

Knowledge of and technique for using inhalation devices among asthma patients and COPD patients*

Técnica e compreensão do uso dos dispositivos inalatórios em pacientes com asma ou DPOC

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Abstract

Objective: To evaluate knowledge of and techniques for using prescribed inhalation devices among patients with asthma or COPD treated at a tertiary teaching hospital. **Methods:** Patients were assessed after medical visits, and their physicians were blinded to this fact. Patients were asked to demonstrate their inhaler technique and were then interviewed regarding their knowledge of inhalation devices, control of the disease and instructions received during medical visits. **Results:** We included 120 volunteers: 60 with asthma and 60 with COPD. All of the asthma patients and 98.3% of the COPD patients claimed to know how to use inhaled medications. In the sample as a whole, 113 patients (94.2%) committed at least one error when using the inhalation device. Patients committed more errors when using metered-dose inhalers than when using the dry-powder inhalers Aerolizer® ($p < 0.001$) or Pulvinal® ($p < 0.001$), as well as committing more errors when using the Aerolizer® inhaler than when using the Pulvinal® inhaler ($p < 0.05$). Using the metered-dose, Pulvinal® and Aerolizer® inhalers, the COPD group patients committed more errors than did the asthma group patients ($p = 0.0023$, $p = 0.0065$ and $p = 0.012$, respectively). **Conclusions:** Although the majority of the patients claimed to know how to use inhalation devices, the fact that 94.2% committed at least one error shows that their technique was inappropriate and reveals a discrepancy between understanding and practice. Therefore, it is not sufficient to ask patients whether they know how to use inhalation devices. Practical measures should be taken in order to minimize errors and optimize treatment.

Keywords: Metered dose inhalers; Nebulizers and vaporizers; Asthma; Pulmonary disease, chronic obstructive.

Resumo

Objetivo: Avaliar a compreensão e a técnica de uso dos dispositivos inalatórios prescritos de pacientes com asma ou DPOC atendidos em um hospital-escola terciário. **Métodos:** Os pacientes foram avaliados na sala de pós-consulta sem que o médico soubesse do estudo. Foi solicitado que o paciente demonstrasse como utiliza a medicação inalatória e, em seguida, esse foi entrevistado sobre a compreensão dos dispositivos inalatórios, controle da doença e orientações recebidas durante as consultas. **Resultados:** Foram avaliados 120 voluntários: 60 asmáticos e 60 com DPOC. Todos os asmáticos e 98,3% do grupo DPOC relataram saber utilizar os medicamentos inalatórios. Na amostra como um todo, 113 pacientes (94,2%) cometeram pelo menos um erro ao utilizar o dispositivo inalatório. Os pacientes cometeram mais erros ao utilizar aerossol dosimetrado do que ao utilizar os inaladores de pó seco Aerolizer® ($p < 0,001$) ou Pulvinal® ($p < 0,001$), assim como mais erros ao utilizar Aerolizer® do que ao utilizar Pulvinal® ($p < 0,05$). O grupo DPOC cometeu significativamente mais erros que o grupo asma ao utilizar o aerossol dosimetrado ($p = 0,0023$), Pulvinal® ($p = 0,0065$) e Aerolizer® ($p = 0,012$). **Conclusões:** Embora a maioria dos pacientes relatasse saber a técnica adequada de utilização dos dispositivos inalatórios, 94,2% cometeu pelo menos um erro na utilização dos dispositivos, demonstrando técnica insatisfatória e discrepância entre a compreensão e a prática. Portanto, apenas questionar os pacientes sobre o uso dos dispositivos inalatórios não é suficiente. Medidas práticas devem ser tomadas a fim de diminuir os erros e otimizar a terapêutica.

Descritores: Inaladores dosimetrados; Nebulizadores e vaporizadores; Asma; Doença pulmonar obstrutiva crônica.

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Introduction

Asthma and COPD are respiratory diseases that have high prevalence rates in developed and developing countries alike, both diseases being recognized as worldwide public health problems.

