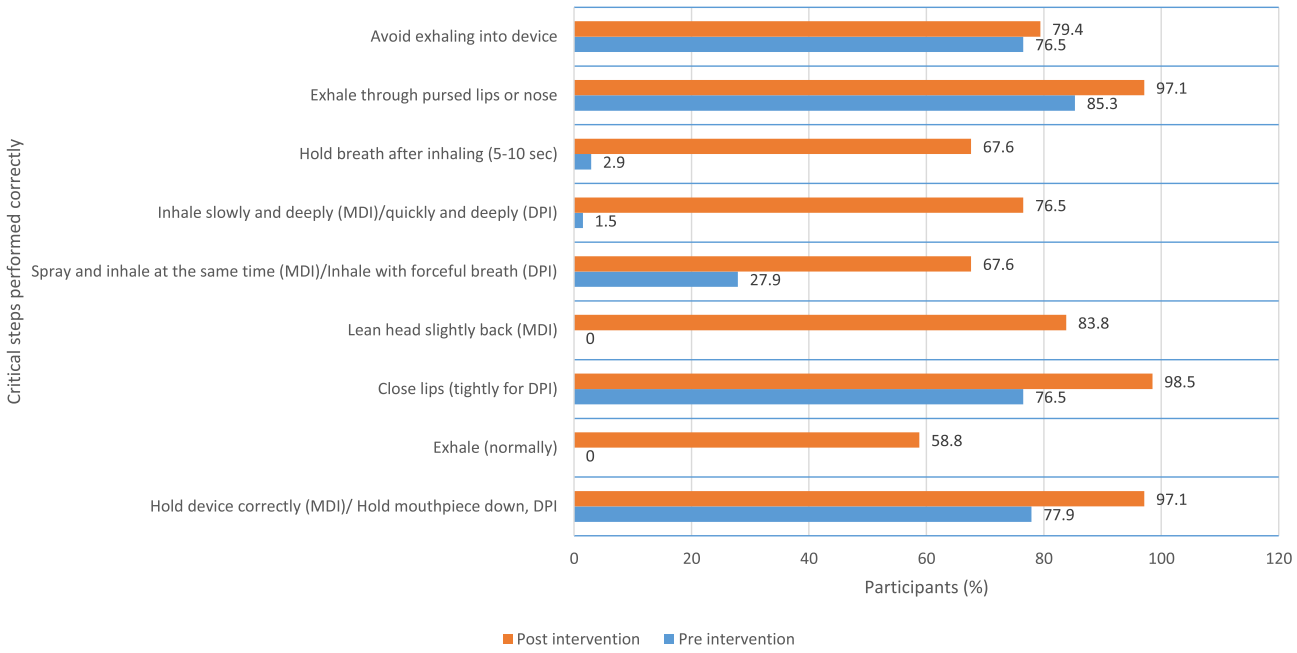

Figure 3 Comparison of correct critical steps on inhalation before and after pharmacist-led intervention. The x-axis shows the percentage of participants, while the y-axis represents the critical steps. The total number of participants is 68.

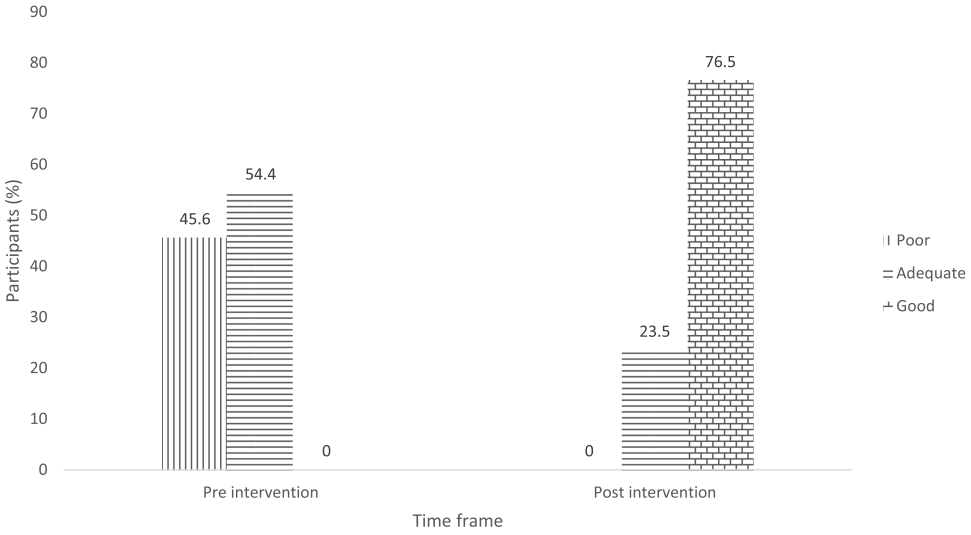

Figure 4 Level of knowledge on inhalation before and after pharmacist-led intervention. The x-axis represents the level of knowledge Pre-post intervention, while the y-axis shows the percentage of participants. The total number of participants is 68.

