












RESEARCH ARTICLE

DRY POWDER INHALERS TECHNIQUE OF COMMUNITY PHARMACISTS: AN OBSERVATIONAL STUDY FROM LAHORE, PAKISTAN

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Abstract

Introduction: Inaccurate utilization of various inhaler devices may severely influence the drug therapeutic effectiveness. The aim of this study is to evaluate the community pharmacist knowledge, attitudes and practice regarding the use of dry powder inhalers (DPIs).

Method: The present observational study was conducted for the evaluation of pharmacist's knowledge and patient counseling attitude concerning the use of DPIs. A total of 114 community pharmacists from various community pharmacies of Lahore, Punjab were selected and a validated questionnaire was used to assess the knowledge of community pharmacists. The DPI technique presented by "National Heart, Lung and Blood Institute" was used as criteria for evaluation. The covert simulated patient approach was used to evaluate the DPI technique of pharmacists without any biasness.

Results: Out of 114, only 27.2% pharmacists presented adequate knowledge about the correct use of inhaler device (DPIs). Pharmacists from chain pharmacies presented higher adequacy 66.7% as compared to individual pharmacies i.e., 33.3%. Pharmacists whose working experience was more than 5 years presented better DPIs technique knowledge.

Conclusion: The study demonstrated that majority of the community pharmacist (72.8%) have inadequate dry powder inhaler technique at baseline. Setup type (Chain pharmacies) and work experience were the demographic variables that were positively associated with the adequate technique.

Keywords: Chain pharmacies; community pharmacists; covert simulation technique; dry powder inhaler, national heart; lung and blood institute.

INTRODUCTION

Respiratory disease such as asthma and lung infections cause mortality and morbidity globally¹. Other diseases such as pneumonia, pleural disease and appearance of malignancies in respiratory tract, TB, lung cancer are leading cause of death worldwide². Chronic obstructive pulmonary disease (COPD) is described by chronic airflow destruction that is usually growing and related with unusual inflammatory response to the lung¹. The comorbidities along with COPD impact on patient's health severely³. COPD is most known lung disease with different etiological processes that contribute in lung damage such as inflammation and oxidative stress⁴. Asthma is airways inflammatory disorder related with hyper responsiveness of continuous wheezing, coughing and chest tightness

usually at morning or during night³. Asthma worse due to acute episodes of coughing, breathlessness, wheezing or any combination of following symptoms. Exacerbations are related with obstruction of airways and can be demonstrated by PEF and FEV1 measurement⁵. Severe asthmatic attack increases the risk of respiratory failure in the patients and without proper or immediate treatment; it may progress to ventilator failure or death⁵. The occurrence of asthma symptoms, respiratory problems, emergency department visits, and hospitalization for asthma attacks is linked to allergen exposure as well as irrational use of prescribed drugs⁶.

For the effective management of these respiratory conditions, pharmacological management in crucial especially the inhalation therapy⁷. As inhalation therapy provides rapid onset of action along with

enhanced bioavailability, therefore, inhalation devices are being widely prescribed and dispensed worldwide⁶. Among various inhaler devices, metered dose inhalers, dry powder inhalers and nebulizers are the most common devices used by the patients⁴.

The most popular delivery method for aerosol delivery of drug is the pressurized MDI, also known as a metered dose inhaler³. MDI have several benefits, including portability, the ability to formulate a fixed dose, and the lack of a need for an external power source⁵. Medications such as steroids, bronchodilators and anticholinergics can be administered with inhalation devices³.

Devices known as “Dry powder inhalers” are designed to pump medication into the airways by utilizing the energy released during patient inspiratory activity⁷. Dry powder inhalers deliver medication in the powdered form and are activated by the force of inhalation³. The drugs commonly used in the dry powder inhaler include; Salmeterol and Budesonide⁸. They are composed of mixture consisting of drug particles such as micronized carried by carrier molecules, most commonly lactose⁹. In prescribing a DPI, inspiratory efficiency of the patient is a vital consideration since all DPI products currently on the market are dependent on patient inspiratory flow¹⁰. Dry powder inhalers have several attributes of an ideal inhaler, however no individual device shows all functional features for optimum clinical performances in different respiratory diseases⁸. Pharmacists play a crucial role in patient education by providing essential information on medication use, potential side effects, and interactions with other drugs⁴. Their expertise ensures that patients understand how to take their medications correctly, which is vital for treatment effectiveness and safety³. Pharmacists also help patients manage chronic conditions, promoting adherence to prescribed therapies, and offering guidance on lifestyle changes that can enhance health outcomes⁹. Their involvement is key to empowering patients to make informed decisions about their health¹¹.