In Brazil, the prevalence of asthma in children ranges from 18% to 27%.^(1,2) There are 350,000 asthma-related hospitalizations in Brazil annually, asthma being the fourth leading cause of hospitalization via the *Sistema Único de Saúde* (SUS, Unified Health Care System)—2.3% of the total number—and the third leading cause of hospitalization among children and young adults.⁽³⁾ In 2004, 367,000 people were hospitalized for asthma in Brazil, resulting in SUS expenditures of approximately 123.2 million Brazilian reais, and there were more than 2,000 asthma-related deaths.⁽⁴⁾ Asthma treatment aims to ensure that the disease is under the best control possible, and inhaled medications, such as corticosteroids and bronchodilators, are initially used.

The true prevalence of COPD in Brazil is not known. However, it is estimated to be approximately 12% in adults.⁽⁵⁾ In a study conducted in the city of São Paulo, the prevalence of COPD ranged from 6.0% to 15.8% in individuals over 40 years of age.⁽⁶⁾ In most countries, COPD is one of the leading causes of death, having ranked sixth in 1990, and it is predicted to become the third leading cause of death worldwide by 2020.⁽⁷⁾ In Brazil, COPD ranks from fourth to seventh among the leading causes of mortality, and the number of COPD-related deaths has been increasing in both genders in the last 20 years.⁽⁵⁾ In 2003, COPD was the leading cause of hospitalization of individuals over 40 years of age, with expenditures of 72 million Brazilian reais.⁽⁵⁾ Similarly to asthma treatment, COPD treatment aims to ensure that the disease is under the best control possible, and inhaled medications, such as bronchodilators and corticosteroids are initially used as well.

Inhaled medications are administered directly to the airways, providing a higher local concentration and a lower risk of systemic side effects.⁽⁸⁾ For years, jet nebulizers were the only inhalation devices available; however, the development of other devices (metered-dose inhalers, with and without spacers, and dry powder inhalers) made it possible to improve the delivery

of drugs to the lungs, as well as to decrease local and systemic side effects.^(9,10) Personal preferences, convenience, facility of use and economic factors can affect treatment efficacy, adherence to treatment and disease control. Education programs, for children and adults alike, play a central role in training patients to use inhalation devices correctly.⁽¹¹⁻¹³⁾ In Brazil, a national asthma education program, which has a standardized model of post-medical visit assessment, revealed an improvement in the identification of problems related to asthma management and an improvement in the quality-of-life indices.⁽¹⁴⁾

Inhalation therapy plays a central role in the treatment of patients with asthma or COPD, and its use requires supervised continuous training.^(8,15,16) The objective of the present study was to evaluate practical knowledge and understanding of the use of inhalation devices among volunteers with asthma or COPD treated at a tertiary teaching hospital.

Methods

This was an observational study carried out between September of 2008 and January of 2009. The sample comprised 120 patients—60 with asthma (asthma group) and 60 with COPD (COPD group)—treated in the outpatient clinics of the *Hospital das Clínicas da Faculdade de Medicina de Ribeirão Preto da Universidade de São Paulo* (HCFMRP-USP, University of São Paulo at Ribeirão Preto School of Medicine *Hospital das Clínicas*). Those patients were being subjected to extensive follow-up, typically returning for visits every three months. The patients had asthma or COPD, as defined in the IV Brazilian Guidelines for Asthma Management⁽¹⁵⁾ and the II Brazilian Consensus on Chronic Obstructive Pulmonary Disease,⁽⁵⁾ respectively, and were on continuous inhaled medication. The volunteers were included in the study after having given written informed consent. The consent form was approved by the HCFMRP-USP Research Ethics Committee.

