

# Opinion and Knowledge of Pulmonologists, Primary Care Physicians, and Nurses About Inhaled Therapy in COPD. Inhal-Epoc Survey

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**Purpose:** Despite the efforts made to improve inhalation technique by both patients and healthcare professionals, significant deficiencies were found in critical aspects of inhaler use and device selection. The aim of this study is to know the current opinion and knowledge of pulmonologists, primary care physicians, and nurses about inhaled therapy in chronic obstructive pulmonary disease (COPD).

**Methods:** Survey conducted between April-July 2023 by a committee of experts formed by 2 pulmonologists, 2 primary care physicians, and one nurse specialist in inhaled therapy. It consisted of 27 questions and was sent by e-mail to professionals throughout Spain with experience in the management of COPD with inhaled therapy.

**Results:** A total of 554 experts from all over Spain participated. Thirty-one percent and 43.5% of the respondents could not identify, respectively, which were the critical steps for correct inhalation of the pressurized metered-dose inhaler (pMDI) and the multidose dry powder inhaler (DPI). Conventional pMDIs were considered to be the devices that provide greater oropharyngeal deposition and less pulmonary deposition. The majority of respondents considered essential or important to take into account the patients' opinion in selecting the inhaler, and preferred to review the inhalation technique rather than change the device. The main criteria for the choice of inhaler in COPD patients were their previous experience, preference, and severity. With a wide dispersion of results, Ellypta®, pMDI with chamber, Genuair®, Respimat®, and conventional pMDI were preferred in that order.

**Conclusion:** Knowledge about inhaled therapy in COPD remains insufficient. There is a significant and important lack of knowledge in key aspects of the use of inhaler devices, such as the critical steps for correct inhalation and the selection criteria for inhalation devices. It is necessary to continue promoting training programs for both patients and healthcare personnel in inhalers and inhalation techniques.

**Keywords:** COPD, DPI, inhalation device, inhaled therapy, pMDI

## Introduction

Chronic obstructive pulmonary disease (COPD) is a progressive chronic respiratory condition that represents a significant public health burden worldwide. Effective management of COPD involves the use of inhaled therapies, which play a crucial role in controlling symptoms and improving patients' quality of life. Despite the advantages of inhaled therapy over other routes of administration, such as faster onset of action, lower required doses, and fewer systemic adverse effects,<sup>1</sup> it has the limitation to be administered properly for a minimal amount of the drug to reach the lower airways and exert its pharmacological action successfully. Incorrect use of the inhaler device would lead to increased reliever use, increased use of emergency medical services, and worsening of disease.<sup>2-7</sup>



Since the appearance of the first inhaler device 60 years ago (Medihaler-Epi®), today's devices have evolved significantly, allowing treatment to be individualized for each patient. However, this evolution requires healthcare professionals to keep constantly up to date with the characteristics of the new inhaler devices, their limitations and drawbacks and, above all, the inhalation technique required for their operation. For this reason, most clinical practice guidelines consider training patients in the correct use of inhalation devices to be essential.<sup>8–12</sup>

Despite the involvement of medical societies and the pharmaceutical industry and the recommendations offered in all clinical practice guidelines to improve the use of inhaled therapy,<sup>13,14</sup> numerous studies have shown that most patients do not adequately use inhalation devices<sup>15–22</sup> or that the healthcare personnel involved in the treatment and supervision of these patients do not have sufficient knowledge or skills in their use.<sup>21,23–30</sup> In this context, it is essential to assess the level of knowledge of health professionals responsible for COPD management, such as pulmonologists, primary care physicians, and nurses, regarding available inhaled therapies.

This study aims to address the imperative need for a thorough understanding of the degree of knowledge that these health care professionals in Spain have about inhaled therapies used in the treatment of COPD. The information gathered through this research will not only contribute to improving the care and treatment of COPD patients, but will also provide valuable insights for the design of educational and training programs to strengthen the training of health professionals in this field.

