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A PROSPECTIVE OBSERVATIONAL STUDY ON PRESCRIBING PATTERN OF INHALERS AND EVALUATING THE ADHERENCE TO INHALATIONAL TECHNIQUE IN PATIENTS WITH OBSTRUCTIVE LUNG DISEASE

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ABSTRACT

BACKGROUND: Chronic Obstructive Pulmonary Disease (COPD) and asthma are the two main forms of Obstructive Lung Diseases (OLD). Due to the airway lumen narrowing, they are characterized by reduced airflow out of the lungs. Since inhalers make it easier to administer medication to the respiratory tract, they are the treatment of choice. Inhalers aid in preventing flare-ups and the worsening of symptoms. However, in order to achieve the desired therapeutic effect, the inhalers must be used correctly. The patient may make mistakes when using the inhalers because they may not receive enough information or counselling. A higher prognosis for Obstructive Pulmonary Disease is linked to appropriate medication adherence and usage. Appropriate patient counselling reduces the likelihood of inhalational technique errors and increases adherence to inhalers. **AIM:** To investigate how often inhalers are prescribed and assess how well Obstructive Lung Disease patients adhere to their inhalational regimen. **OBJECTIVE:** To study the prescribing pattern of inhalers in Obstructive Lung Disease, to find the errors in inhalational techniques before and after patient counselling and to evaluate the adherence to inhalers before and after counselling in patients with Obstructive Lung Disease. **MATERIALS AND METHODS:** 61 patients

with COPD or asthma were included in a prospective observational study. Proforma from the outpatient record and in-person interviews with the patient were used to gather patient data. Patients were instructed to use their inhalers, and a standard checklist was used to evaluate any errors in inhalation technique. The Evaluation of Adherence to Inhalers (EAI), a 12-item questionnaire, was used to evaluate inhaler adherence. The total questionnaire score was used to calculate adherence. Following the evaluation, each participant received instruction and counselling on appropriate inhalation techniques. A month after the patient counselling, the assessment of inhalational technique errors and the adherence test were conducted again. **RESULT:** According to the study, 44.26% of the sample was older than 60. Of them, women made up the majority (63.9%). Patients with asthma made up about 60.6% of the total. 80.3% of patients only use one inhaler at a time. The MDI was the most commonly used inhaler (42.6%), followed by the DPI (45.9%) and the MDI with spacer (11.48%). Budesonide + Formoterol fumarate combination is the most commonly used inhalation medication. The age group of 41–60 years old had the lowest error frequency (p value <0.05), followed by that of 61–80 years old. Following patient counselling, patients with COPD and asthma were more likely to adhere to their inhalers (P value = 0.003). **CONCLUSION:** The majority of patients exhibited difficulty in correctly using the MDI with spacer. All medical professionals need to be more aware of this; in particular, pharmacists should make sure they understand the proper way to use inhalers, even though the majority of patients in our study were actually given advice on how to use them by nurses. Patients with asthma and COPD were more often prescribed Formoterol + Budesonide inhalers. Since there was a significant improvement in adherence to inhalers following pharmacist intervention in our study, the current results demonstrated that pharmacist counselling can improve adherence to inhalers in patients with Obstructive Lung Disease.

KEY WORDS

Chronic Obstructive Pulmonary Disease (COPD), Obstructive Lung Disease (OLD), Asthma, Inhalers, Errors, Adherence, Patient counselling.

INTRODUCTION

CHRONIC OBSTRUCTIVE PULMONARY DISEASE

The introduction of Chronic Obstructive Pulmonary Disease (COPD) highlights the non-reversible airflow limitation as a hallmark of the illness. The restriction of airflow is typically progressive and linked to an aberrant inflammatory reaction of the lungs to harmful particles or gases. Emphysema and chronic bronchitis are the two most common conditions that make up COPD [1,2,3,4]. When all other causes of cough have been ruled out, chronic bronchitis is linked to chronic or recurrent excess mucus secretion into the bronchial tree and cough that occurs on most days for at least three months of the year for at least two consecutive years [5,6,7,8]. Although there is no visible fibrosis, emphysema is characterized by abnormal, permanent enlargement of the air spaces distal to the terminal bronchioles, along with wall destruction [9,10,11,12]. Environmental tobacco smoke exposure is the most common cause of COPD, but other chronic inhalational exposures can also cause the disease [3,4,14,15, 16]. When harmful particles and gases are inhaled, neutrophils, macrophages, and CD8+ lymphocytes become activated. This leads to the release of several chemical mediators, such as leukotriene B4, interleukin-8, and tumour necrosis factor-α [17, 18]. Widespread detrimental alterations in the pulmonary vasculature, lung parenchyma, and airways are caused by these inflammatory cells and mediators [5,9,12]. Oxidative stress and an imbalance between the lungs' protective and aggressive defence systems (proteases and antiproteases) are potential additional pathophysiologic processes [19, 20]. Cell and tissue damage results from the increased oxidants produced by cigarette smoke reacting with and damaging different proteins and lipids [6,8,13]. Additionally, by blocking antiprotease activity, oxidants worsen the protease-antiprotease imbalance and directly cause inflammation [21, 22].

SIGN AND SYMPTOMS OF COPD

- Difficulty in breathing during physical activities
- Wheezing
- Chest tightness
- A chronic cough that may produce mucus (sputum)
- Frequent respiratory infection
- Tiredness
- weight loss (in later stages) [5,7,23]

ASTHMA

A chronic inflammatory disease of the airways, asthma is characterized by the involvement of numerous cells and cellular components. Chronic episodes of wheezing, dyspnoea, tightness in the chest, and coughing are brought on by inflammation in susceptible people. A blockage in airflow is typically linked to these episodes [25,26, 27].

CAUSES OF ASTHMA

- The presence of allergies may increase the likelihood of developing asthma.
- Environment: Exposure to allergens or irritants in the air can cause an individual to develop asthma. These substances include smoke from second or thirdhand sources, fumes, allergens, and toxins. Due to their developing immune systems, these can be particularly dangerous for newborns and early children [20,28, 29].
- Hereditary: You are more likely to get asthma or other allergic diseases if asthma runs in your family.
- Respiratory infections: The developing lungs of young children can be harmed by some respiratory infections, including respiratory syncytial virus (RSV).
- Cold weather
- High stress and emotions
- GERD, a disorder where stomach acids reflux up into the throat [31, 32].

SIGN AND SYMPTOMS OF ASTHMA

- Difficulty in breathing
- Pain and chest tightness
- Wheezing
- Trouble sleeping caused by shortness of breath
- Coughing or wheezing attacks that are worsened by a respiratory virus, such as flu [25,33,34].

A key component of managing COPD and asthma is inhaled therapy. Among the inhaler devices commonly used for aerosolized medication administration in routine respiratory practice are nebulizers, dry powder inhalers, and meter dose inhalers (MDIs).

The ideal inhalation technique and proper device handling and preparation are prerequisites for the best inhaler technique.

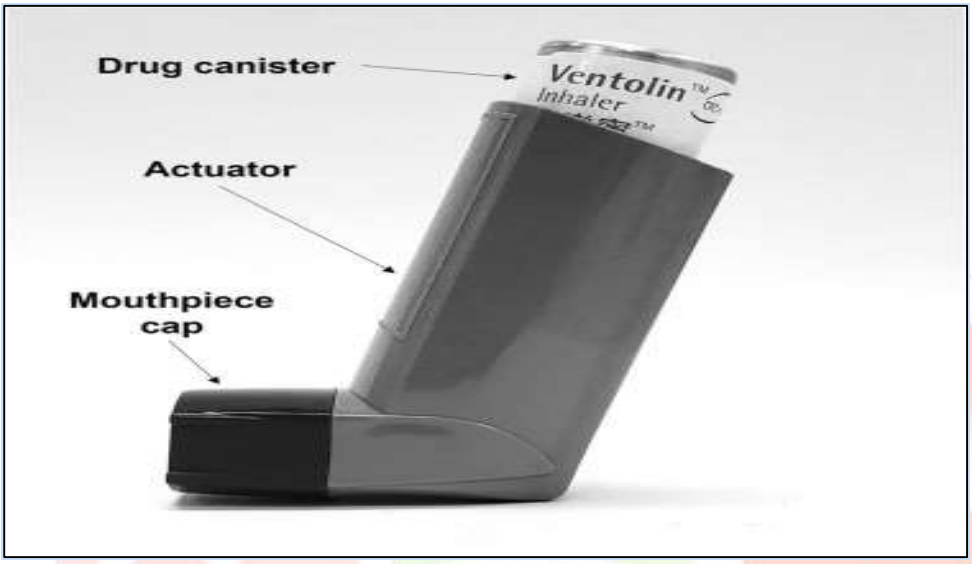
In real-world COPD and asthma patient practice, inhaler technique errors are extremely common, even though MDIs are thought to be more difficult to use than DPIs [13, 18].

Insufficient drug delivery to the lungs, and consequently, ineffective disease control and unfavourable disease outcomes, have been linked to misuse of inhalers [35, 36].

TYPES OF INHALERS

MDI

- A metered-dose inhaler (MDI) is a portable device that inhales aerosolized asthma medication into your lungs. A mouthpiece is connected to the canister.
- A chemical propellant forces a puff of medication into your lungs when you press on the canister. When using an MDI, you must time the release of the medication with your breathing [19,22, 23].