METHODS

Study design

The present study contained a cross-sectional design to access the dry powder inhaler technique of community pharmacists. To ensure transparency and observe the inhaler technique demonstrated to patient, a covert simulated patient approach was used. The investigators simulated the role of patients and inquire the community pharmacists to demonstrate and instruct them above the correct usage technique of dry powder inhalers. The study aimed to increase awareness and improve the effectiveness of DPI use by identifying common issues and educating users on proper techniques

Inclusion and exclusion criteria:

This research included community pharmacists currently practicing at community pharmacies in Lahore. Pharmacists eligible for this study must be registered and licensed professionals. Pharmacists working in clinical or industrial setups were excluded

from the study. Moreover, the community pharmacists who were not registered by pharmacy council were excluded. Stratified convenient sampling technique was employed to access the sample size. The sample size recruited was 114, out of which 100 were pharmacies and 4 were medical stores. All of these belonged to the urban areas.

Data collection form containing demographic information of the pharmacy and community pharmacist was utilized. The DPI technique presented by “National Heart, Lung and Blood Institute” was used as criteria for evaluation.

Data collection procedure:

For this research study a covert simulated patient approach procedure is followed for the collection of data from multiple community pharmacies. This approach involves trained individuals, acting as simulated patients, to visit the pharmacies under the guise of routine interactions. The simulated patients are briefed to present the common scenarios related to dry powder inhalers (DPIs), such as seeking advices on how to use the inhaler or asking questions about the side effects. They are also trained to provide detailed yet realistic responses and reactions to pharmacist inquiries and advices.

Step Evaluation criteria

In accordance to “National Heart, Lung and Blood Institute” guidelines for DPI use, the steps were used as evaluation criteria to assess pharmacists’ knowledge of the correct technique for using a dry powdered inhaler. Each step was evaluated as either correct (scored as 1) or incorrect/skipped (scored as 0). A score of 1 indicated that the pharmacist demonstrated the step correctly, while a score of 0 indicated that the step was performed incorrectly or omitted. The total score ranged from 0 to 9, score equal or above 6 out of 9 were termed as greater adequate DPI usage technique.

Statistical analysis

The collected data from the study subjects was analyzed and interpreted by using SPSS v21.0, IBM. To summarize the variables, inferential and descriptive statistics were used. Chi square tests (Pearson chi square) were used to find factors relating associations between independent variables. P-values were regarded as statistically significant values if they were less than 0.05.

RESULTS

Demographic characteristics of the included setups are mentioned in Table 1, among which majority setups were pharmacies, and belonged to urban areas.

Demographic variables of the respondents (community pharmacists) included gender, age group, education, working experience in pharmacy (years) as presented in Table 2. The DPI technique presented by “National Heart, Lung and Blood Institute” presents 9 steps in appropriate usage technique of DPIs. Each correctly demonstrated step is scored 1. The details of pharmacist’s demonstration are mentioned in Table 3.

Table 1: Demographic characteristics of the setup (N=114).

No.	Variable	Categories	N (%)
1	Setup	Pharmacy	110 (96.5)
		Medical store	4 (3.5)
2	Type of Pharmacy	Chain pharmacy	36 (31.6)
		Individual pharmacy	78 (68.4)
4	In working since	<5 years	57 (50)
		>5 years	57 (50)

Table 4 shows the level of demonstration presented by pharmacists to patients, focusing on their attitudes towards verbally describing and physically demonstrating the steps for using dry powder inhalers (DPIs). Table 5 presents the additional information related to dry powder inhalers (DPIs) that should be provided to patients by pharmacists. This additional information is in accordance to the guidelines provided by "National Heart, Lung and Blood Institute".

Table 2: Demographic characteristics of the respondents (N=114).

No.	Variable	Categories	N (%)
1	Gender	Male	112 (98.2)
		Female	2 (1.8)
2	Age group	20-39	107(93.9)
		40 and above	7(6.1)
3	Education	M.Pharm	36(31.6)
		B. Pharm	6(5.3)
		D. Pharm	72(63.2)
4	Work experience in pharmacy (years)	<1	9(7.9)
		1-4	72(63.2)
		5-9	24(21.1)
		≥10	9(7.9)
5	Training/workshop attended on correct use of DPIs	Yes	6(5.3)
		No	107(93.9)

Table 7 represents the association of respondents' demographics with the adequacy of DPI knowledge, in this study that demonstrated a significant positive association with the work experience in pharmacy (years). While, Table 8 presents the association of level of demonstration by pharmacist with the adequacy of DPI knowledge.