All of the patients were assessed immediately after routine medical visits by a sixth-year medical student and a physical therapist, both of whom had been previously trained. Their physicians were blinded to this fact, and the assessment was performed in the infirmary room for post-medical visit assessment. Initially, the use of inhalation devices was evaluated in a prac-

tical manner, by asking patients to demonstrate their inhaler technique. The observer filled out a form that has been validated in the literature for checking the use of such devices (Appendix 1 in the online version).^(10,17-19) The following devices containing placebo were available: metered-dose inhalers; Pulvinal® inhalers; Aerolizer® inhalers; Handhaler® inhalers; Turbuhaler® inhalers; and Diskus® inhalers. Subsequently, participants were interviewed regarding their knowledge of inhalation devices, control of the disease and instructions received during routine medical visits (Appendix 2 in the online version). After the assessment, participants were given oral instructions regarding the correct use of the devices.

The quantity of errors committed by the patients when using the different devices was compared using the Kruskal-Wallis test. The quantity of errors committed by the asthma group patients and by the COPD group patients was compared for each device separately using the Mann-Whitney test. Regarding the questionnaire, the responses obtained in the asthma group for each question were compared to those obtained in the COPD group using Fisher's exact

test. The level of statistical significance was set at $p \leq 0.05$ for all analyses.

Results

The asthma group comprised 60 patients, aged 18-72 years (mean, 48 ± 12 years), 17 (28.3%) of whom were male and 43 (71.7%) of whom were female. Of those, 54 (90.0%) used inhaled corticosteroids, 41 (68.3%) used long-acting β_2 -agonists and 44 (73.3%) used short-acting β_2 -agonists. The COPD group comprised 60 patients, aged 47-91 years (mean, 65 ± 10 years), 39 (65.0%) of whom were male and 21 (35.0%) of whom were female. Of those, 29 (48.3%) used inhaled corticosteroids, 53 (88.3%) used long-acting β_2 -agonists, 25 (41.7%) used short-acting β_2 -agonists and 2 (3.33%) used long-acting anticholinergics. All of the patients completed the questionnaire. Table 1 shows the percentages of positive responses to each question regarding the use of inhaled medications in the asthma group and in the COPD group.

The comparison of the responses obtained in the two groups revealed significant differences

Table 1 - Percentage of positive responses to the questionnaire regarding inhaled medications, by patient group.

Questions	% of positive responses ^a		p
	Asthma	COPD	
1. Do you know how to use the inhaled medication prescribed?	100.0	98.3	1.00
2. Do you have any questions about how to use inhaled medications?	5.0	8.3	0.72
3. Do you think that inhaled medications yield good results?	86.7	94.9	0.66
4. Do you think that your inhaler technique or the way you use your inhaled medication is important?	96.6	96.7	1.00
5. Has your physician (or another health care professional) taught you how to use your inhaled medication yet?	90.0	75.0	0.05
6. Has your physician ever observed you using your inhaled medication?	66.7	26.7	< 0.0001
7. Does your physician reevaluate how you use your inhaled medication at every medical visit?	40.7	17.3	0.01
8. How many times has your physician observed you using your inhaled medication?			
Never	30.5	69.2	< 0.0001
Once	20.3	19.2	1.00
Twice	11.9	3.8	0.17
Three times	13.6	3.8	0.10
Four times	5.1	1.9	0.62
Five or more times	18.6	1.9	0.005
9. Do you think that your disease is well controlled?	80.0	78.0	0.83

^aOne volunteer in the asthma group did not respond to questions 4, 7 and 8, one volunteer in the COPD did not respond to questions 3 and 9, and eight volunteers in the COPD group did not respond to questions 7 and 8.

Table 2 – Absolute number and percentage of patients with asthma or COPD who committed at least one error when using inhalation devices.

