

The Impact of an Educational Intervention on the Skill of Community Pharmacists in the Use of a Pressurized Metered-dose Inhaler: A Covert Simulated Patient Approach in Pakistan

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ABSTRACT

Introduction: Metered-dose inhalers are the most widely prescribed and dispensed inhaler devices worldwide for the management of asthma. The present study aimed to assess the impact of educational intervention on the competency of community pharmacists of Islamabad, Pakistan regarding the pressurized metered-dose inhaler (MDI) technique. **Materials and Methods:** The intervention involved educating pharmacists practically through placebo inhalers and theoretically through literature brochures; based upon the "National Asthma Education and Preventive Program" inhaler technique. A total of 100 pharmacists were recruited from the rural and urban sectors of Islamabad. A covert simulated patient approach was used to evaluate the inhaler technique of pharmacists. Type of pharmacy, education status of pharmacists and the influence of already received training on the use of inhaler devices were the factors that demonstrated a significant positive association with the competency of pharmacists. **Results:** McNemar test was applied for pre and post-intervention intragroup comparisons to further assess categorical variables. A p -values <0.05 were considered statistically significant. The competency of

pharmacists increased significantly from 24% before intervention to 33% after intervention ($p < 0.001$). **Conclusion:** Originally, the inhaler technique competency of the majority of pharmacy professionals was observed to be inappropriate. However, the educational intervention proved to be effective in substantially enhancing the skill of community pharmacists regarding the MDI technique.

Keywords: Metered-dose inhalers; Community pharmacy professionals; Educational intervention; National Asthma Education and Preventive Program; Covert simulated patient approach.

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INTRODUCTION

Respiratory diseases are the major cause of morbidity along with mortality worldwide. Globally, around four million people die each year due to complications from chronic respiratory diseases. Moreover, 334 million adults are expected to be suffering from asthma worldwide.¹ Prevalence of asthma in Pakistan is expected to be 5-10% in adults, and 19% among children, imposing a substantial impinge upon the quality of life of elderly individuals, adolescents, and children.²

Inhalation therapy is the backbone of asthma management due to the advantage of localized delivery of bronchodilator drugs to bronchioles with minimal adverse effects, greater efficacy and rapid onset of action as compared to the oral route of administration. Inhaled bronchodilators are the first-line treatment in asthmatic patients and inhaled corticosteroids (ICS) are most commonly prescribed for long-term management of chronic respiratory conditions. Numerous inhalation devices are available worldwide but pressurized metered-dose inhalers (pMDIs) are the most widely prescribed due to the advantage of portability, multiple-dose delivery, and better efficacy.³

Globally, around three million adult asthmatic patients are estimated to be using MDIs. An appropriate inhaler technique is essential to achieve desired results for the management of asthma.⁴ The optimal inhaler technique requires essential steps to be performed in a coordinated way for the proper delivery of active pharmaceutical agents to the bronchioles for desired outcomes. Suboptimal inhaler technique may result in reduced drug delivery, low efficacy and consequently poor disease control with increased hospitalization. Hence, the use of inappropriate inhaler techniques results in treatment failure.⁵

Guidelines recommend that inhaler technique should be verbally described and physically demonstrated to patients, repeatedly and their procedure should be observed at each visit.⁶ Inappropriate MDI technique in patients results due to inadequate inhaler technique instructions by health care providers. Pharmacy professionals are on the front line of delivering medication and teaching the use of drug delivery apparatus to patients. Moreover, pharmacists are the last health care professionals in contact with patients before the medications are dispensed, therefore

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they are ideally positioned to demonstrate inhaler usage technique to patients.⁷

The United States of America (USA) initiated the National Asthma Education and Preventive Program (NAEPP) in March, 1989 to resolve the constantly growing health problem of asthma. It is regulated by the National Heart, Lung and Blood Institute (NHLBI). The goal of NAEPP is to improve the quality of life of asthma patients, as well as to decrease morbidity and mortality related to asthma. The NAEPP raise awareness among patients and healthcare professionals regarding management of asthma through educational programs.⁸

According to the guidelines presented by NAEPP, the adequate MDI usage technique involves 11 steps which are:

- “Step 1: Shake the contents well
- Step 2: Remove the cap
- Step 3: Hold the inhaler upright
- Step 4: Tilt the head back slightly
- Step 5: Breath out slowly
- Step 6: Open mouth with inhaler 1-2 inches away with lips tightly sealed around it
- Step 7: Breathe in slowly through the mouth and actuate the canister once
- Step 8: Hold the breath for 10-20 sec

Step 9: Exhale and wait 1 min before the second dose

Step 10: Shake again before second dose

Step 11: After use, replace mouthpiece cover.”