MDI WITH SPACER

A spacer is a tool that you can use if you are having problems doing this. The release of the medication can be synchronized with your inhaled breath by using a spacer.

DPI

- When you breathe in through a dry powder inhaler (DPI), medication is delivered to your lungs.
- A DPI doesn't use a propellant to force medication into your lungs like an MDI does. Rather, the medication is triggered by your inhalation.
- DPIs are available in devices with one or more doses. Up to 200 doses can be found in multiple-dose devices.
- Bronchodilators like Spiriva and steroids like Pulmicort are examples of COPD dry powders that can be used with a DPI [29,31].

- An improved prognosis for obstructive pulmonary disease (OPD) is linked to appropriate medication adherence and usage. Since inhalers make it easy for drugs to enter the respiratory system, they are the treatment of choice [35,36].
- Inhalers aid in preventing flare-ups and the worsening of symptoms. However, in order to achieve the desired therapeutic effect, the inhalers must be used correctly. The patient may make mistakes when using the inhalation technique because they may not have received the necessary information or counselling [30,33]

ADHERENCE TO INHALERS

Poor adherence to inhalational therapy will frequently cause the disease to worsen [10,17]. Adherence is defined as "the extent to which a person's behaviour (in terms of taking medications, following diets, or executing lifestyle changes) coincides with medical or health advice.". The patient's misconception that using an inhaler could become habit-forming, fear of side effects, difficulty in using the device, and belief that medications are not necessary during the symptom-free period are among the reasons for noncompliance with inhalers. Therefore, appropriate counselling is required to increase adherence [37, 38].

MATERIALS AND METHODS

ETHICS APPROVAL

The study was approved by the Institutional Ethical Committee of Cosmopolitan Hospital, Pvt. Ltd., Trivandrum, on 14th January 2023.

AIM OF THE STUDY

To investigate the prescribing pattern of inhalers and evaluate the adherence to inhalational technique in patients with Obstructive Lung Disease.

OBJECTIVES OF THE STUDY

- To study the prescribing pattern of inhalers in Obstructive Lung Disease.
- To find the errors in inhalational techniques before and after patient counselling.
- To evaluate the adherence to inhalers before and after counselling in patients with Obstructive Lung Disease.

METHODOLOGY

All pertinent information for the study was gathered directly from patient interviews and case files. Data were gathered via the use of appropriately created proforma. The Cosmopolitan Hospital in Thiruvananthapuram, Kerala, India's Research and Ethical Committee gave its approval for the study. By closely observing the patient's performance and applying a standard checklist, the inhalational technique errors were evaluated. Patients were instructed to use their inhalers to record their errors; correct and incorrect steps received scores of 0 and 1, respectively. Using the Evaluation of Adherence to Inhalers (EAI) questionnaire, the patient's adherence to inhalers was evaluated. The questionnaire has twelve questions. There are two possible responses to the first two questions. Each response was given a score between 1 and 2, which was determined by looking up medical records and inhalation technique. Five answers are available for the previous ten questions. After a direct interview with the patient, scores of 1, 2, 3, 4, and 5 were assigned.

Adherence were calculated on the basis of total score of questionnaires.

≥50 points - Good adherence

46 – 49 points - Intermediate adherence

≤ 45 points - Poor adherence

Following the evaluation, each participant received instruction and counselling on correct inhalation techniques. A month after the patient counselling, the assessment of inhalational technique errors and the adherence test were conducted again.

STUDY DESIGN

A Prospective Observational Study was conducted in patients with Obstructive Lung Disease from Pulmonology Department in Cosmopolitan Hospital Trivandrum, a tertiary care centre after obtaining permission from the Institutional Ethical Committee.

STUDY PERIOD AND STUDY SETTING

The study period was 6 months after getting clearance from the Institutional Ethical Committee (IEC) in the Department of Pulmonology, Cosmopolitan Hospital, Post Graduate Institute of Medical Science, Trivandrum, Kerala.

STUDY POPULATION

A total of 61 adult patients with COPD (n= 24) or Asthma (n= 37) who were currently using at least one inhaler device were included in this prospective observational study conducted in the out patients from Pulmonology department of Cosmopolitan hospital Thiruvananthapuram, Kerala. Written informed consent was obtained from each subject following a detailed explanation of the objectives and protocol of the study.

INCLUSION CRITERIA

- Individuals who expressed willingness to partake in the research.
- Obstructive Lung Disease patients.
- Pulmonology Department's outpatients.

EXCLUSION CRITERIA

- Paediatric patients meet the exclusion criteria.
- Individuals suffering from mental disorders.
- Individuals who received new inhaler prescriptions.

STATISTICAL ANALYSIS

Microsoft Excel was used to conduct the statistical analysis. The improvement in adherence to inhalers before and after patient counselling was determined using the chi-square test, and the paired t-test was used to analyse the statistical difference in the occurrence of errors between before and after counselling. The occurrence of errors in different age groups was analysed using single factor anova. A p-value of less than 0.05 was deemed statistically significant.

RESULT

The findings are as follows: 61 patients with Obstructive Lung Diseases who met the inclusion criteria and had been using inhalers for longer than two weeks were included in our study. A common checklist was used to analyse the inhalational technique errors. The Evaluation of Adherence to Inhalers (EAI) questionnaire was used to assess the patient's adherence to their inhalers.

AGE WISE DISTRIBUTION OF PATIENTS

AGE (In years)	**NUMBER OF PATIENTS** (n = 61)	**PERCENTAGE** (%)
20-40	18	29.51
41-60	16	26.23
61-80	27	44.26
TOTAL	**61**	**100**

Table: 1 Distribution of study population according to age.

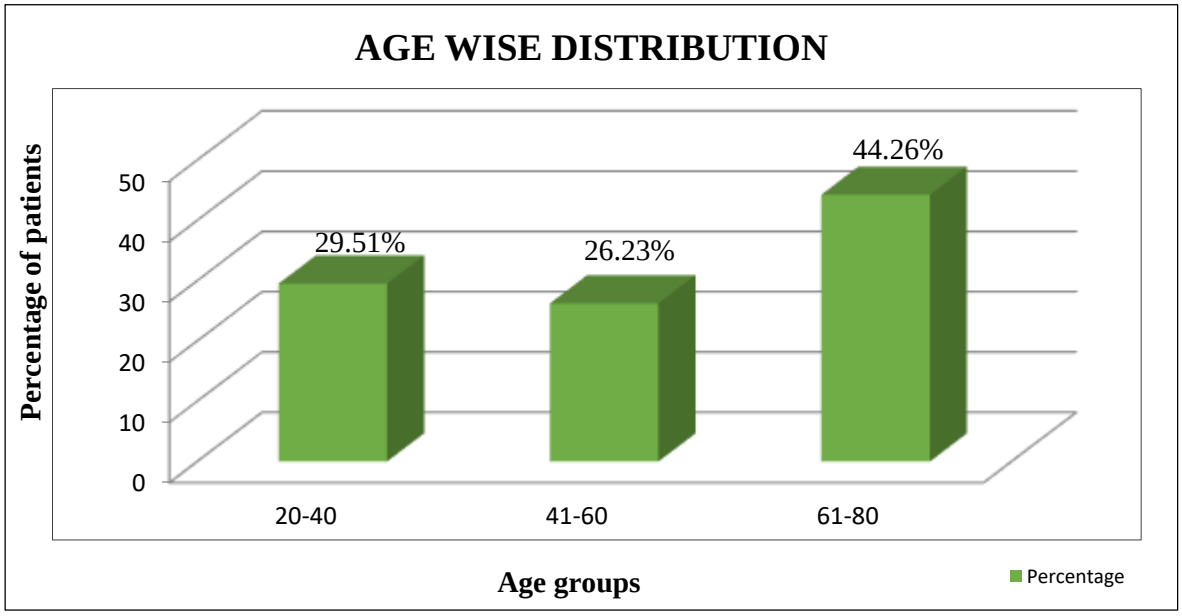


Fig 8: Distribution of study population according to age

- As per the demographic data of the study population, patients who were taking inhalers were found to be more in the age group above 60 with a percentage of 44.3%, followed by age group of 20-40 with 29.5% and 26.2% of patients were in the age group of 41-60.

GENDER WISE DISTRIBUTION

GENDER	NUMBER OF PATIENTS (n=61)	PERCENTAGE (%)
MALE	22	36.06
FEMALE	39	63.94
TOTAL	**61**	**100**

Table: 2 Distribution of study population according to gender.