Type of device	Asthma group (n = 60)	COPD group (n = 60)
Metered-dose inhaler	42 (95.5%)	22 (95.7%)
Aerolizer®	41 (87.2%)	49 (90.7%)
Pulvinal®	25 (61.0%)	13 (92.9%)
Handhaler®	-	2 (100.0%)
Turbuhaler®	1 (100.0%)	1 (100.0%)
Diskus®	-	-

in the responses to five questions. The frequency with which patients reported that their physicians (or other health care professionals) had already instructed them in the correct use of their medication, had watched them use their medication correctly, reevaluated how they used their medication in every medical visit and had observed them using their medication five or more times was greater in the asthma group than in the COPD group ($p = 0.05$, $p < 0.0001$, $p = 0.01$ and $p = 0.005$, respectively). In addition, approximately 70% of the COPD group patients reported that their physicians had never observed them using their inhaled medica-

tion, compared with 30% of the asthma group patients ($p < 0.0001$).

Of the asthma patients, 12 (20.0%) used only one device, 23 (38.3%) used two devices, and 25 (41.7%) used three devices. Regarding the type of device used, the patients were distributed as follows: 47 (78.3%) used Aerolizer® inhalers; 44 (73.3%) used metered-dose inhalers; 41 (68.3%) used Pulvinal® inhalers; and 1 (1.7%) used a Turbuhaler® inhaler. Only 5 (11.4%) used metered-dose inhalers with a spacer. Of the COPD patients, 33 (55.0%) used only one device, 20 (33.3%) used two devices and 7 (11.7%) used three devices. Regarding the type of device used, 54 (90.0%) used Aerolizer® inhalers, 23 (38.3%) used metered-dose inhalers, 14 (23.3%) used Pulvinal® inhalers, 2 (3.3%) used Handhaler® inhalers, and 1 (1.7%) used a Turbuhaler® inhaler. Only 5 (21.7%) used metered-dose inhalers with a spacer.

In the sample as a whole, 113 patients (94.2%) committed at least one error when using the inhalation device. Therefore, only 2 asthma patients and 5 COPD patients performed all of the steps correctly when using inhaled medication. The COPD group patients committed more errors when using the inhalation devices than did the asthma group patients ($p < 0.0001$). The percentage of errors committed by the asthma group patients and by the COPD group patients when using the different devices is shown in Table 2 and Figure 1.

Patients committed more errors when using metered-dose inhalers than when using the dry-powder inhalers Aerolizer® ($p < 0.001$) or Pulvinal® ($p < 0.001$), as well as committing more errors when using Aerolizer® inhalers than when using Pulvinal® inhalers ($p < 0.05$; Figure 2). There was no difference in the quantity of errors committed by the patients when the Handhaler® and Turbuhaler® inhalers were compared. However, only 2 patients used these devices. The comparison between the COPD group patients and the asthma group patients in terms of the different devices revealed that, using the metered-dose, Pulvinal® and Aerolizer® inhalers, the former committed more errors than did the latter ($p = 0.0021$, $p = 0.0053$ and $p = 0.011$, respectively).

The analysis of the most common errors committed by all of the patients when using the different devices revealed that, when using

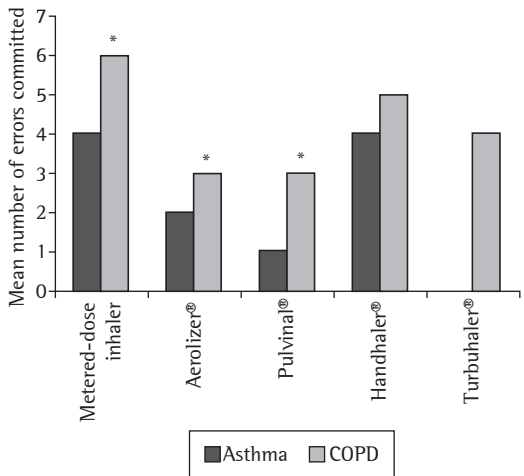


Figure 1 – Mean number of errors committed by the 60 asthma patients and by the 60 COPD patients when using inhalation devices. The COPD patients committed more errors than did the asthma patients when using the metered-dose, Aerolizer® and Pulvinal® inhalers ($p = 0.0021$, $p = 0.011$ and $p = 0.0053$, respectively). The statistical comparison of the Handhaler® and Turbuhaler® inhalers was not possible since only 2 patients used these devices.