DISCUSSION

Knowledge and awareness regarding the use of dry powder inhaler (DPIs) in asthma patients is important for improved health compliance, patient satisfaction and adherence⁴. Therefore, it makes more crucial for the pharmacists or other health care providers (HCPs) to have adequate knowledge and skills for correct inhaler usage technique³. Inadequate utilization of various inhaler devices may significantly impact the drug therapeutic effectiveness⁵. Educational intervention produced positive outcomes related to the community pharmacist's knowledge and skills with using inhaler devices⁴. Cross sectional study was conducted for the evaluation of community pharmacist's knowledge concerning the use of inhaler device (DPIs). For this research, 114 community pharmacies were selected in Lahore, Pakistan. Data

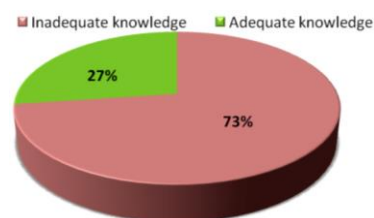
**Figure 1: Knowledge of community pharmacist regarding DPIs.**

Figure 1, demonstrates the overall adequacy of community pharmacists related to dry powder inhaler (DPI) usage technique. Table 6 represents the association of demographic variables with the adequacy of DPI knowledge that demonstrated a significantly positive association with the chain pharmacy as compared to the individual pharmacy and the pharmacists who are working more than 5 years in the field show great association with adequacy of knowledge.

collection form was prepared with the help of National Heart, Lung and Blood Institute guidelines to assess the inhaler technique. For the evaluation purpose, covert simulated patient approach was used. The aim of this study was to gauge the community pharmacist's understanding about the different scenario presented by the patients and about the dry powder inhaler correct usage technique.

According to the result of this study, 27.2% of pharmacists have significant knowledge and 72.8% have inadequate knowledge, as presented in Table-6. The knowledge of using DPIs was inadequate in majority of community pharmacists working at the pharmacies in Lahore. Similarly, a cross-sectional study held in Mangaluru, India in 2018 utilized the KAP questionnaire and observed the effect of pharmacist education on patients' understanding, behaviors, and practices when using inhaler medications for obstructive airway diseases¹¹. The KAP scores showed statistical improvement, with a mean change of 11.3 ± 6.9 ($p < 0.001$) and as per the findings of the study. The results of this study indicate that there is no substantial difference ($p > 0.05$) between the patient's knowledge levels and the change in KAP scores¹¹.

Table 3: Knowledge about correct use of DPIs.

No.	DPI technique steps	Correct	Incorrect/Skipped
1	Open the cover, hold the inhaler in upright position	114 (100)	0 (0)
2	Load a dose of medicine in mentioned compartment. Do not tip or shake the inhaler.	114 (100)	0 (0)
3	Stand up or sit up straight with head straight.	43 (37.7)	71 (62.3)
4	Holding the inhaler away from mouth, breathe out completely to empty your lungs.	61 (53.5)	53 (46.5)
5	Place the mouthpiece of inhaler in your mouth and close the lips around it to form a tight seal.	81 (71.1)	33 (28.9)
6	Take a fast, deep, forceful breath in through your mouth. Take as big a breath as possible.	31 (27.2)	83 (72.8)
7	Hold your breath and count to 10.	26 (22.8)	88 (77.2)
8	Take inhaler out of your mouth. Breathe out slowly	101 (88.6)	13 (11.4)
9	If you have you have an action plan and it says to take more than 1 dose of medicine, wait 1 minute between doses. Repeat steps 2 through B.	20(17.5)	94(82.5)

Table 4: Level of demonstration by pharmacists.

Variable	Categories	N (%)
Level of demonstration	Verbally described only	3 (2.6)
	Verbally described+ physically demonstrated	111 (97.4)

Also, during 2014 another similar study was conducted in Spain to access the degree of knowledge, attitude and preference related to inhale therapy among community pharmacists¹². Total of 3000 questionnaires delivered during the survey period, 1722 (57.4%) were returned. A limited understanding of inhaled therapy

was evident in 76.4% of the research participants, and a mere 6% of community pharmacists endowed satisfactory knowledge about the subject. Furthermore, 33.1% of respondents reported not receiving training on proper inhaler technique and 73.3% reported not having their inhalation technique checked¹².

Table 5: Additional information provided by pharmacist.