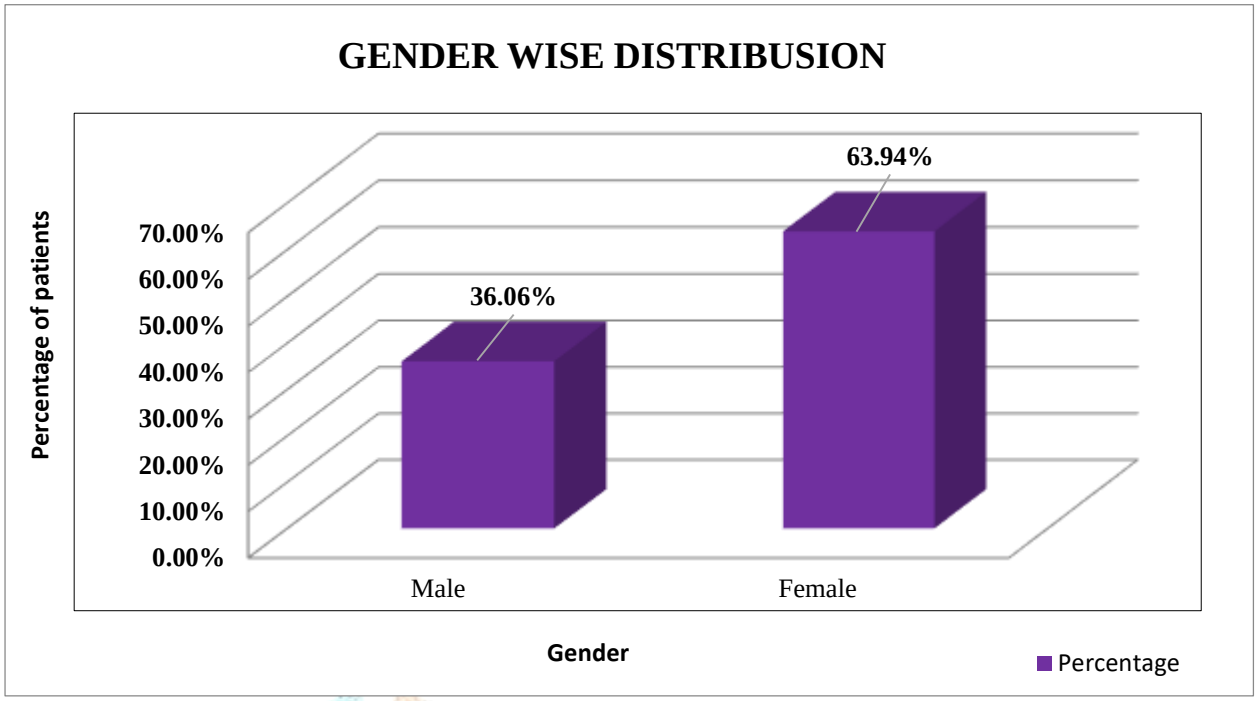


Fig 9 : Distribution of study population according to gender

- Gender-wise distribution of the overall study population indicated that the female population overrides male population with 63.93% dominance over 36.06%. The entire study population included 22 male patients and 39 female patients, which indicated that the incidence of obstructive lung disease in female is more than that of male population.

DISEASE WISE DISTRIBUTION

DISEASE	NUMBER OF PATIENTS (n=61)	PERCENTAGE (%)
COPD	24	39.35
ASTHMA	37	60.65
TOTAL	**61**	**100**

Table 3: Distribution of study population according to disease

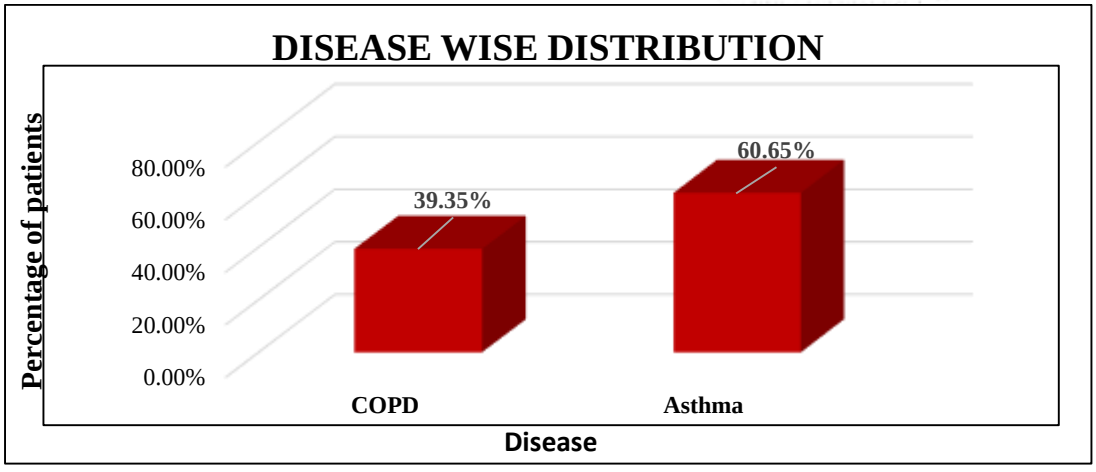


Fig 10: Distribution of study population according to disease.

- Disease wise distribution of overall study population indicated that asthma patients with 60.65% overrides COPD patients with 39.35%. The entire study population included both COPD patients

and asthma patients, which indicated that the incidence of getting COPD is less than that of asthma.

PRESCRIBING PATTERN OF INHALERS AMONG THE STUDY POPULATION

INHALER	NUMBER OF PATIENTS (n=61)	PERCENTAGE (%)
MDI	26	42.62
MDI with spacer	7	11.48
DPI	28	45.90
TOTAL	61	100

Table 4 : Distribution of study population according to the type of inhalers.

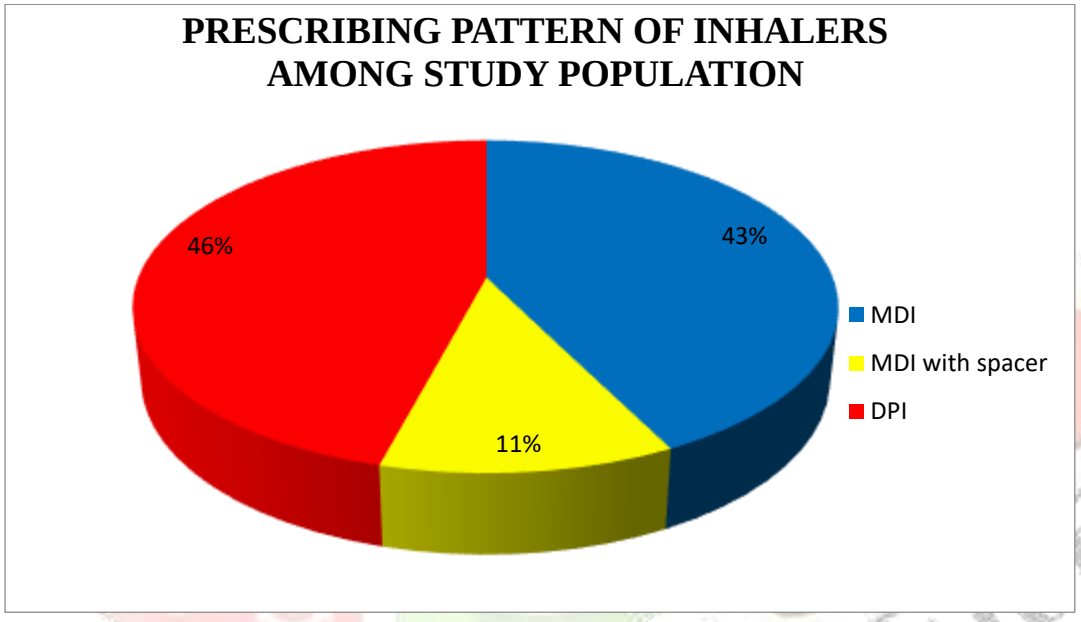


Fig 11: Distribution of study population according to the type of inhalers

- As per the demographic data of the study population, majority of the patients were taking DPI with 46%, followed by MDI with 42.6% and 11.4% of patients were taking MDI with spacer.

NUMBER OF INHALERS PRESCRIBED AMONG THE STUDY POPULATION

NUMBER OF INHALERS	NO. of PATIENTS (n=61)	PERCENTAGE (%)
ONE	49	80.3
TWO	12	19.7
TOTAL	61	100

Table 5: Distribution of study population according to number of inhalers prescribed

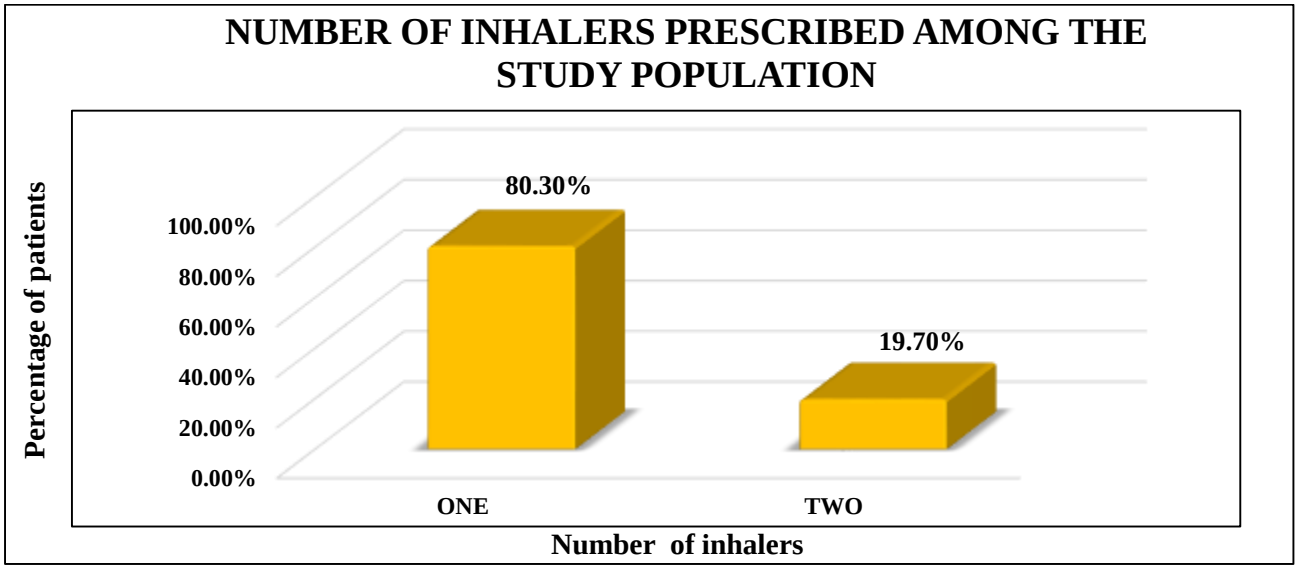


Fig 12: Distribution of study population according to number of inhalers prescribed.