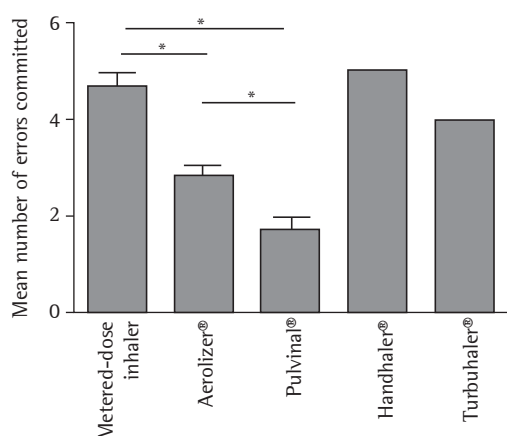


Figure 2 – Mean number of errors committed by the 120 patients with asthma or COPD when using the different inhalation devices. The statistical comparison of the Handhaler® and Turbuhaler® inhalers was not possible since only 2 patients used these devices. * $p < 0.05$.

Aerolizer® inhalers, 55 patients (54.5%) did not exhale properly before inhaling the medication. Using metered-dose inhalers, 49 patients (73.1%) did not keep the inhaler at a correct distance from their lips, 41 (61.2%) did not exhale properly before inhaling the medication, 28 (41.8%) did not shake the inhaler before use, and 23 (34.3%) did not exhale slowly during the procedure. Using Pulvinal® inhalers, 27 patients (49.1%) did not exhale properly, and 9 (16.4%) did not twist the inhaler until it clicked.

Discussion

All of the asthma patients and nearly all (98.0%) of the COPD patients claimed to know how to use inhalation devices correctly. However, the fact that, in the sample as a whole, the majority of the patients (94.2%) committed at least one error when using such devices shows that their technique was inappropriate and reveals a discrepancy between understanding and practice.

The incorrect use of inhalation devices can result in inappropriate treatment of respiratory diseases.^(20,21) There are various devices available for inhalation therapy, which makes it possible to use the medications in several ways. The beneficial role of fitting the device to the patient is undeniable. However, if not adequately reviewed,

medical prescription and patient practice can be impaired.

Some studies have evaluated the use of inhaled medications in various populations, with different results. One group of authors analyzed the technique for using different devices in patients in “real life” and found that the two most common errors were not exhaling properly (in 28.9%) and not holding their breath (in 28.3%). Of the patients assessed, 66% committed at least one error when using metered-dose inhalers and 49–55% committed at least one error when using inhalation devices “activated by inhalation” (powder).⁽¹⁷⁾ In a study conducted in Spain, the assessment of more than 1,640 European volunteers (746 patients, 466 nurses and 428 physicians) regarding inhalation techniques revealed that only 9% of the patients, 15% of the nurses and 28% of the physicians knew how to use metered-dose inhalers.⁽¹⁸⁾ Another group of authors, assessing 4,078 asthma patients, found that 71% had difficulty using metered-dose inhalers and that incorrect use was associated with poorly controlled asthma.⁽²¹⁾

In Brazil, the technique of 40 asthma patients, 20 sixth-year medical students and 36 resident physicians for using metered-dose inhalers and powder inhalers was evaluated. The authors of the study observed that 33–40% of the volunteers in each group committed errors when using metered-dose inhalers, the same occurring with 4–12% of the same volunteers when using powder inhalers. However, there was no significant difference among the groups or between devices.⁽²²⁾