No.	Additional information	Categories	N (%)
1	Store the DPI in cool, dry place.	Yes	113 (99.1)
		No	1 (0.9)
2	If medicine is ICS, rinse your mouth with water afterwards to avoid infection in mouth.	Yes	0 (0)
		No	114 (100)
3	If inhaler has built in counter to tell how many doses are left, and the counter gets to 0, throw it away.	Yes	0 (0)
		No	114 (100)

*ICS-Inhaled Corticosteroid

Table 6: Association of demographic variables of setup with adequacy of DPI knowledge.

No.	Variable	Categories	Adequate knowledge	Inadequate knowledge	p-value	η^2
1.	Setup	Pharmacy	31 (28.2%)	79 (71.8%)	0.213	-
		Medical store	0(0%)	4(100%)		
2.	Type of Pharmacy	Chain pharmacy	24(66.7%)	12(33.3%)	<0.001	0.603
		Individual pharmacy	7(9.0%)	71(91.0%)		
3.	In working since	<5 years	10(17.5%)	47(82.5%)	0.021	0.217
		>5 years	21(36.8%)	36(63.2%)		

Another study was conducted in Amman, Jordan where education unveiling significant association between asthma knowledge and inhaler technique was evaluated, which opposes our study¹³. This study evaluates all HCPs involved in asthma patient education and look into interactions between asthma knowledge as well as inhaler technique skills¹³. The findings of the study revealed that a significant correlation between understanding and ability to illustrate appropriate inhaler technique, proposing that keeping good inhaler technique skills may rely on optimizing information. The instruction improved the HCP's inhaler technique skills and sustained them over time¹³. Similarly, another study was conducted among the community pharmacists of Spain, showed interesting results that only 6% of community pharmacists had adequate knowledge about inhaled

therapy, particularly in comparison to 76.4% of survey respondents who had confined or no understanding at all¹². Among 114 community pharmacists recruited, 112 were male, but only 25.9% had the appropriate skills. The average age of the majority of pharmacists is 20–39. Furthermore, the most of pharmacists (63.2%) held a D-Pharm degree, and 36.1% of them felt they knew enough about how to use DPIs. The training or workshop was attended only by six pharmacists. In contrast, a cross-sectional observational study was carried out in Vietnam to assess community pharmacists' knowledge based on a concise training course¹⁴. According to the findings of the study, pharmacists' average age was 32.6 years, and well almost 90% of them were female and most of pharmacists (85.4%) held a college diploma and secondary diploma in pharmacy¹⁴.

Table 7: Association of respondent's demographics with adequacy of DPI knowledge.

No.	Variables	Categories	Adequate knowledge	Inadequate knowledge	p-value	η^2
1	Gender	Male	29(25.9%)	83(74.1%)	0.20	-
		Female	2(100%)	0(0%)		
2	Age group	20-39	30(28.0%)	77(72.0%)	0.428	-
		40 and above	1(14.3%)	6(85.7%)		
3	Education	M. Pharm	4(11.1%)	32(88.9%)	0.19	-
		B. Pharm	1(16.7%)	5(83.3%)		
		D. Pharm	26(36.1%)	46(63.9%)		
4	Work experience in pharmacy (years)	<1	1(11.1%)	8(88.9%)	0.001	0.356
		1-4	14(19.4%)	58(80.6%)		
		5-9	9(37.5%)	15(62.5%)		
		≥ 10	7(77.8%)	2(22.2%)		
5	Training/workshop attended on correct use of DPIs	Yes	3(50%)	3(50%)	0.181	-
		No	27(25.2%)	80(74.8%)		

Table 8: Association pharmacist's demonstration with the adequacy of DPI knowledge.

Variable	Categories	Adequate knowledge	Inadequate knowledge	p-value	η^2
Level of demonstration	Verbally described only	0(0%)	3(100%)	0.283	-
	Verbally described + physically demonstrated	31(27.9%)	80(72.1%)		

Compared to the untrained group, pharmacists who had managed to finish the training program were significantly more skilled at accurate counseling about medication compliance¹⁴. Another study was carried out in Lagos, Nigeria to analyze how well community pharmacists demonstrated the inhaler technique to patients¹⁵. Total 28 (66.7%) out of the 42 community pharmacists who participated in this study were male, between the age group of 26 and 76 years, among which 6 (14.3%) of the respondents managed to hold additional non-pharmacy academic credentials, in addition to their basic pharmacy degree¹⁵. Of the respondents, only 28.6% had any significant experience with inhaler technique and further indicating those pharmacists' understanding and competency regarding the appropriate inhaler techniques was poor¹⁵.