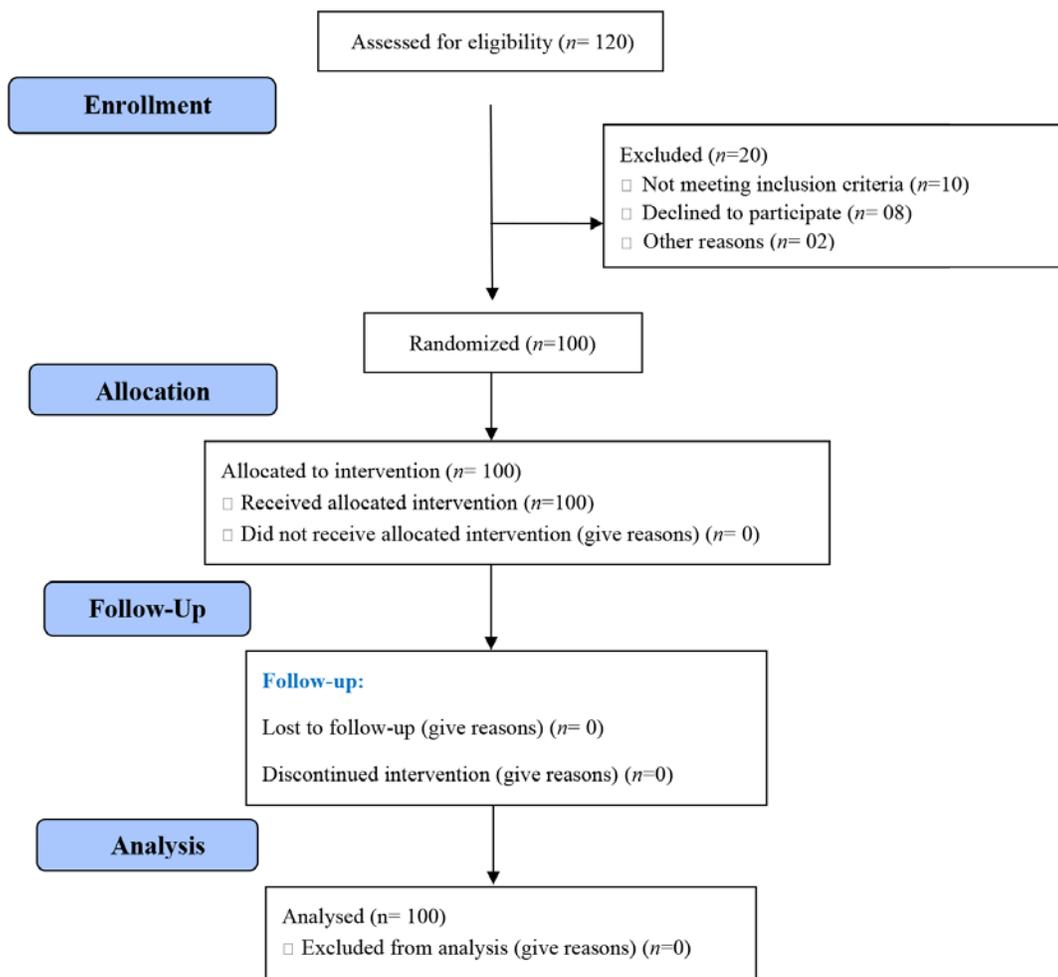
The steps of inhaler technique should be performed correctly for desired results.⁶

