

Misuse of Respiratory Inhalers Among Hospitalized Patients in a Tertiary Health Care Hospital in Kabul

Ershad Ahmad Mushkani¹, Fahima Hamidy², Tawfiq Ahmad³, Mohammad Asef Adelyar⁴

¹Department of Pharmacology, Kabul University of Medical Sciences, Kabul, Afghanistan; ²Department of Nursing Skills, Aliabad Teaching Hospital, Kabul University of Medical Sciences, Kabul, Afghanistan; ³Department of Ophthalmology, Shahr Ara Hospital, Kabul University of Medical Sciences, Kabul, Afghanistan; ⁴Department of Abdominal Surgery, Aliabad Teaching Hospital, Kabul University of Medical Sciences, Kabul, Afghanistan

Correspondence: Ershad Ahmad Mushkani, Department of Pharmacology, Kabul University of Medical Sciences, Kabul, Afghanistan, Tel +93-744600222, Email ershadahmad2605@gmail.com

Objective: Evaluation of the techniques of respiratory inhaler use among stable inpatients with COPD in Ali Abad Teaching Hospital.

Methods: This cross-sectional study was conducted between April 2020 and October 2022 at the cardiopulmonary department of Ali-Abad Teaching Hospital. Participants were requested to demonstrate how to use their prescribed inhalation devices. The inhaler's accuracy was evaluated using checklists that had been previously established and included key procedures.

Results: We studied 318 patients performing a total of 398 inhalation maneuvers with five different IDs. Across all studied inhalation maneuvers, the maximum number of misuses was observed in those using the Respimat (97.7%), and the minimum number of misuses was observed in those using the Accuhaler (58.8%). For the pMDI, the steps "take a deep breath after activating the inhaler" and "hold the breath a few seconds" were most frequently inaccurately performed. Regarding the pMDI with spacer, the steps "exhale fully" were most commonly carried out in mistake. For the Respimat, the steps "hold the breath a few seconds after inhalation activation" and "exhale fully" were most frequently inaccurately performed. According to gender, the misuse was less in females for all studied inhalers ($p < 0.05$). Higher proportion of literate participant correctly used all types of inhalers as compared to the illiterate patients ($p < 0.05$). According to the findings of this study, the majority of patients (77.6%) lacked knowledge of proper inhaler technique.

Conclusion: The misuse rates were high for all studied inhalers; however, among studied inhalers, the Accuhaler had the greatest proportion of correct inhalation techniques. In order to ensure proper inhaler technique, patients should be educated before receiving inhaler medicines. Therefore, it is crucial for doctors, nurses, and other healthcare professionals to comprehend the problems with the performance and proper usage of these inhaler devices.

Keywords: COPD, misuse, inhaler

Introduction

Respiratory inhalers are the cornerstone of COPD management, and effective therapy depends on the appropriate inhalation technique.¹⁻³ The use of inhaled medication reduces the occurrence of systemic adverse reactions, and medicines are delivered directly to the airways (target zone), it requires individual instruction,⁴ multiple steps for use,⁵ and patients should understand the different series of device-specific directions.⁶ Management of symptoms may be affected by the inappropriate inhaler technique subsequently of inadequate the dosage.^{7,8}

Patients who use inhalers incorrectly have lower treatment success rates, which increases their need for emergency departments, raises the expense of their illness, and diminishes their quality of life.⁹ Risk factors for inhaler misuse are use of multiple devices,¹⁰ inadequate instruction,¹¹ older age,¹² and low health literacy.¹⁰ Unfortunately, misuse of respiratory inhalers is a common issue around the world.^{8,13,14} Despite this, the rate of inhaler misuse is still unknown in Kabul.

The objective of this study was to evaluate the techniques of respiratory inhaler use among inpatients with COPD in Ali Abad Teaching Hospital, since the rate of inhaler misuse in this hospital is unclear. Additionally, we intended to evaluate the type of inhaler device, the number of IDs used by each patient, and the demographic characteristics of patients.