Disease Control

There was no difference in the number of asthmatic patients categorized as poorly controlled (1 patient) and partially controlled (3 patients) before and after the intervention. None of the patients had well-controlled asthma before or after the intervention.

For COPD patient, a decrease in the "severe impact" category based on CAT score was observed which was shifted to the "moderate-severe impact" category (Table 3).

There were no patient in "well controlled" and "mild –moderate impact" category based on scores of ACT or CAT so to streamline the classification of disease control within the context of asthma and COPD, a pragmatic approach has been adopted. Notably, the distinction between well-controlled and less-controlled states has been simplified for clarity. The categorization now

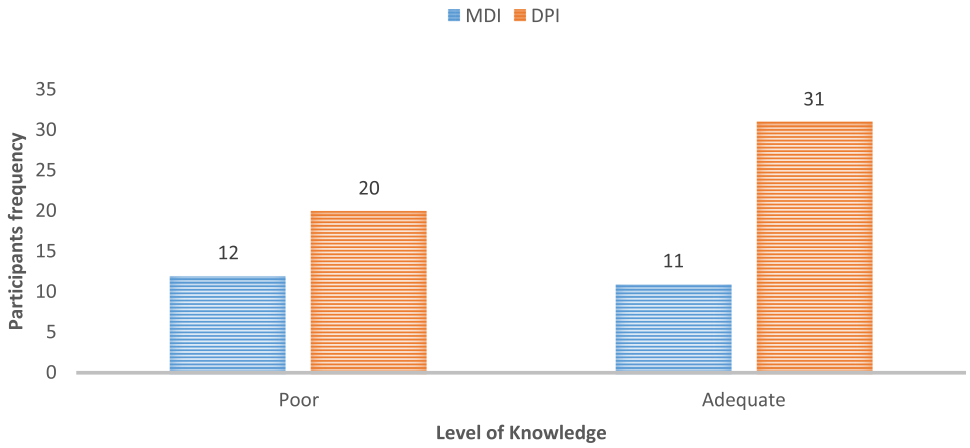

Figure 5 Pre-interventional level of knowledge between the types of inhaler use. The x-axis shows the level of knowledge across different types of inhalers, while the y-axis represents participant frequency (n = 74). An independent-samples Mann–Whitney *U*-test revealed that the distribution of inhalation technique scores is not significantly different across categories of inhaler types used ($P = 0.08$).

revolves around two main groups: "partially controlled" and "poorly controlled". Within the partially controlled group, patients exhibit either an ACT score between 16 and 19, a range previously designated as partially controlled asthma, or a CAT score between 21 and 30, encompassing moderate to severe control scenarios. In the poorly controlled category, patients are identified by an ACT score of 16 or less, previously associated with poorly controlled asthma, or a CAT score ranging from 31 to 40, indicative of severe impact (Table 4). A Related-Samples McNemar Change Test indicated that there was no significant impact of the pharmacist-led intervention on disease control for both asthma and COPD patients ($P>0.99$).

Correlations Between Variables

Due to the small number of asthmatic patients (n = 5), the correlation was performed solely for the COPD patient. The results indicated a significant moderate negative correlation between the variables "TIA" and "CAT", ($\rho=-0.31$; P=0.01), implying that as adherence to inhaler usage increases, the CAT scores tend to decrease, indicating a reduced disease impact on the patient. A significant moderate negative correlation between the variables "inhalation technique score" and "CAT score" was observed ($\rho=-0.31$; $P=0.01$), suggesting as the inhalation technique improves, the scores on the CAT tend to decrease, indicating a reduced impact of the disease on the patient.