Treatment failure in patients with asthma or COPD can occur due to incorrect use of inhaled medications resulting from various factors, such as lack of counseling, inadequate counseling and learning styles of patients.^(7,8,23) One group of authors demonstrated that knowledge of the use of metered-dose inhalers among health care professionals at a referral hospital in Brazil was unsatisfactory.⁽¹⁰⁾ Another group of authors found that only 30% of the resident physicians correctly demonstrated the technique for using an inhalation device to patients with uncontrolled asthma.⁽²⁴⁾ In addition, the technique for using inhaled medications should be constantly reevaluated, since some patients might not perform the technique properly even after various counseling

sessions and the correct technique can become inadequate over time.^(23,25) One group of authors prospectively assessed 93 patients with COPD or asthma who had never used inhaled medication via a metered-dose inhaler and found that, 10 days after the first explanation, only 48.4% of the patients performed the inhaler technique correctly.⁽²⁶⁾

The results shown demonstrate that the technique for using inhalation devices among asthma patients and COPD patients treated at a tertiary teaching hospital is inappropriate. The fact that the patients tended to always respond that they knew how to use the devices seems to be responsible for a vicious cycle, in which the patients claim to know how to do it and the team, believing it to be true, do not test them. This explanation is reinforced by the low number of physicians who evaluate and, most importantly, reevaluate the technique for using inhalation devices. It is of note that, at our facility, no health care professionals other than physicians evaluate patient technique for using inhaled medications, and there is no structured education program for patients. Other factors, such as the socioeconomic level of the patients and the fact that the counseling is performed by resident physicians in training, might have contributed to the use of inappropriate technique.

The patients with COPD committed more errors than did those with asthma. One possible explanation for this fact is that many of the asthma patients were assessed in an outpatient clinic specializing in asthma, where care is provided exclusively by residents in pulmonology. In contrast, the COPD patients were treated by residents in pulmonology and in general clinical medicine. This theory is corroborated by the responses to the questionnaire. Those responses demonstrated that the asthma patients received better counseling about the use of inhaled medications. Other possible explanations include the differences between the two groups in their characteristics, such as age, socioeconomic conditions and duration of the disease. Further studies are needed to clarify this issue. Although the COPD patients committed more errors than did the asthma patients, the latter also showed inappropriate technique for using inhalation devices.

Regarding the devices tested, the number of errors in the use of the metered-dose, Aerolizer®

and Pulvinal® inhalers, in this sequence, was found to be greater. Due to the small number of patients who used Turbuhaler® and Handhaler® inhalers, the results regarding these devices should be analyzed with caution. Despite the difference in the number of errors in the use of the devices, it is not possible, in the present study, to establish a correlation between this finding and the clinical control of patients. If possible, the use of different devices for a single patient should be avoided.⁽²⁷⁾

An interesting finding is the small number of asthma patients and COPD patients who used a spacer. This could be the result of the misconception that the function of the spacer is only to facilitate the use of inhaled medications. Another function of the spacer is to allow the larger particles that do not reach the distal airways to be retained in the device rather than in the oropharynx, whereas smaller particles are inhaled, reaching the distal airways with better treatment results and lower risk of systemic absorption.^(10,28) Recently, some studies showed clinical equivalence of hydrofluoroalkane (HFA) metered-dose inhalers without a spacer and chlorofluorocarbon (CFC) metered-dose inhalers with a spacer.⁽²⁹⁾ In our study, we did not evaluate whether the metered-dose inhaler used CFC or HFA.

Since respiratory disease control also depends on the correct use of inhaled medications, it is essential that practical measures be taken to minimize errors and increase the efficacy of medications. Various measures, such as a practical reevaluation of patient technique by their physicians in several medical visits, despite patients claiming to know the correct technique, as well as a practical reevaluation by the health care team after medical visits and the implementation of short- or long-term education programs, can be adopted.⁽³⁰⁾ Although the need for the development of new medications to treat respiratory diseases is indisputable, it is imperative that the inhaled medications available be used properly before deciding whether the disease is uncontrolled or is partially controlled, as well as before instituting new and costly therapeutic measures.⁽²³⁾

Our data reveal a discrepancy between the understanding and the practical use of inhalation devices among asthma patients and COPD patients, as well as showing that their technique

was unsatisfactory. Practical measures should be taken to reduce the number of errors committed by patients when using inhaled medications, thereby allowing better control of respiratory diseases.

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