Materials and Methods

Study Population, Parameters and Design

This cross-sectional study was conducted between April 2020 and October 2022 at the cardio-respiratory department of Ali-Abad Teaching Hospital, which is a 200-bed teaching hospital in Kabul, Afghanistan. Patients who were admitted with a diagnosis of COPD, and agree became study participants. The inclusion criterion was the use of at least one inhaler device. Patients who were admitted with diagnosis of asthma diagnosis, dementia, coma or other structural lung diseases were excluded from study.

Demographic characteristics, including the patient's age, gender, education level, vision, type, and number of inhalers, were collected using structured questionnaires. The poor vision subgroup included patients who required a health care worker to read the questionnaires and write down their responses. Participants with good vision could independently read and respond to the questionnaires.

Checklists for Evaluating Proper Inhaler Technique

An educated health care worker was involved in assessing the accuracy of the respiratory inhaler technique step by step by using detailed checklists. The checklists were developed according to the manufacturers' references and reports in the available literature.^{11,15}

The knowledge of respiratory inhalers included three items: the inhaler dosage, the time frame for using the inhaler, and washing the mouth to avoid oral ulcers.^{16,17}

Statistical Analysis

Descriptive statistics, such as means, standard deviations, and proportions, were used to describe the demographic characteristics of patients. Statistical significance was accepted at $P < 0.05$. All of the analyses were conducted using SPSS version 21.

Ethical Issues

Informed consent was obtained from the study participants prior to study commencement. Every patient was evaluated regarding inhaler use on an advised schedule (mentioned in the patient file). In a case of misuse, the patient was educated about the correct use of the inhaler at the end of the interview by the health care worker. This research was approved by the institutional review board of Kabul University of Medical Sciences (Reference: 38/3-13/05/2020) and the study was conducted according to the principles of the Declaration of Helsinki.

Results

Sample Characteristics

Of the 338 participants who were eligible, 318 patients (94.02%) were enrolled. Twenty participants (6.28%) declined to participate in the study. The demographic characteristics of patients are described in Table 1. The total inhalation maneuvers were 398, with five different IDs. pMDI users ($n = 261$, 65.57%) were the highest among the enrolled population, followed by pMDI with spacer users ($n = 54$, 13.56%), Respimat[®] users ($n = 45$, 11.30%), Handihaler[®] users ($n = 21$, 5.27%), and Accuhaler[®] users ($n = 17$, 4.27%). Participants were currently using one (74.8%), two (20.44%), or three inhalers (4.17%). Regardless of having received prior instructions for the proper use of inhalers, all participants mentioned using them for longer than a week. Most of the participants were illiterates (54.72%), and 43.4% of individuals were current smokers. The mean (SD) patient age was 59.1 (9.8) years (range: 49–71 years), and most were men (82.07%).

Table 1 Demographic Characteristics of Patients (N=318)

	N	%
Age, years (mean \pm SD)	59.1 \pm 9.8	
Age \geq 60 years	216	67.92
Male Gender	261	82.07
Literate	144	45.28
Good vision	163	51.25
Duration of inhaler use, months (mean \pm SD)	14 \pm 9.6	
Number of inhalers used \geq 2	80	25.15
Smoking rate	138	43.4
Frequent ECOPD (\geq 2/last year)	144	45.2
Type of inhalers		
pMDI	261	65.57
pMDI with spacer	54	13.56
Respimat [®]	45	11.30
Handihaler [®]	21	5.27
Accuhaler [®]	17	4.27

Note: All data is provided as percentages (n), except where otherwise noted.

Abbreviations: ECOPD, COPD exacerbations; MDI, pressurized meter-dose inhaler.

Inhalation Misuse by IDs

311 patients (97.7%) performed at least one essential step incorrectly for all inhaler devices. Across all studied inhalation maneuvers, the maximum number of misuses was observed in those using the Respimat (97.7%), and the minimum number of misuses was observed in those using the Accuhaler (58.8%). For the pMDI, the steps “take a deep breath after activating the inhaler (orally)” and “hold the breath a few seconds after inhalation activation” were most frequently inaccurately performed. Regarding the pMDI with spacer, the steps “exhale gently to residual volume” were most commonly carried out in mistake. Meanwhile, for the Accuhaler and Handihaler, the step “exhale gently to residual volume” and “hold the breath a few seconds after inhalation activation” were most frequently done incorrectly. For the Respimat, the steps “hold the breath a few seconds after inhalation activation” and “exhale fully” were most frequently inaccurately performed.