Table 3 Disease Control CAT Score

Disease Control		Pre Intervention n (%)	Post-Intervention n (%)
CAT	Well controlled	0	0
	Mild-moderate impact	0	0
	Moderate-severe Impact	6	15 (23.4%)
	Severe impact	58	49 (76.6%)

Table 4 Disease Control Pre and Post Intervention

	Pre Intervention n (%)	Post Intervention n (%)	*P*- value
Partially controlled disease	9 (14.9)	18 (26.5)	>0.99
Poorly controlled disease	59 (85.1)	50 (73.5)	

Note: McNemar test at a 5% level of significance.

Discussion

The findings of this study reveal a distinct difference in the prevalence of asthma and COPD in the study population. While asthma was diagnosed in 6.8% of the participants, the majority, accounting for 93.2% of the sample, had COPD. This significant contrast underscores the disproportionate burden of COPD within the community. Additionally, the observation that in tertiary care hospitals, COPD patients are commonly treated, while asthmatic patients are typically managed in primary care settings, may contribute to this disparity.[29] A similar pattern was observed in previous studies conducted by Maya et al, and Shrestha et al, where the majority of patients had COPD, with percentages ranging from 66.7% to 87.1%.[30,31] However, a study by Manandhar et al showed a different trend, with a lower proportion of COPD patients (15%) compared to asthma (85%).[32] The prevalence of older individuals in the study aligns with the known association between advanced age and increased prevalence of respiratory diseases, particularly COPD, linked to aging and prolonged exposure to risk factors.[33] Our findings align consistently with previous research conducted in Nepal, where the mean ages ranged from 63.4 years to 68.5 years.[23] A balanced gender distribution (48.6% male, 51.4% female) was seen in this study, while prior Nepalese studies noted more females as inhaler users.[23] This underscores the complexity of gender-related respiratory health patterns. A notable proportion of patients in the study were illiterate (29.7%), mirroring the country's overall illiteracy rate of 28.9%.[34]

Pharmacist-led intervention improved inhaler adherence in asthma and COPD patients, though some still showed poor adherence, indicating a need for ongoing support. Clinical trials report adherence levels of 70% to 90%, real-world settings often see declines to 10% to 40%.[35,36] Addressing poor adherence benefits individuals and reduces healthcare economic burdens, highlighting the importance of a holistic, patient-centered approach to managing chronic respiratory conditions.[37,38] The intervention, addressing educational gaps, aims to enhance patient understanding and improve adherence, contributing to better outcomes.[37–41] The reported changes in adherence scores and statistical significance support the effectiveness of the pharmacist-led intervention, emphasizing the valuable role of pharmacists in patient education and support in both clinical practice and the broader healthcare system.[42,43]

In the baseline assessment, a notable proportion of patients demonstrated noncompliance, with 48.6% displaying sporadic noncompliance and 41.9% deliberate noncompliance to inhalers. Intriguingly, every participant (100%) exhibited unwitting noncompliance, indicating critical errors in inhalation technique or a lack of awareness regarding correct dosage and frequency. This 100% incidence rate stands out in comparison to rates ranging from 26.6% to 79.6% reported in other studies.[25,35,44–47] The absence of counseling sessions before the study may contribute to these errors.[48] Despite a post-intervention decrease in noncompliance rates, statistical significance was observed only for sporadic noncompliance, suggesting potential for further improvement in other areas. The reported results of the intervention indicate substantial improvements in various types of noncompliance, signifying the success of the pharmacist-led intervention in addressing different aspects among participants. The distinctions between sporadic, deliberate, and unconscious noncompliance underscore the multifaceted nature of adherence challenges and emphasize the importance of tailored interventions. These positive changes bear significant clinical implications, potentially leading to improved therapeutic outcomes, reduced risk of exacerbations, and enhanced overall disease management.[49,50] The intervention's notable decrease in non-adherence highlights the ongoing need to prioritize customized strategies for addressing diverse patterns of non-adherence.[51,52] Addressing low adherence to inhaled treatment for chronic respiratory diseases proves complex, influenced by diverse factors. Despite efforts to improve adherence through interventions, their effectiveness has been inconsistently reported in the literature.[45,48]

This study identified errors that were consistent with the most common errors documented in the literature regarding inhalation technique.[18,23,39,53–63] The high prevalence of incorrect inhaler use in Nepal can be attributed to various factors. One major factor is the lack of prioritization of pharmaceutical care services in hospitals.[64,65] Additionally, inadequate regulatory compliance and professional competency of pharmacists may also play a significant role.[66] Furthermore, healthcare professionals' insufficient proficiency in using inhalers and low health literacy among patients are likely to contribute substantially to the problem of incorrect inhaler usage.[67,68] Qualified pharmacists administering a standardized, one-time intervention have demonstrated notable improvements in patients' inhalation techniques. This study has provided sufficient evidence of improvement in inhalation techniques before and after the intervention.