- Majority of the study population were using single inhaler with a percentage of 80.3 %. Only 12 people were given multiple (2) inhalers with a percentage of 19.7%.

PRESCRIBING PATTERN OF MEDICATIONS AMONG THE STUDY POPULATION

INHALERS PRESCRIBED	Number of patients	PERCENTAGE (%)
Fluticasone propionate + Formoterol Fumarate	5	6.8
Formoterol fumarate + Budesonide	35	48
Levosalbutamol	2	2.7
Fluticasone furoate + Vilanterol	5	6.8
Glycopyrronium powder	5	6.8
Salmeterol + Fluticasone propionate	6	8.2
Glycopyrronium +Formoterol fumarate + Budesonide	7	9.6
Tiotropium powder	4	5.6
Budesonide	1	1.4
Formoterol fumarate + Glycopyrronium powder	2	2.7
Formoterol fumarate + Mometasone	1	1.4
TOTAL	73	100

Table 6 : Distribution of study population according to medications prescribed.

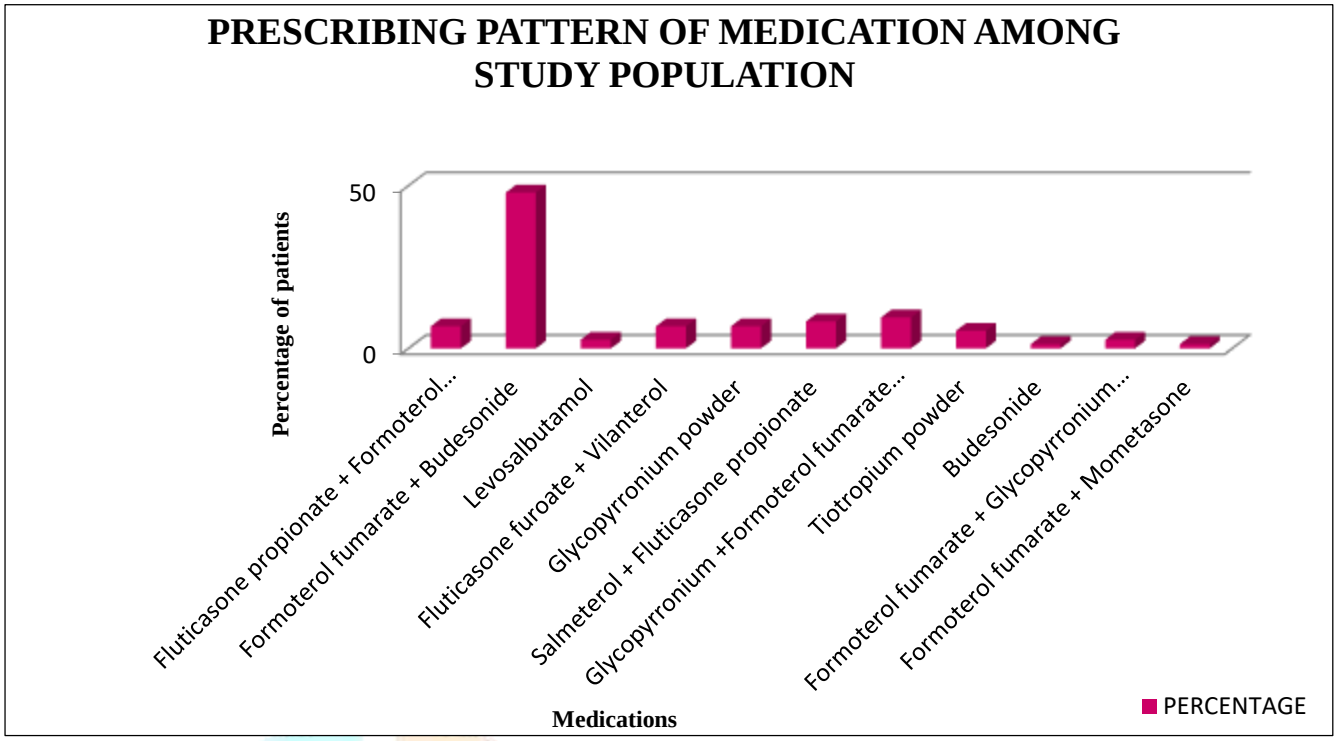


Fig 13 : Distribution of study population according to medications prescribed

- Formoterol + Budesonide combination was most commonly prescribed in obstructive lung disease with a percentage of 48%.

PRESCRIBING PATTERN OF MEDICATIONS ACCORDING TO DISEASE

INHALERS PRESCRIBED	ASTHMA	COPD
Fluticasone propionate + Formoterol Fumarate	5	0
Formoterol fumarate + Budesonide	20	15
Levosalbutamol	0	2
Fluticasone furoate + Vilanterol	4	1
Glycopyrronium powder	3	2
Salmeterol + Fluticasone propionate	4	2
Glycopyrronium +Formoterol fumarate + Budesonide	4	3
Tiotropium powder	2	2
Budesonide	0	1
Formoterol + Mometasone	0	1

Table 7: Pattern of medications prescribed according to disease

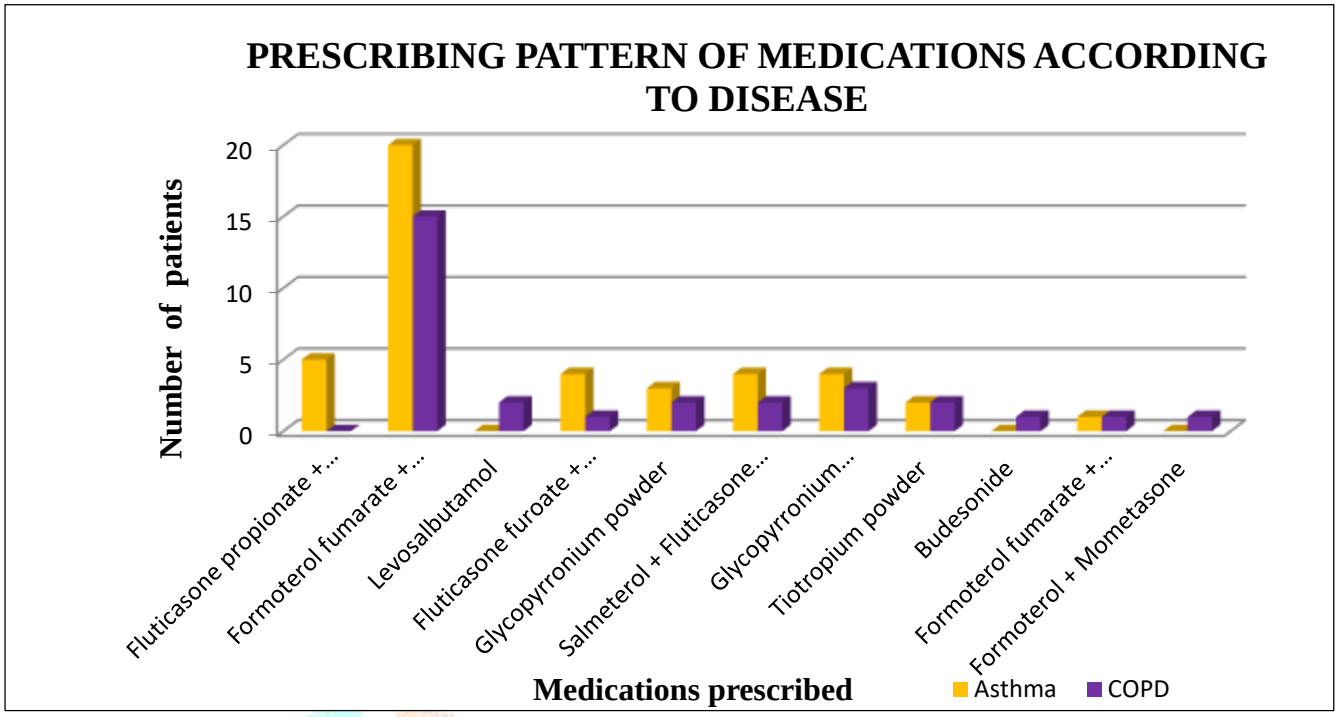


Fig 14: Pattern of medications prescribed according to disease

- For both asthma and COPD, the most commonly prescribed inhaled medication was Formoterol + Budesonide combination.