Patient Characteristics Related to Misuse of Inhalers

The correct and misused frequencies for each inhaler according to age, gender, education, vision, and knowledge of respiratory inhalers are presented in Table 2. Except for pMDI with spacer, the misuse of other inhalers was higher in the older age group (\geq 60 years) as compared to those under 60 years old. According to gender, the misuse was less in females for all studied inhalers as compared to male ($p<0.05$); moreover, in the male group, the misuse of Handihaler was more as compared to other inhalers ($p<0.05$). Meanwhile, higher proportion of literate participant correctly used all types of inhalers as compared to the illiterate patients ($p<0.05$). Further, among of illiterate group the misuse of Respimat was more as compared to other inhalers ($n=26$, 86.6%). Participants with poor vision were more likely to misuse all types of respiratory inhalers compared to those with good vision ($p<0.05$). Furthermore, when compared to other inhalers, misuse of Respimat was higher in the poor vision group ($n = 23$, 76.6%). According to the findings of this study, the majority of patients (77.6%) lacked knowledge of proper inhaler technique ($p<0.05$).

Table 2 Characteristics of Correct and Misuse of Different Inhalers

		pMDI		pMDI with Spacer		Respimat®		Accuhaler®		Handihaler®	
		Correct	Misuse	Correct	Misuse	Correct	Misuse	Correct	Misuse	Correct	Misuse
Age	Age < 60 years	33 (35.4)	59 (35.1)	20 (58.8)	11 (55)	10 (66.6)	11 (36.6)	4 (40)	3 (42.8)	6 (46.1)	3 (37.5)
	Age ≥60 years	60 (64.5)	109 (64.8)	14 (41.1)	9 (45)	5 (33.3)	19 (63.3)	6 (60)	4 (57.2)	7 (53.9)	5 (62.5)
Gender	Male	70 (75.2)	120 (71.4)	24 (70.5)	13 (65)	9(60.0)	25 (83.3)	6 (60)	4 (57.2)	8 (61.5)	7 (87.5)
	Female	23 (24.7)	48 (28.5)	10 (29.4)	7 (35)	6 (40.0)	5 (16.6)	4 (40)	3 (42.8)	5 (38.5)	1 (12.5)
Education	Literate	69 (74.1)	27 (16.0)	25 (73.5)	7 (35)	12 (80.0)	4 (13.3)	7 (70)	3 (42.8)	10 (76.9)	2 (25)
	Illiterate	24 (25.8)	141 (83.9)	9 (26.47)	13 (65)	3 (20.0)	26 (86.6)	3 (30)	4 (57.2)	3 (23.1)	6 (75)
Vision	Good	63 (67.7)	54 (27.9)	22 (64.7)	7 (25)	10 (66.6)	7 (23.3)	8 (80)	2 (28.5)	11 (84.6)	3 (37.5)
	Poor	30 (32.2)	114 (67.8)	12 (35.2)	13 (75)	5(33.3)	23 (76.6)	2 (20)	5 (71.5)	2 (15.4)	5 (62.5)
Knowledge of respiratory inhaler	Good	75 (80.6)	23 (13.6)	20 (58.8)	5 (10)	13 (86.6)	7 (23.3)	9 (90)	2 (28.5)	10 (76.9)	2 (25)
	Poor	18 (19.4)	145 (86.4)	14 (41.2)	15 (90)	2(13.4)	23 (76.7)	1 (10)	5 (71.5)	3 (23.1)	6 (75)

Note: Data are presented as n (%).

Abbreviation: pMDI, pressurized meter-dose inhaler.

Discussion

This study demonstrates that a significant majority of COPD patients receiving regular care from internal medicine doctors misused their inhalers by performing at least one essential step for medicine delivery incorrectly. Patients who used the Accuhaler device had the highest percentage of accurate techniques, whereas those who used Respimat and pMDI made the most mistakes (Table 3).