If pharmacists have poor competency regarding the MDI technique, the patient’s knowledge will remain poor as well. Moreover, it is observed that the appropriateness of the inhaler technique is declined with time. This employs that pharmacists’ knowledge regarding the MDI technique should be accessed at regular intervals to ensure correct guidance to patients.⁹

Numerous studies have been conducted over time that recommends the delivery of educational training seminars and programs for inhaler using patients as well as health care providers to keep their knowledge updated. Furthermore, pharmacists’ inhaler technique improves with educational sessions but is observed to deteriorate with time if not repeated regularly.¹⁰

This study aimed to access the competency of community pharmacists regarding MDI technique along with the impact of educational intervention on improving their inhaler technique in Islamabad, Pakistan.

CONSORT FLOW DIAGRAM



MATERIALS AND METHODS

Study Approval, Design and Settings and Study Subjects

Ethical approval from Institutional Ethical Review Board and Bio-Ethical Committee (BEC) of Quaid-i-Azam University, Islamabad was attained with protocol approval number BEC-FBS-QAU2018-96.

An interventional study was conducted on pharmacists working at community pharmacies in Islamabad (Capital of Pakistan). The capital of Pakistan is estimated to contain 1.43 million residents in the 2016 survey. This cosmopolitan city is estimated to have the highest literary rate of 88% among other cities in Pakistan.¹¹

Inclusion and exclusion criteria

Pharmacists currently practicing at community pharmacies in Islamabad were recruited for this study. As, in Pakistan, registered Pharmacists can counsel the patients regarding medications, and the medical device uses. However, the pharmacists already being enrolled in an educational program regarding inhaler devices were exempted from this study.

Study Sample

To estimate the sample size, a total number of registered pharmacies in this city was identified by requesting a list of registered pharmacies from the Drug Regulatory Authority of Pakistan (DRAP). Out of 210 registered pharmacies, 140 belonged to urban sectors, while 70 belonged to rural areas. The total number of pharmacies was listed in Microsoft Excel. Through randomization, the top 100 were selected and enrolled for this study.

Data collection method

The study was conducted in two phases; the baseline and the Post-intervention phase. The gap between the baseline and intervention was of 1 week. While the gap between the intervention and post-interventional assessment was of 1 month based on Kishore P.V. methodology.¹²

Covert Simulated patient approach

The covert simulated patient method was used to access competency in the MDI technique of pharmacists, both pre and post-intervention. This methodology has been adapted from exploratory, quasi-experimental research conducted at Western Australian community pharmacy setups.¹³

At baseline, all the pharmacists working in targeted pharmacies were approached to get signed the Informed Consent Form (ICF) for the participation in the current study. The principal investigator along with another trained pharmacist had visited the targeted pharmacies to collect the data. Where the principal investigator herself acted as a simulated patient who was asking about the guidance regarding inhaler usage technique whereas the other trained pharmacist was monitoring the explanation given by pharmacists on the 11 steps of MDI technique according to NAEPP guidelines for use of MDIs.

After the collection of baseline data, an educational intervention was given to the pharmacists working in targeted pharmacies by the principal investigator. Pharmacists were educated individually at each pharmacy setup according to NAEPP guidelines for use of MDIs and inhaler technique demonstration was conducted with a placebo MDI. Inhaler technique brochures were also distributed to the pharmacists which were also designed by NAEPP guidelines.

The post-intervention assessment was performed with a gap of one month after the educational intervention. A similar data collection procedure was adapted for post-intervention assessment as well. A well-trained pharmacist on behalf of the principal investigator along with another trained pharmacist visited the targeted pharmacies to collect

the data again. During this phase, the principal investigator did not visit the study participants to avoid any kind of biasness in the study.

Criteria for the scoring of pharmacist's knowledge regarding the optimal technique of MDIs

Scores were recorded as correct, incorrect, and skipped steps, based on 11-step criteria according to NAEPP guidelines.¹⁴ Each correctly demonstrated step was scored 1, whereas 0 was awarded for incorrectly demonstrated or skipped steps. A pharmacist with a total score of ≥ 7 out of a total of 11 was considered as having adequate knowledge and is competent in inhaler technique, this cut-off criteria was based upon Ali et al., methodology.¹⁵

Statistical analysis

The collected data were analyzed by using Statistical Package for Social Sciences program software (SPSS Inc., version 21.0, IBM corp., Armonk, NY, USA). Descriptive and inferential statistics were applied to summarize outcome variables. Categorical variables were presented as percentages and frequencies whereas quantitative variables were demonstrated as mean and Standard Deviations (SD). To find factors, chi-square tests were applied and where assumptions of chi-square

Table 1: Demographic characteristics of Pharmacy Setups (n=100).