Table 4 presents the level of demonstration by pharmacists, focusing on their attitudes towards the verbally describing and physically demonstrating the steps for using dry powder inhalers (DPIs). However, Table 8 shows the correlation between the pharmacist's level of demonstration and the sufficiency of DPI knowledge. The current study revealed that 97.4% pharmacists demonstrate the inhaler device physically as well as verbally to patients. Similarly, a cross-sectional observational study conducted in Turkey assessed the knowledge of inhaler devices among pharmacy workers of 4221 pharmacies concluded that 60% of pharmacists demonstrate the inhaler technique to the patients which opposes our study¹⁶.

A cross-sectional observational study involving covert simulated patient approach conducted upon the community pharmacies of Islamabad, Pakistan presented that 51% of the pharmacists only verbally describe the inhaler technique to patients. Whereas, 49% of the community pharmacists verbally describe the inhaler technique along with physical demonstration during patient counselling³. The probable reason could be the increased workload of

community pharmacists, that results in less time provided to patients individually for counseling.

Other research, while somewhat using a different methodological approach, also revealed that community pharmacists had poor knowledge about inhalation therapy. A survey carried out among community pharmacists of Spain presented the findings that 73.3% of pharmacists did not bother to check the inhalation technique, and 33.1% of respondents did not obtain training on suitable inhaler technique¹².

The present study demonstrated that step 3, step 4, step 6, step 8 and step 9 were incorrect or skipped by pharmacists, as presented in Table 3. Step 9 were the most incorrect one with 82.5% respondents incorrectly demonstrating it. Most of the pharmacists (77.2%) skipped or not explained the step 7 appropriately. Similarly, an observational study conducted in metropolitan Toronto evaluated pharmacist understands and ability to utilize the inhaled devices¹⁷. The study concluded that while demonstrating the steps of inhaler device (Turbuhaler), step 6, step 9 and step 10 shows less level of demonstration percentage as compared other steps¹⁷.

In our study 100% pharmacists skipped to demonstrate the additional information step i.e., rinse the mouth after using ICS, which causes the errors in inhalation technique by the patients. In the similar manner, a cross-sectional study conducted in Portugal for almost 4 months in which the identification of improper procedure for using inhaler techniques was evaluated in community pharmacies¹⁸. The findings of the study were that 61.1% patients who received ICS overlooked to wash their mouths as instructed by the pharmacists¹⁸. Another study was conducted in Khartoum, Sudan evaluating the knowledge, skills and adequate demonstration of inhaler technique in community pharmacists regarding Turbuhaler device various pharmacists gave direct explanation for most of the steps¹⁹. Moreover, step 12 that involved washing and gargling of mouth with water after the dose

administration were only demonstrated by 8% pharmacists which opposes our study, that explained all of the community pharmacists skipped this step while demonstrating the inhaler technique¹⁹.

The findings of the study present the importance of educating pharmacists regarding the use of inhalation devices. By conducting regular workshops and seminars, the knowledge and skills of community pharmacists could be kept updated regarding the usage technique of various medical devices. The updated knowledge of community pharmacist would result in better patient counseling that would ultimately lead to appropriate usage technique, promoting enhanced patient satisfaction and hence adherence. Thus, promoting enhanced quality of life in asthma and chronic obstructive pulmonary disease (COPD) patients²⁰.

Limitations of the study

The study was conducted in different regions of Lahore, Pakistan, due to which the results could not be extrapolated nationwide. Similar study with larger sample size and different regions of the country should be conducted throughout the country to access the inhaler technique, nationwide.

CONCLUSIONS

Patient compliance with the use of dry powder inhalers (DPIs) tends to depend on the pharmacist's understanding of its utilization. Pharmacists should use suitable techniques, have the right attitude, and be knowledgeable on how to use the inhaler techniques.

This study evaluates community pharmacists' knowledge and technique regarding the use of DPIs using a covert simulated patient framework. The fundamental knowledge and professional expertise required to demonstrate the appropriate inhalation technique of the product such as (DPIs) was observed to be lacking in most of the participating community pharmacists. There seems to be no doubt that it will have a devastating effect on patient education. Particularly in comparison to the pharmacists working in individual pharmacies, community pharmacists employed by chain pharmacies retain significant knowledge.

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AUTHOR'S CONTRIBUTIONS

Shahid S, Batoool S, Rafique U: writing original draft, methodology, investigation. **Dua-E-Zahra S, Shuja M:** formal analysis, data curation, conceptualization. **Nadeem MS, Hamza M:** writing, review and editing, methodology. **Shahid S, Amjad U, Iqbal MZ:** formal analysis, data curation, conceptualization. All authors reviewed and approved the final version of the article.

DATA AVAILABILITY

The accompanying author can provide the empirical data that were utilized to support the study's conclusions upon request.

CONFLICT OF INTEREST

None to declare.

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