This is in accordance with the reports of other studies in which the misuse of Respimat was higher as compared to others inhalers.^{17,18} According to previous studies, a greater percentage of individuals misused the MDI than those who used other inhalers.^{18,19} Additionally, a prior study revealed that a higher percentage of MDI with spacer users (20.8%) correctly handle the device when compared to MDI users (6.0%) and dry power inhaler (DPI) users (16.12%).²⁰

The steps that were most likely to be carried out inaccurately across all of the inhalers were “exhale gently to residual volume”, “holding breath” and “Take a deep breath after activating the inhaler (orally).” These mistake in accordance with the report of other study.¹⁷

Table 3 Misuse Rates for Each Step of the Five Types Inhaler

Essential Steps ^{11,15}	pMDI n=261	pMDI + Spacer n=54	Respimat® n=45	Handihaler® n=21	Accuhaler® n=17
Shake inhaler thoroughly	56 (21.4)	13 (24)	9 (20)	NA	NA
Check dose counter	NA	NA	NA	NA	5 (29.4)
Open cap or cover*	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Keep inhaler horizontal	NA	NA	NA	0 (0.0)	0 (0.0)
Keep inhaler upright*	0 (0.0)	NA	0 (0.0)	NA	NA
Lever is slid until it clicks	NA	NA	NA	NA	0 (0.0)
Put capsule in chamber and turn back mouthpiece*	NA	NA	NA	0 (0.0)	NA
Press and release the buttons*	0 (0.0)	0 (0.0)	2 (4.4)	3 (14.2)	1 (5.8)
Hold spacer level and pressing down on canister once	NA	30 (66.6)	NA	NA	NA

(Continued)

Table 3 (Continued).

Essential Steps ^{11,15}	pMDI n=261	pMDI + Spacer n=54	Respimat® n=45	Handihaler® n=21	Accuhaler® n=17
Insert cartridge*	NA	NA	18 (40.0)	NA	NA
Insert inhaler correctly into spacer	NA	0 (0.0)	NA	NA	NA
Exhale fully (before the inhaler activation)	112 (42.9)	41 (75.9)	38 (84.4)	16 (76.1)	9 (52.9)
Closes lips the mouthpiece	0 (0.0)	0 (0.0)	0 (0.0)	2 (9.5)	5 (29.4)
Take a deep breath after activating the inhaler (orally)*	214 (81.9)	NA	20 (44.4)	11 (52.3)	6 (35.2)
Breathe in and out through mouthpiece at least three times	NA	37 (68.5)	NA	NA	NA
Hold the breath a few seconds after inhalation activation	208 (79.6)	NA	39 (72.2)	17 (80.9)	10 (58.8)
Closes the cap or cover	13 (4.9)	1 (1.8)	2 (4.4)	2 (9.5)	1 (5.8)
Patients who inhale incorrectly	240 (91.9)	45 (83.3)	44 (97.7)	17 (80.9)	10 (58.8)
Odds ratio	3.0	2.9	5.3	2.6	1.0
95% confidence interval	1.6–5.0	1.4–4.7	1.8–13.3	1.3–5.7	
P-value	0.001	0.001	0.001	0.029	

Notes: Data are presented as n (%). *Critical errors.

Abbreviations: pMDI, pressurized meter-dose inhaler; NA, not applicable to the device.

The steps that caused the greatest mistakes while handling the pMDI were “Take a deep breath after activating the inhaler (orally)” and “hold the breath a few seconds after inhalation activation.”

Due to the hand-lung coordination needed to use the pMDI, it is generally more difficult. Adding a spacer to the pMDI helps eliminate this issue.²¹ Previous studies have shown that healthcare professionals, such as doctors, nurses, pharmacists, and respiratory technicians, may not be familiar about proper device handling.^{13,22}

The results of this study reveal that a relatively high rate of mistakes occurred in the steps “hold breath”, and “exhale gently to residual volume” which was consistent with the results of the previous study.^{7,17,23}

Misuse of inhalers were significantly associated with incorrect inhaler-related knowledge, this finding is consistent with earlier study.^{16,17}

Except for pMDI with spacer, the misuse of other inhalers was higher in the older age group (≥ 60 years) as compared to those under 60 years old. This is consistent with another study, which reveals that older age is a risk factor for inhaler misuse.¹²

Based on gender the misuse rate of all studied inhalers was lower among female compared to male. However, other studies that have been published found no differences in inhaling technique associated with gender.^{12,24} Another study discovered that females are more likely to use incorrect inhalation technique.²⁵