ASSESSMENT OF ERRORS IN INHALATIONAL TECHNIQUE AMONG MDI USERS

STEPS FOR USING MDI	BEFORE COUNSELLING		AFTER COUNSELLING	
	INCORRECT STEPS	PERCENTAGE (%)	INCORRECT STEPS	PERCENTAGE (%)
STEP 1	0	0	0	0
STEP 2	11	42.30	0	0
STEP 3	9	34.61	3	11.54
STEP 4	8	30.76	1	3.84
STEP 5	0	0	1	3.84
STEP 6	15	57.69	9	34.61
STEP 7	13	50	6	23.07

Table 8 : Distribution of errors in inhalational technique among MDI users before and after counselling

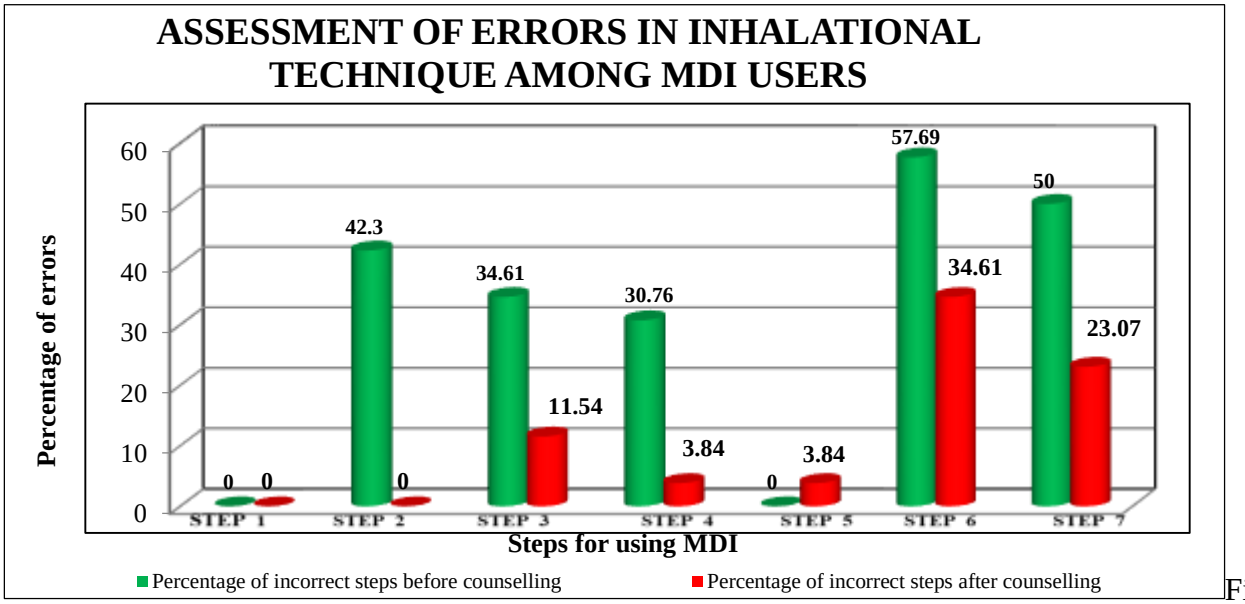


Fig 15: Distribution of errors in inhalational technique among MDI users before and after counselling

- By the study we were able to minimize the errors in inhalational technique via patient counselling.
- Among the seven steps, step 6 (Patients were unable to hold their breathe for a count of 15 seconds) was most commonly done in an incorrect manner. After counselling percentage of occurrence of error in step 6 was decreased from 57.69% to 34.61%.

ASSESSMENT OF ERRORS IN INHALATIONAL TECHNIQUE AMONG MDI WITH SPACER USERS

STEPS IN USING MDI WITH SPACER	BEFORE COUNSELLING		AFTER COUNSELLING	
	INCORRECT STEPS	PERCENTAGE (%)	INCORRECT STEPS	PERCENTAGE (%)
STEP 1	0	0	0	0
STEP 2	3	42.85	0	0
STEP 3	3	42.85	0	0
STEP 4	7	100	3	42.85
STEP 5	2	28.57	0	0
STEP 6	7	100	6	85.71
STEP 7	6	85.71	3	42.85

Table 9: Distribution of errors in inhalational technique among MDI with spacer users before and after counselling.

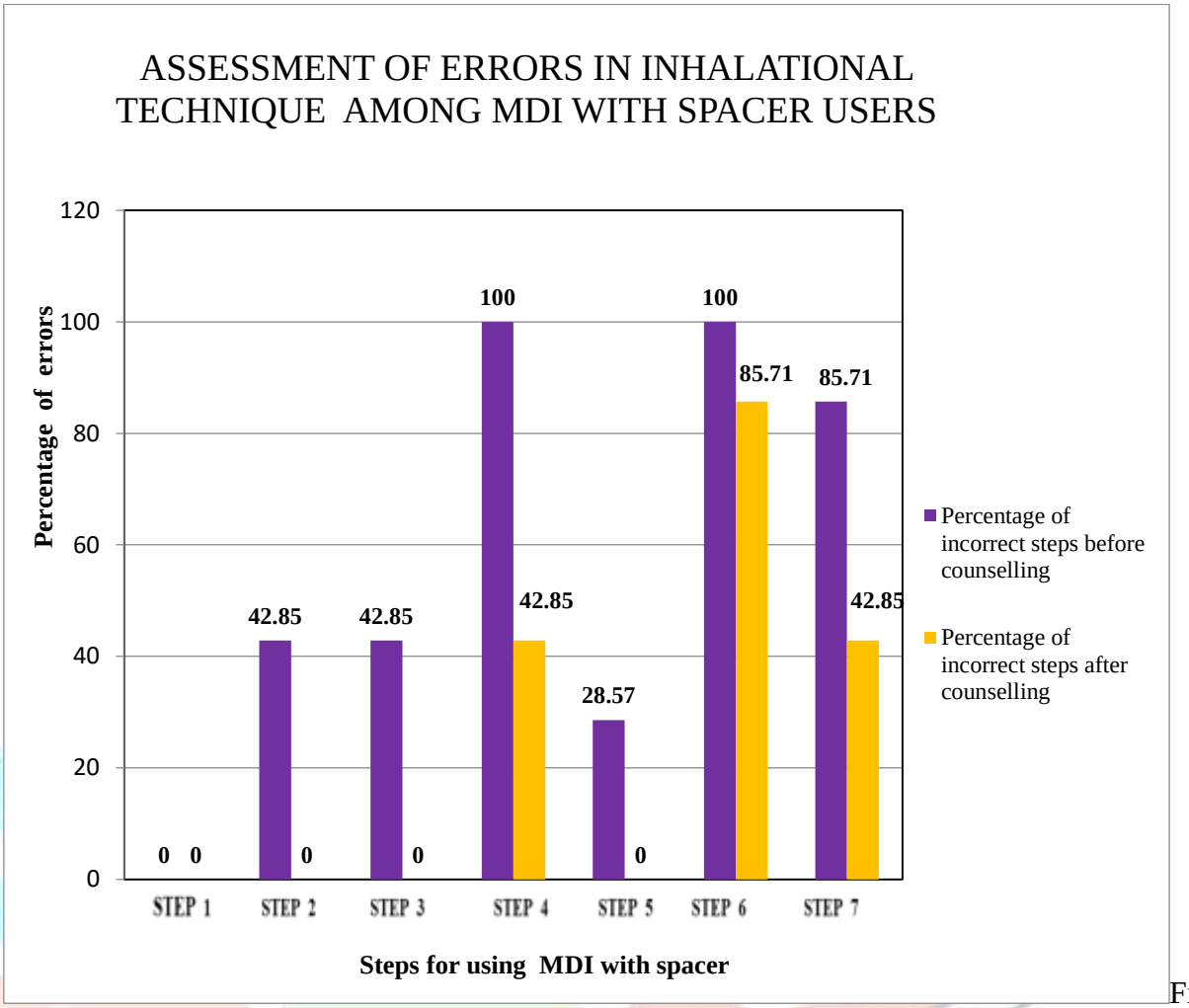


Fig 16: Distribution of errors in inhalational technique among MDI with spacer users before and after patient counselling

- Among the seven steps, step 4 (Patients were not closing their lips after the mouth piece has been put in to their mouth.) and step 6 (Patients were unable to hold their breathe for a count of 15 seconds) were most commonly done in an incorrect manner (100%).
- After counselling percentage of error in step 4 and step 6 were decreased to 42.85% and 85.71% respectively.