Variables	Percentage (%)	
Area	Rural	16
	Urban	84
Pharmacy Type	Chain Pharmacy	23
	Individual Pharmacy	77
Duration of Setup	Less than 1 year	4
	1- 3 years	17
	3.1- 6 years	29
	6.1- 9 years	24
	More than 9 years	26

Table 2: Demographic particulars of Study participants (Pharmacists) (n=100).

Variables	Percentage (%)	
Gender	Male	69
	Female	31
Marital Status	Married	34
	Un-Married	66
Age Group	20-29 years	62
	30-39 years	38
Education	Graduation	93
	Post-Grad	7
Experience	< or = 5 years	85
	> than 5 years	15
Previous Training on MDIs	Yes	6
	No	94

Table 3: Effect of intervention on MDI technique.

*Steps	Pre Demonstration			Post Demonstration			P** value
	Correct n=100	Incorrect n=100	Skipped n=100	Correct n=100	Incorrect n=100	Skipped n=100	
1. Shake the contents well.	50	00	50	65	00	35	<0.001
2. Remove the cap.	32	00	68	42	00	58	<0.001
3. Hold the inhaler upright.	15	25	60	42	07	51	<0.001
4. Tilt the head back slightly.	17	40	43	53	13	34	<0.001
5. Breathe out slowly.	28	11	61	57	05	38	<0.001
6. Open mouth with inhaler 1-2 inches away/ in the mouth with lips tightly sealed around it.	88	10	2	95	02	03	0.092
7. Breathe in slowly through mouth and actuate the canister once.	63	37	00	93	07	00	<0.001
8. Hold breath for 1-2 sec.	33	32	35	70	10	20	<0.001
9. Exhale and wait 1 min before 2 nd dose.	27	5	68	45	06	49	<0.001
10. Shake again before 2 nd dose.	16	00	84	26	00	74	0.013
11. After use replace mouth piece cover.	13	00	87	21	00	79	0.021

*Inhaler technique steps according to NAEPP guidelines.6 **McNemar Test. $p < 0.05$ is considered statistically significant.

Table 4: Competency of Pharmacists and improvement in demonstration (Pre and post-intervention)

Competency in MDI Technique	Pre- Intervention %	Post- Intervention %	p* Value
Competent	24 %	33 %	<0.001
Non-Competent	76 %	67 %	
Level Of Demonstration			
Verbally Described only	51%	29%	<0.001
Verbally Described along with Physical Demonstration	49%	71%	

*McNemar Test. $P < 0.05$ is considered statistically significant.

analysis requirements were not met, Fisher exact tests were applied to calculate p -values. McNemar test was applied for baseline and post-intervention intragroup comparisons to further access categorical variables. The p -values < 0.05 were considered statistically significant.

RESULTS

Table 1 demonstrates the demographic characteristics of Pharmacy setups included in the present study. A total of 100 pharmacies were included with 84% belonging to the urban sectors of Islamabad.

Table 2 depicts the demographic characteristics of the community pharmacists recruited for this study. Among 100 pharmacists included in this study, the majority were male with an undergraduate level of education in pharmaceutical sciences.

Table 3 presents the effect of educational intervention on MDI technique of pharmacists.

Table 4 presents the competency of pharmacists regarding MDI technique and the level of demonstration of MDI technique of pharmacists to patients.

Table 5 represents the association of demographic variables with the competency in inhaler technique (post-intervention). Chi-square test

Table 5: Association of Demographic variables with competency post intervention.