In the present study, a higher proportion of literate participants correctly used all types of studied inhalers as compared to the illiterate patients. This result is inconsistent with the findings of the study, in which they discovered that patients with higher levels of education had fewer errors during the essential step.^{8,24,25} However, other studies showed that handling inhalers incorrectly did not increase with lower levels of education.^{17,26}

Additionally, our findings showed incorrect inhaler techniques was higher among poor vision patients (Table 2). Similarly, A previous study found that poor vision was related to Diskus misuse but not to MDI misuse.⁶

This study also has some limitations. First, keep in mind that any technique that a manufacturer suggests might be inaccurate. Second, there is now no “optimal” way to evaluate inhaling technique, however, using checklists is somewhat subjective. Third, the small sample size of patients handling the pMDI with a spacer, Respimat, Handihaler, and Accuhaler.

This study offers the first evidence on the misuse inhaler in Kabul. Community pharmacy employees and other medical personnel could be helpful in enhancing patients’ MDI method.

Conclusion

The misuse rates were high for all studied inhalers; however, among studied inhalers, the Accuhaler had the greatest proportion of correct inhalation techniques. In order to ensure proper inhaler technique, patients should be educated before receiving inhaler medicines. Therefore, it is crucial for doctors, nurses, and other healthcare professionals to comprehend the problems with the performance and proper usage of these inhaler devices.