ASSESSMENT OF ERRORS IN INHALATIONAL TECHNIQUE AMONG DPI USERS

STEPS IN USING DPI	BEFORE COUNSELLING		AFTER COUNSELLING	
	INCORRECT STEPS	PERCENTAGE (%)	INCORRECT STEPS	PERCENTAGE (%)
STEP 1	1	3.6	0	0
STEP 2	5	17.8	1	3.6
STEP 3	16	57.1	5	17.8
STEP 4	13	46.4	4	14.2
STEP 5	24	85.7	11	39.2
STEP 6	18	64.2	9	32.1
STEP 7	5	17.8	3	10.7

Table 10: Distribution of errors in inhalational technique among DPI users before and after patient counselling

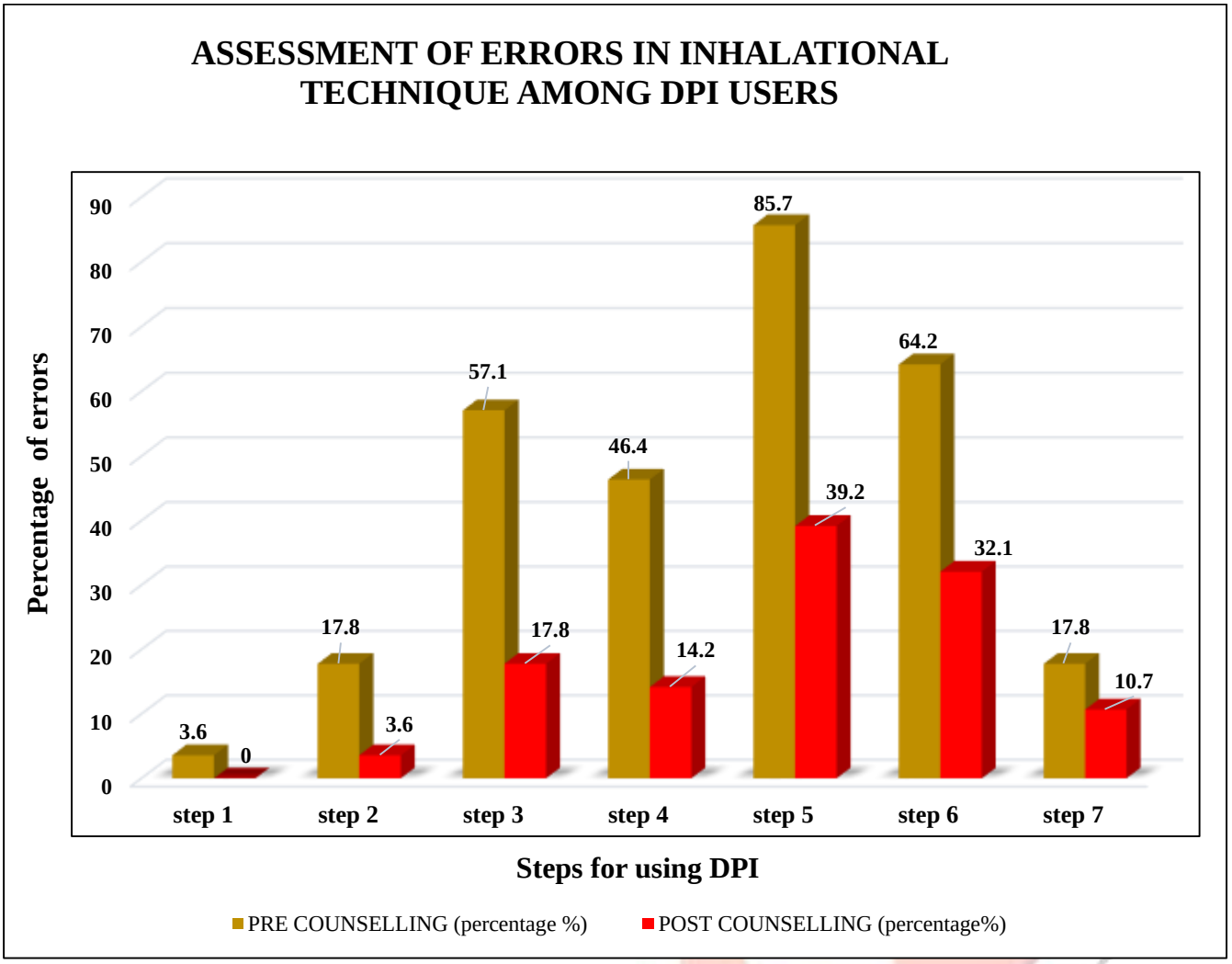


Fig 17: Distribution of errors in inhalational technique among DPI users before and after patient counselling

- Among the seven steps, step 5 (the patients were unable to hold their breathe for a count of 15 seconds) was most commonly done in an incorrect way.
- After counselling percentage of error in step 6 was decreased from 85.7% to 39.2%.

ASSESSMENT OF TOTAL ERRORS IN DIFFERENT INHALERS AMONG THE STUDY POPULATION

TYPE OF INHALER	TOTAL NUMBER OF ERRORS BEFORE COUNSELLING	TOTAL NUMBER OF ERRORS AFTER COUNSELLING	p- value
MDI	56	20	< 0.05
MDI with spacer	28	12	< 0.05
DPI	82	33	< 0.05

Table 11: Distribution of total errors in different inhalers before and after patient counselling

INHALER DEVICE	MEAN ± SD	
	BEFORE COUNSELLING	AFTER COUNSELLING
MDI	2.15 ± 1.3	0.76 ± 0.87
MDI WITH SPACER	4 ± 0.57	1.7 ± 0.48
DPI	2.93 ± 1.1	1.17 ± 0.98

Table 12: Occurrence of mean error in different inhalers

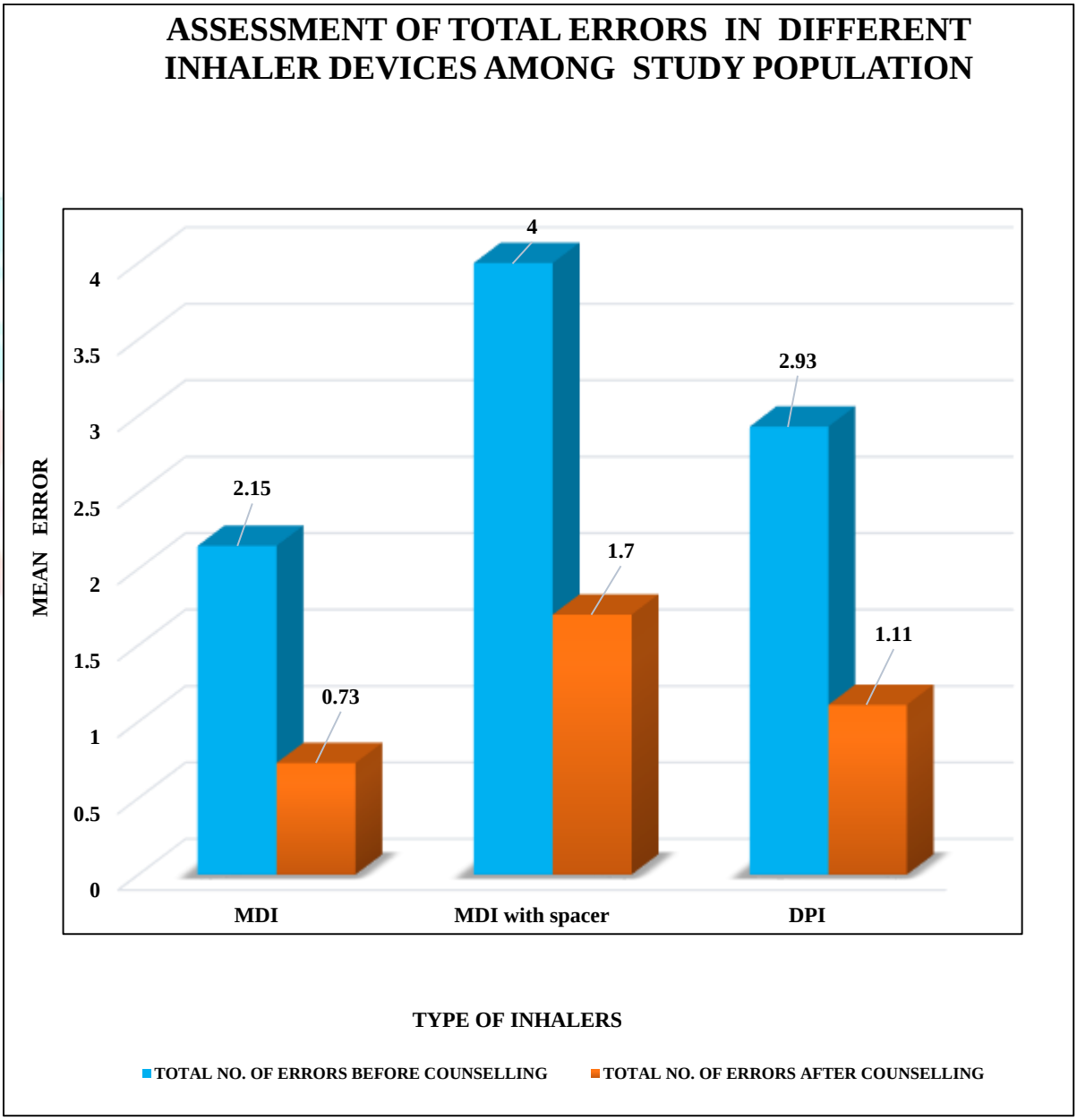


Fig 18: Distribution of total errors in different inhalers before and after patient counselling

- Since the p value is less than 0.05, the rate of incidence of committing errors in inhalational techniques have been significantly reduced.

- The mean difference of the occurrence of errors in MDI, MDI with spacer and DPI inhalers were found to be 1.42, 2.3 and 1.82 respectively.

DISTRIBUTION OF ERRORS IN INHALATION TECHNIQUE AMONG DIFFERENT AGE GROUPS

Age group	Total number patients (n=61)	Total number of errors before counselling	Mean ± SD	p– value
20-40	18	24	1.27 ± 0.82	<0.05
41-60	16	41	2.56 ± 0.89	
61-80	27	102	3.77 ± 0.8	

Table 13: Occurrence of errors in different age groups before patient counselling

- p value less than 0.05 demonstrated that occurrence of errors was higher among patients with age above 60 years, followed by age group of 41 -60.
- Before counselling, occurrence of mean error in each age group 20-40, 41-60 and 61-80 were found to be 1.27, 2.56 and 3.77 respectively.