Demographic Variables	Categories	Frequency n=100	Non-Competent	Competent	p* value
Gender	Male	69	46	23	0.916*
	Female	31	21	10	
Marital Status	Married	34	26	08	0.148*
	Un-Married	64	41	25	
Age group	20-29	62	38	24	0.121*
	30-39	38	29	09	
Education	Graduation	93	66	27	<0.001**
	Post-Grad	07	01	06	
Experience	<= 5 years	85	58	27	0.532*
	>= 5 Years	15	09	06	
Training	Yes	06	00	06	<0.001**
	No	94	67	27	
Location	Rural	16	13	03	0.186**
	Urban	84	54	30	
Type of Pharmacy	Chain	23	09	14	<0.001*
	Individual	77	58	19	

Chi-Square test*, Fisher's Exact test**.

and Fischer exact tests revealed that type of pharmacy, education status of pharmacists and the influence of already received training were the factors that demonstrated a significantly positive association with the competency of pharmacists.

DISCUSSION

The current study is novel in its type that was conducted in any city in Pakistan. This study revealed that the majority of the community

pharmacists practicing in Islamabad demonstrated poor efficiency in inhaler technique at baseline. But, the inhaler technique was substantially improved as the result of educational intervention; from 24% before to 33% after the provision of intervention.

The introduction of inhalation therapy along with oral therapy for the treatment of respiratory diseases was a major innovation in medical sciences.¹⁶ MDIs are the most frequently prescribed and dispensed dosage form in inhalation therapy. However, to maximize the therapeutic outcomes, the MDI usage technique should be appropriate. Pharmacists are responsible for educating patients regarding the MDI technique. Inadequate inhaler technique results in poor asthma control of patients that occurs due to incorrect inhaler technique demonstration by health care providers.¹⁷

Therefore, the patient's inhaler technique depends directly on the pharmacist's demonstration.¹⁸ However, according to a study conducted in the United Kingdom, merely 7% of health care professionals could demonstrate all the essential steps correctly, showing poor inhaler technique of pharmacists.¹⁹ Therefore, to ensure adequacy, the inhaler technique should be monitored regularly and periodically.²⁰

This study identified that the majority of pharmacists were not competent regarding inhaler technique. Among 100 pharmacists being evaluated for this study, only 24% demonstrated optimal inhaler technique, which was far better than the study conducted in Oman, where only 15% of pharmacists demonstrated appropriate inhaler technique²¹ and another study conducted in Gondar town, Ethiopia; where only 4.8% of pharmacists showed competency by demonstrating all the essential steps appropriately.¹⁴ The probable reason behind could be the lack of educational sessions and seminars for updating the knowledge and skills of practicing pharmacists, at regular intervals. But the findings of this study are much lower than a study performed at Malaysian healthcare setups, where 58% of asthmatic patients demonstrated an efficient technique that could be directly related to their pharmacists having efficient inhaler techniques.²² The low competency rate of pharmacists regarding inhaler techniques could be related to the lack of training sessions and educational programs. Since such programs influence the inhaler technique significantly.

This current study suggested that 51% of pharmacists verbally described the inhaler technique to patients. Whereas, in conformity to another study conducted in South Carolina, where 25% of patients never received verbal instructions for the use of inhalers prescribed to them.³ The possible reason behind could be the raised working hours of pharmacists, due to which they are unable to educate patients individually, especially during peak hours when there is enhanced patient load. Pharmacists who have been working at chain pharmacy setups exhibited better competency as compared to pharmacists working at individual pharmacy setups. These results are similar to the study performed at community pharmacies of Al-Ahsa region of Saudi Arabia.⁹ This might be because chain pharmacy setups conduct different training programs periodically for their staff to maintain their standards nationwide.

According to the present study, Step 6 "Open mouth with inhaler 1-2 inches away/ in the mouth with lips tightly sealed around it" was demonstrated by the majority (88%) of the pharmacists whereas; step 5 "Breathe out slowly" was the least demonstrated among essential steps. While according to the study conducted in Mekelle, step 7 "Breathe in slowly and actuate the canister once" was the least demonstrated step.¹⁵ However, two different studies from Iran concluded that step 7 (actuating the canister) was the most repeatedly occurred error.²³ This present study revealed that step 9 "exhale and wait 1 min before the second dose" was skipped and incorrectly demonstrated by 73% of respondents. These results might be because of the lack in training sessions for pharmacists. Similar results were obtained from a study in Nepal.¹²

Gender influence on the competency of MDI technique of pharmacists was observed to be insignificant in this study, which complies with the results of a study performed at Northwest, Ethiopia.¹⁴ The probable reason would be the same curriculum for male and female students for pharmacy studies that results in equal professional efficiency.