The reported improvements in functionality, component fitting, and cleanliness highlight the success of the intervention in addressing issues related to the technical aspects of inhaler use. These improvements are crucial for optimizing the therapeutic outcomes of inhaler medications and enhancing overall patient adherence to prescribed regimens. The findings underscore the importance of considering not only patient education but also device-related factors in interventions aimed at improving adherence and treatment efficacy.[40,69–71] There was a notable improvement in the "Shake well before use" step for MDIs, the patients maintained a consistently high level of proficiency in removing the locking cap, and the overall inhaler preparation process remained at 100% accuracy. These findings indicate the effectiveness of the intervention in enhancing specific aspects of inhaler technique and ensuring a high level of overall proficiency among the participants.[72–74]

Indeed, the findings suggest that the intervention had a positive impact on various aspects of inhaler technique, leading to increased adherence to correct steps after the intervention. The notable enhancements observed in holding the device correctly, exhaling, closing lips during exhalation, leaning the head back during inhalation, and following specific steps after inhaling collectively indicate improved patient proficiency in using inhaler devices. These improvements are indicative of the effectiveness of the intervention in enhancing patient proficiency in using inhaler devices.[21,71,75] The study's finding suggest that the pharmacist-led intervention had a notable effect on improving the inhalation technique, indicating the effectiveness of the intervention in enhancing participants' ability to correctly use inhalers. Studies have shown that modes of instruction such as patient counseling, and physical demonstration are the most effective.[76,77] Furthermore, research has shown that multi-media presentations, such as videos, play a significant role in enhancing inhaler techniques among patients.[78,79]

The baseline assessment revealed that 14.9% and 85.1% of patients had partially controlled and poorly controlled disease, consistent with existing studies, indicating suboptimal disease control.[56,67,80] Mehuys et al's study on asthma patients, similar to ours, demonstrated that educating asthma patients positively impacted health outcomes, linking improved ACT scores to better inhalation techniques and medication adherence.[62] Although our study participants showed no significant difference in disease control pre and post-intervention, the late winter timing and a 4-week follow-up might have influenced the results, with respiratory symptoms being more commonly reported in cold weather.[81–83] Various factors, including physical activity, motivation, and nutrition, might have influenced disease control, contributing to the lack of noticeable differences.[2,3] The short duration of our study compared to trials reporting significant health improvements underscores the need to consider the study context.[84,85] Notably, a significant negative correlation was observed between adherence to inhaler usage and CAT scores, suggesting that increased adherence is associated with better COPD control.[52,69,86,87] Additionally, improved inhalation technique correlated with enhanced COPD control, emphasizing the need for comprehensive management strategies, including education and support for patients to optimize inhalation techniques.[31,88] Monitoring changes in CAT scores over time can provide valuable insights into the effectiveness of interventions aimed at improving inhalation technique and overall disease control.[89]

The study faced several limitations that could impact the reliability of its findings. Subjective assessment of certain inhaler device use steps introduced potential bias. The presence of an observer during technique assessment, without the possibility of blinding, may have influenced results. Being a single-centric study raised concerns about representation, potentially overlooking broader population dynamics. The pre-post interventional design lacked consideration for various influencing factors, such as changes in medication or external elements like air pollution. Challenges in accurately assessing adherence and inhalation technique, coupled with the Hawthorne effect, where participants might modify behavior due to study awareness, further underscore the need for cautious interpretation of the study's outcomes.

Conclusion

This study indicates the potential efficacy of pharmacist-led interventions in enhancing adherence to inhaler use and improving inhalation technique. Although immediate improvements in disease control were not observed, a single session with pharmacist counseling demonstrated notable improvements in both adherence and inhalation technique for patients with respiratory conditions such as asthma and COPD in a resource limited center.

Abbreviations

ACT, Asthma Control Test; COPD, Chronic obstructive pulmonary disease; CAT, COPD Assessment Test; DPI, dry powder inhalers; IRC, Institutional Review Committee; KUSMS, Kathmandu University, School of Medical Sciences; pMDI, pressurized metered-dose inhalers; SMI, soft mist inhalers; TAI, Test of Adherence to Inhaler.

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Disclosure

The authors report no conflicts of interest in this work.

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