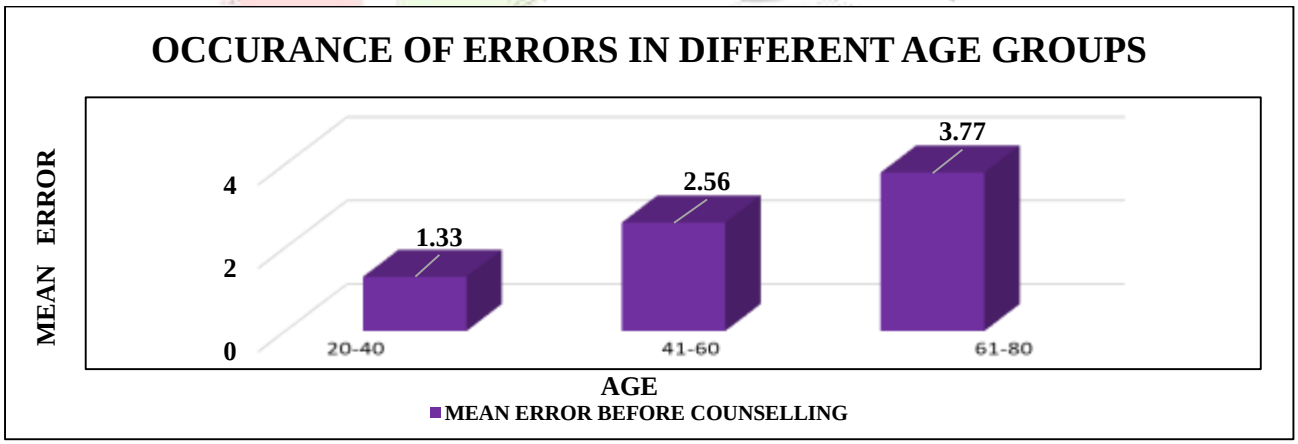


Fig 19: Occurrence of errors in different age groups before patient counselling

- Since p-value is less than 0.05, occurrence of errors was higher among patients with age group 61-80. Before counselling occurrence of mean error in each age groups 20-40, 41-60 and 61-80 were found to be 1.33, 2.56 and 3.77 respectively.

EVALUATION OF ADHERENCE AMONG THE STUDY POPULATION

SCORE OF ADHERENCE	BEFORE COUNSELLING		AFTER COUNSELLING		p- value
	No. of patients (n=61)	Percentage (%)	No. of patients (n=61)	Percentage (%)	
≥ 50 – Good adherence	9	14.8	30	49.2	<0.05
46-49 - Intermediate adherence	11	18	15	24.6	
≤45 - Poor adherence	41	67.2	16	26.2	

Table 14: Distribution of patients based on the score of adherence before and after patient counselling

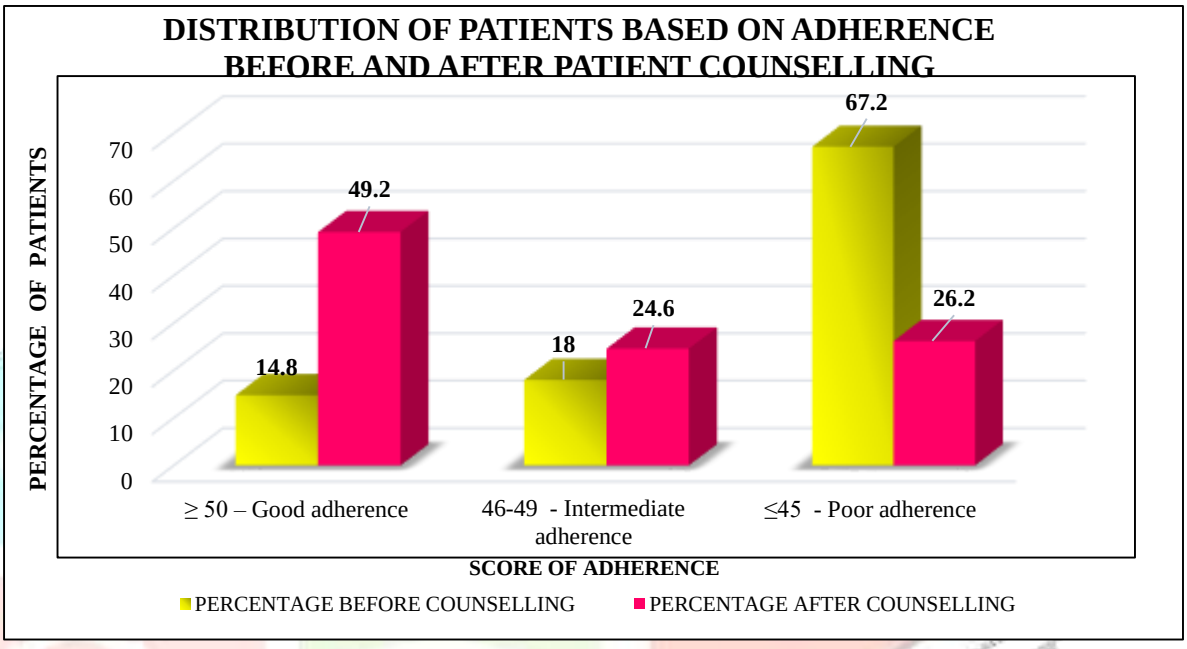


Fig 20: Distribution of patients based on the score of adherence before and after patient counselling

- Since the p-value is less than 0.05, adherence to inhalers in both Asthma and COPD patients has been increased after patient counselling.
- Before counselling, it showed that among the study population of 61 patients, 67.2% patients were with poor adherence, followed by 18% with intermediate adherence and 14.8% of patients were having good adherence. After counselling number of patients with good adherence were improved to 49.2% and poor adherence were decreased to 26.2 %.

DISCUSSION

- Obstructive Pulmonary Diseases is a spectrum of pulmonary diseases which affects the airways, including Chronic obstructive pulmonary disease (COPD), chronic bronchitis, asthma, bronchiectasis, bronchiolitis, cystic fibrosis. In obstructive pulmonary diseases, inhalational drugs are the cornerstone of the therapy. Inhaled medications aids in achieving higher local concentration of the drug at a lower dose than other routes and results in better therapeutic ratio. However improper administration of inhalers and lack of adherence is a common barrier to adequate control of these patients to prevent exacerbations.
- The primary objective of the study was to determine the prescribing pattern of inhalers and to assess the errors and adherence to inhaler before and after patient counselling. In this study we considered a total of 61 patients who were using inhalers for more than 2 weeks and satisfied the inclusion criteria. The errors in the inhalational technique were analyzed using a standard checklist. The adherence to inhalers of the patients were determined by a questionnaire

- In our study 44.3 % of the sample were above the age of 60 years. Majority of them were females (63.9%). About 60.65% were asthmatic patients. 80.3 % of patients use only single inhaler. Mostly used inhaler was DPI (45.9%) followed by MDI (42.6%) and then MDI with spacer (11.4%). Mostly used inhalational medication is Formoterol fumarate + Budesonide.
- A study conducted by **Susmera Varghese et al**; on **"Assessment of common errors in inhalational technique**" showed that 59% of females use inhalers compared to that of males (43%) also showed that more than 30% of them were using formoterol + Budesonide inhalation. About 85% of patients were prescribed with single inhaler, 12% with two inhalers and 3% with three inhalers. In their study, adherence to all inhalers were found to be increased after counselling. All these observations were similar to our study.
- A study conducted **by Maher R Khdour et al;** on "**Assessment of the inhalational technique and adherence to therapy**" concludes that most of the enrolled patients were females (59.1%) and mostly used inhaler was DPI (40%) and followed by MDI (19.5%). Result of this study were correlated with our study results.
- A study conducted by **Piyush Arora et al;** on "**Evaluating the technique of using inhalation device in COPD and bronchial asthma patients**" demonstrated that DPI users (43.3%) were the highest among the enrolled population followed by MDI (22.3%) without spacer and then MDI with spacer (16.7%). In their study, 82.3% of the total enrolled patients committed at least one error during device usage. These observations were similar to our study.
- A study conducted by **Andrea Hammerlein et al;** on **"Pharmacist-led intervention study to improve inhalation technique in asthma and COPD patients"** which was conducted in 597 patients and observed that 78.9% made at least one mistake in performing the inhalational technique at baseline and after pharmacist intervention it dropped to 28.3%. In our study also we could minimize the errors in inhalational technique after patient counselling.
- A study conducted by **Sonia Santhakumar et al;** on **"Assessment to adherence to inhalers in asthmatics"** concluded that out of 111 enrolled patients 67.6% were females and this result was similar to our study result.
- The EAI questionnaire was used to assess the patient's adherence to inhalers. The EAI questionnaire was performed in each patients before and after counselling. EAI is assessed in the beginning of study and follow up was conducted after one month when the patients came for review. It is a 12item questionnaire which has a total score of 54. Score ≥ 50 indicates good adherence.
- Errors in inhalational techniques before and after counselling were assessed by using a standard checklist. There were 7 steps to assess the errors in inhalational technique. All correct and incorrect steps were given a score of o and 1 respectively. Proper demonstration of inhalational techniques and importance of adherence to inhalers in preventing the exacerbation of disease were also included in patient counselling.