This study demonstrated no association of age group and working experience with inhaler technique competency which contradicts a study from Saudi Arabia, where pharmacists, having aged 30-35 years and work experience of 3-4 years demonstrated better competency regarding inhaler technique.⁹

Pharmacists with formerly received training on inhaler technique demonstrated better competency as compared to those pharmacists who have not. Thus, a positively significant association was observed between inhaler training formerly received and competency of pharmacists, similar in results to the study performed on pharmacists of Gondar town, Ethiopia¹⁴ as well as in accordance with the study conducted in Yemen that concluded that previous training was the only factor that greatly influenced inhaler technique improvement.²⁴ As, educational programs and training on a regular basis keep the knowledge of healthcare professionals refreshed and up to date.²⁵

According to a study performed in Karachi, southern Pakistan; numerous factors have been identified as the reason for not providing proper training to patients by pharmacists. These reasons include; raised working hours, increased work pressure, insufficient time to educate patients individually and lack of awareness about the significance of educating patients.²⁰

The competency of pharmacists regarding inhaler technique is improved with the provision of an educational intervention with 24% pre-intervention to 33% post-intervention but still, despite individual educational guidance, the majority of pharmacists could not demonstrate adequate inhaler technique. These results might be because repeated and group-based training sessions play a comparatively better role in enhancing inhaler technique competency as compared to an individual, short-duration guidance. As presented by randomized controlled parallel-group research from Sydney, Australia suggested that repeated physical demonstrations improve inhaler technique in a better way as compared to verbal, short duration, single time instructions.²⁶

Findings of the present study comply with the results of the study from the United Kingdom that concluded that training programs improve the majority's inhaler technique.¹⁹ Similarly, an interventional study involving informational leaflets conducted at Nepal demonstrated significant improvement in inhaler technique post-intervention.¹² Likewise, the inhaler technique of pediatricians from Brazil was significantly improved post-intervention ($p < 0.05$).¹⁸ That is probably because the training programs and educational interventions keep the knowledge and skills of pharmacists refreshed and updated.

Therefore, educational seminars and training programs are very helpful at keeping the knowledge of pharmacists updated. However, the lack of such programs might be the reason for the inadequate MDI technique of majority of the pharmacists along with patients.²⁶

CONCLUSION

Despite being actively involved in patient counseling, the majority of pharmacists demonstrated poor competency in inhaler techniques. These results lead to the conclusion that patients visiting these pharmacists are inadequately instructed about inhaler techniques. However, no substantial association was observed between the working experience of pharmacists and competency in the MDI technique. Whereas, a significant association was noted among education status; pharmacy setup types with proficiency in MDI technique. Study subjects who had

attended inhaler workshops showed better competency as compared to those who had not. Educational intervention successfully improved the inhaler technique of community pharmacists, suggesting the need for periodic educational training in the future.

Limitations

This study was a single-center study that was conducted in Islamabad only. Therefore, the results of this study cannot be generalized nationwide. The simulated patient approach may have affected the pharmacist's demonstration of the inhaler technique which could have influenced scores and results. The post-interventional assessment was evaluated with a gap of merely one month; such a short duration evaluation might have influenced positive results.

Recommendations

Further studies with larger sample sizes should be conducted in other cities of Pakistan as well, to conclude these results nationwide. Educational programs and seminars on inhaler technique education should be conducted to keep pharmacists' knowledge updated. Regular follow-up studies should be conducted following these educational programs.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

MDI: Metered-dose Inhalers; **NAEPP:** National Asthma Education and Preventive Program; **NHLBI:** National Heart, Lung and Blood Institute; **ICS:** Inhaled corticosteroids.

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