Acknowledgments

The authors wish to thank the patients who kindly participated in this research and acknowledge the staff members of the hospital and Khalidullrahman Hamidy for his considerable assistance in the data analysis.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Global initiative for chronic obstructive lung disease (GOLD). Global strategy for the diagnosis management and prevention of COPD; 2014. Available from: <http://www.goldcopd.org/>. Accessed March 13, 2014.
2. Wright J, Brocklebank D, Ram F. Inhaler devices for the treatment of asthma and chronic obstructive airways disease (COPD). *Qual Saf Health Care*. 2002;11:376–382. doi:10.1136/qhc.11.4.376
3. Duarte-de-Araújo A, Teixeira P, Hespagnol V, Correia-de-Sousa J. COPD: misuse of inhaler devices in clinical practice. *Int J Chron Obstruct Pulmon Dis*. 2019;30:1209–1217. doi:10.2147/COPD.S178040
4. Papi A, Haughney J, Virchow JC, et al. Inhaler devices for asthma: a call for action in a neglected field. *Eur Respir J*. 2011;37:982–985. doi:10.1183/09031936.00150910
5. Thompson J, Irvine T, Grathwohl K, Roth B. Misuse of metered-dose inhalers in hospitalized patients. *Chest*. 1994;105:715–717. doi:10.1378/chest.105.3.715
6. Press VG, Arora VM, Shah LM, et al. Misuse of respiratory inhalers in hospitalized patients with asthma or COPD. *J Gen Intern Med*. 2011;26:635–642. doi:10.1007/s11606-010-1624-2
7. Cochrane MG, Bala MV, Downs KE, Mauskopf J, Ben-Joseph RH. Inhaled corticosteroids for asthma therapy: patient compliance, devices, and inhalation technique. *Chest*. 2000;117(2):542–550. doi:10.1378/chest.117.2.542
8. Melani AS, Bonavia M, Cilenti V, et al.; Gruppo Educazionale Associazione Italiana Pneumologi Ospedalieri. Inhaler mishandling remains common in real life and is associated with reduced disease control. *Respir Med*. 2011;105(6):930–938. doi:10.1016/j.rmed.2011.01.005
9. Bourbeau J, Bartlett SJ. Patient adherence in COPD. *Thorax*. 2008;63(9):831–838. doi:10.1136/thx.2007.086041
10. van der Palen J, Klein JJ, van Herwaarden CL, Zielhuis GA, Seydel ER. Multiple inhalers confuse asthma patients. *Eur Respir J*. 1999;14(5):1034–1037. doi:10.1183/09031936.99.14510349
11. Rootmensen GN, van Keimpema AR, Jansen HM, de Haan RJ. Predictors of incorrect inhalation technique in patients with asthma or COPD: a study using a validated videotaped scoring method. *J Aerosol Med Pulm Drug Deliv*. 2010;23:323–328. doi:10.1089/jamp.2009.0785
12. Wieshammer S, Dreyhaupt J. Dry powder inhalers: which factors determine the frequency of handling errors? *Respiration*. 2008;75(1):18–25. doi:10.1159/000109374
13. Plaza V, Sanchis J. Medical personnel and patient skill in the use of metered dose inhalers: a multicentric study. *Respiration*. 1998;65(3):195–198. doi:10.1159/000029259
14. Bosnic-Anticevich S. Inhaler device handling: have we really started to address the problem? *Eur Respir J*. 2017;49:1700120. doi:10.1183/13993003.00120-2017
15. Lenney J, Innes JA, Crompton GK. Inappropriate inhaler use: assessment of use and patient preference of seven inhalation devices. *EDICI Respir Med*. 2000;94:496–500. doi:10.1053/rmed.1999.0767
16. Al-Worafi YM. Evaluation of inhaler technique among patients with asthma and COPD in Yemen. *J Taibah Univ Med Sci*. 2018;13(5):488–490. doi:10.1016/j.jtumed.2018.06.002
17. Liang CY, Chen YJ, Sheu SM, Tsai CF, Chen W. Misuse of inhalers among COPD patients in a community hospital in Taiwan. *Int J Chron Obstruct Pulmon Dis*. 2018;23:1309–1316. doi:10.2147/COPD.S158864
18. Molimard M, Raherison C, Lignot S, Depont F, Abouelfath A, Moore N. 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. doi:10.1089/089426803769017613
19. Dahl R, Backer V, Ollgaard B, Gerken F, Kesten S. Assessment of patient performance of the Handihaler[®] compared with the metered dose inhaler four weeks after instruction. *Respir Med*. 2003;97:1126–1133. doi:10.1016/S0954-6111(03)00162-8
20. Ganguly A, Das AK, Roy A, et al. Study of proper use of inhalational devices by bronchial asthma or COPD patients attending a tertiary care hospital. *J Clin Diagn Res*. 2014;8(10):HC04–HC07. doi:10.7860/JCDR/2014/9457.4976
21. Hindle M, Chrystyn H. Relative bioavailability of salbutamol to the lung following inhalation using metered dose inhalation methods and spacer devices. *Thorax*. 1994;49:549. doi:10.1136/thx.49.6.549
22. Hanania NA, Wittman R, Kesten S, Chapman KR. Medical personnel's knowledge of and ability to use inhaling devices. Metered-dose inhalers, spacing chambers, and breath-actuated dry powder inhalers. *Chest*. 1994;105:111–116. doi:10.1378/chest.105.1.111
23. Jolly GP, Mohan A, Guleria R, Poulouse R, George J. Evaluation of metered dose inhaler use technique and response to educational training. *Indian J Chest Dis Allied Sci*. 2015;57(1):17–20. doi:10.5005/ijcdas-57-1-17

24. Grimwood K, Johnson-Barrett JJ, Taylor B. Salbutamol: tablets, in-halational powder, or nebuliser? *Br Med J.* 1981;282(6258):105–106. doi:10.1136/bmj.282.6258.105
25. Pothirat C, Chaiwong W, Phetsuk N, Pisalthanapuna S, Chetsadaphan N, Choomuang W. Evaluating inhaler use technique in COPD patients. *Int J Chron Obstruct Pulmon Dis.* 2015;8:1291–1298. doi:10.2147/COPD.S85681
26. Lee H, Boo S, Lim Y, Kim S, Kim IA. Accuracy of inhaler use in patients with chronic obstructive pulmonary disease. *Clin Nurs Res.* 2014;23(5):560–574. doi:10.1177/1054773813498269

International Journal of Chronic Obstructive Pulmonary Disease

Dovepress

Publish your work in this journal

The International Journal of COPD is an international, peer-reviewed journal of therapeutics and pharmacology focusing on concise rapid reporting of clinical studies and reviews in COPD. Special focus is given to the pathophysiological processes underlying the disease, intervention programs, patient focused education, and self management protocols. This journal is indexed on PubMed Central, MedLine and CAS. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/international-journal-of-chronic-obstructive-pulmonary-disease-journal>