CONCLUSION

- Our study showed that majority of the patients were using their inhaler incorrectly. DPI continues to be the most commonly prescribed inhaler. There is a need of increased awareness among all health care personnel, especially the pharmacist should ensure that they know the correct inhaler technique whereas most of the patients enrolled in our study were actually advised by nurses on the use of inhalers.
- Routine checkup of inhaler technique should be done during subsequent patient visits. From our study, we understood that both COPD and Asthma patients were more prescribed with Formoterol + Budesonide inhalers. The present results showed that pharmacist counselling can improve adherence to inhalers in Obstructive Lung Disease patients since there was a significant improvement in adherence to inhalers after pharmacist intervention in our study.
- The major reasons for poor adherence to inhalers were forgetfulness, felt better and cessation of administration due to improvement of symptoms, fear of side effects, false beliefs, interruption for their daily activities and cost of inhaler devices and medications.
- Study concluded that effective counselling by pharmacist improved the patient's inhalational technique and adherence to inhalers. Improvement in inhalational technique plays a great role in improvement of disease. The main limitation of our study was a drop out of 6 patients.

BIBLIOGRAPHY

1. Barbara G. Wells, Joseph T. Dipiro et al; Chronic obstructive pulmonary disease; Text book of pharmacotherapeutics; seventh Edition, Mc Graw Hill; 921-930.
2. Denis E O Donnell, Pierantonio Laveneziana, Katherine Webb et al; Chronic obstructive pulmonary disease; clinical integrative physiology; Clinics in chest medicine 35 (1), 51-69.
3. Kim RY, Pinkerton JW, Gibson PG, et al; Inflammasomes in COPD and neutrophilic asthma; Thorax 2015;70:1199-201.
4. Regan EA, Hokanson JE, Murphy JR, et al; Genetic epidemiology of COPD (COPD Gene) study design; COPD 2010;7:32-43.
5. Cosio MG, Saetta M, Agusti A, et al; Immunologic aspects of chronic obstructive pulmonary disease; N Engl J Med 2009; 360: 2445–2454.
6. Seemungal TAR, Donaldson GC, Paul EA, Bestall JC, Jeffries DJ, Wedzicha JA, et al; Effects of exacerbation on quality of life in patients with chronic obstructive pulmonary disease; Am J Respir Crit Care Med 1998;157:1418–1422.
7. Connors AF, Dawson NV, Thomas C, et al; Outcomes following acute exacerbation of severe chronic obstructive disease; Am J Respir Crit Care Med 1996;154:959–967.
8. Marek Lommatzsch, Christian J Virchow, Deutsches Arzteblatt et al; Severe asthma: definition, diagnosis and treatment; International 111 (50), 847, 2014
9. Hogg JC, Chu F, Utokaparch S, et al; The nature of small-airway obstruction in chronic obstructive pulmonary disease; N Engl J Med 2004;350:2645-2653.
10. Salvi SS, Barnes PJ, et al; Chronic obstructive pulmonary disease in non-smokers; Lancet 2009;374:733-743.
11. Hurst JR, Vestbo J, Anzueto A, et al; Susceptibility to exacerbation in chronic obstructive pulmonary disease; N Engl J Med 2010;363:1128-1138.
12. Dekhuijzen, Walter Vincken, JC Virchow, N Roche, An Agusti, F Lavorini, et al; Prescription of inhalers in asthma and COPD: towards a rational, rapid and effective approach; Respiratory medicine,2013 ;107 (12), 1817-1821.
13. Violaine Giraud, Nicolas Roche et al; Inhaler technique and asthma: feasibility and acceptability of training by pharmacists; Respiratory medicine 2011 ;105 (12), 1815-1822.
14. Gregoriano C, Dieterle T, Breitenstein AL, Durr S, Baum A, Maier S, et al; Use and inhalation technique of inhaled medication in patients with asthma and COPD; Respir Res. 2018;19:237.
15. Coelho AC, Souza-Machado A, Leite M, Almeida P, Castro L, Cruz CS, et al; Use of inhaler devices and asthma control in severe asthma patients at a referral centre in the city of Salvador, Brazil; J Bras Pneumol. 2011;37(6):720-728
16. Khassawneh BY, Al-Ali MK, Alzoubi KH, Batarseh MZ, Al-Safi SA, Sharara AM, et al; Handling of inhaler devices in actual pulmonary practice: metered-dose inhaler versus dry powder inhalers; Respir Care. 2008;53(3):324-8.
17. Rogliani P, Calzetta L, Coppola A, Cavalli F, Ora J, Puxeddu E, et al; Optimizing drug delivery in COPD: the role of inhaler devices; Respir Med. 2017;124:6–14.
18. Melani AS, Bonavia M, Cilenti V, et al; Inhaler mishandling remains common in real life and is associated with reduced disease control; Respir Med. 2011;105(6):930–938.
19. Fink JB et al; Inhalers in asthma management: is demonstration the key to compliance; Resp Care. 2005;50(5):598–600.
20. Vestbo J, Anderson JA, Calverley PM, et al; Adherence to inhaled therapy, mortality and hospital admission in COPD; Thorax. 2009;64(11):939–943.
21. Sulaiman I, Cushen B, Greene G, et al; Objective assessment of adherence to inhalers by patients with chronic obstructive pulmonary disease; Am J Respir Crit Care Med. 2017;195(10):1333–1343.
22. Melani AS, Bonavia M, Cilenti V, et al; Inhaler mishandling remains common in real life and is associated with reduced disease control; Respir Med. 2011;105(6):930–938.
23. Molimard M, Raherison C, Lignot S, et al; Chronic obstructive pulmonary disease exacerbation and inhaler device handling: real-life assessment of 2935 patients; Eur Respir J. 2017;49(2):1601794.
24. Press VG, Arora VM, Shah LM, et al. Teaching the use of respiratory inhalers to hospitalized patients with asthma or COPD: a randomized trial; J Gen Intern Med. 2012;27(10):1317–1325.

25. Dekhuijzen PN, Lavorini F, Usmani OS et al; Patients' perspectives and preferences in the choice of inhalers: Patient Prefer Adherence; 2016;10:1561–1572.
26. Chorao P, Pereira AM, Fonseca JA et al; Inhaler devices in asthma and COPD – an assessment of inhaler technique and patient preferences; Respir Med. 2014;108(7):968–975.
27. Brzant L, Bang C, Chew C, Baik SH, Wiseman D, et al; Adequacy of inhaler technique used by people with asthma or chronic obstructive pulmonary disease; J Prim Health Care. 2013;5(3):191–198.
28. Batherink J, Dahri K, Aulakh A, Rempel C, et al; Evaluation of the use of inhaled medication by hospital in patients with chronic Obstructive Pulmonary Disease; Can J Hosp Pharm. 2012;65(2):118–128
29. Bonini M, Usmani OS et al; The importance of inhaler devices in the treatment of COPD; Res Pract. 2015;1(1):9.
30. Bosnic-Anticevich S, Chrystyn H, Costello RW, et al; The use of multiple respiratory inhalers requiring different inhalation techniques has an adverse effect on COPD outcomes. Int J Chron Obstruct Pulmonary Disease,2016;12:59–71.
31. Molimard M, Raherison C, Lignot S, Depont F, Abouelfath A, Moore N et al; Assessment of handling of inhaler devices in real life: an observational study in 3811 patients in primary care; J Aerosol Med. 2003;16(3):249–254.
32. Brocklebank D, Ram F, Wright J, et al; Comparison of the effectiveness of inhaler devices in asthma and chronic obstructive airways disease: a systematic review of the literature; Health Techno Assess. 2001;5(26):1–149.
33. Pothirat C, Chaiwong W, Phetsuk N, Pisalthanapuna S, Chetsadaphan N et al; Evaluating inhaler use technique in COPD patients; Int J Chron Obstruct Pulmon Dis. 2015;10:1291–1298.
34. Al Ammari M, Sultana K, Yunus F, Al Ghobain M, Al Halwan SM. et al; A cross-sectional observational study to assess inhaler technique in Saudi hospitalized patients with asthma and chronic obstructive pulmonary disease; Saudi Med J. 2016;37(5):570–574.
35. Souza ML, Meneghini AC, Ferraz E, Vianna EO, Borges MC et al; Knowledge of and technique for using inhalation devices among asthma patients and COPD patients; J Bras Pneumol. 2009;35(9):824–831
36. Richard C. Boucher et al; Muco obstructive lung diseases; N ENG J MED 2019;1941-1953.
37. Crompton G et al; A brief history of inhaled asthma therapy over the last fifty years; Prim Care Respir J 2006; 15:326–31.
38. Cochrane MG, Bala MV, Downs KE, et al. Inhaled corticosteroids for asthma therapy. Patient compliance, devices and inhalation technique; Chest 2000;117:542–50.
39. Brian J. Lipworth et al; Pharmacokinetics of inhaled drug; Br J Clin Pharmacology 1996;(42)697-705.
40. Angkana Roy, Kayleigh Battle et al; Inhaler device, administration technique, and adherence to inhaled corticosteroids in patients with asthma; Prim care Respir J 2011;20(2) 148-154.