## Methods

Spanish descriptive survey conducted by a committee of experts formed by 2 pulmonologists, 2 primary care physicians, and one nurse specialist in inhaled therapy. It consisted of 27 questions and was sent by e-mail to professionals throughout Spain with experience in the management of COPD with inhaled therapy. The survey was carried out between April and July 2023. In agreement with the clinical research ethics committee of the Hospital Universitario Gregorio Marañón (Madrid, Spain), the study did not require its approval because it did not involve patients, but rather health professionals who accepted the conditions of the survey by participating in it.

The first 5 questions gathered information about the respondents' age, sex, medical specialty, geographical location, and number of COPD patients attended (Table 1). Subsequent questions were developed using a multiple choice format and concerned the following topics: technical knowledge of inhalers (Table 2), patient preferences and satisfaction (Table 3), and specific aspects of inhalers in COPD (Table 4). Final results of the questionnaire were shown as percentages with respect to the total number of respondents.

**Table 1** Characteristics of Respondents (N = 554)

Characteristics of Respondents	N	%
<b>1. Age</b>		
20–30 years	36	6.5
31–40 years	102	18.4
41–50 years	134	24.2
51–60 years	184	33.2
61–70 years	94	17.0
71–80 years	3	0.5
>80 years	1	0.2
<b>2. Sex</b>		
Male	216	39.0
Female	337	60.8
Non-binary	1	0.2

(Continued)

**Table 1** (Continued).

Characteristics of Respondents	N	%
<b>3. Medical specialty</b>		
Primary care	253	45.7
Intrahospital Pulmonology	128	23.1
Outpatient Pulmonology	27	4.9
General Nursery	64	11.6
Respiratory Nursery	57	10.3
Others	25	4.5
<b>4. Which area of Spain do you work in?</b>		
North (Galicia, Asturias, Cantabria, Basque Country, Navarra, La Rioja)	162	29.3
Central (Castilla y León, Castilla-La Mancha, Madrid)	160	28.9
South (Extremadura, Andalucía, Murcia)	102	18.4
East (Aragon, Catalonia, Valencia, Balearic Islands)	112	20.2
Canary Islands, Ceuta and Melilla	18	3.2
<b>5. Provide the approximate proportion of patients in relation to the total number of COPD patients you see in your office</b>		
≤20%	215	38.8
21–40%	201	36.3
41–60%	81	14.6
61–80%	39	7.0
>81%	18	3.3

**Abbreviation:** COPD, chronic obstructive pulmonary disease.

**Table 2** Technical Knowledge of Inhalers (N = 554)

Technical Knowledge of Inhalers		
<b>6. The most important step for a correct inhalation technique with pMDI is:</b>		
Shake the device vigorously before inhalation	29	5.2
Properly coordinating the pulsation during inspiration	382	69.0
Inhale the drug slowly and progressively	76	13.7
Inhale the drug with a vigorous inhalation	12	2.2
Perform a deep exhalation before inhalation	55	9.9
<b>7. The most important step for a correct inhalation technique with DPI is:</b>		
Shake the device vigorously before inhalation	21	3.8
Properly coordinating the pulsation during inspiration	22	4.0
Inhale the drug slowly and progressively	125	22.5
Inhale the drug with a vigorous inhalation	313	56.5
Perform a deep exhalation before inhalation	73	13.2
<b>8. Which of the following devices provides greater oropharyngeal reservoir and lesser pulmonary reservoir?</b>		
DPI	153	27.6
Conventional pMDI	355	64.1
pMDI with inhalation chamber (one press)	14	2.5
pMDI with inhalation chamber (two press)	14	2.5
Extrafine pMDI	18	3.2
<b>9. Choice of the most appropriate inhaler for patients with inspiratory flow less than 30 L/min and good coordination:</b>		
DPI	55	9.9
pMDI activated with inspiration	175	31.6
pMDI with inhalation chamber	324	58.5

(Continued)

**Table 2** (Continued).

<b>Technical Knowledge of Inhalers</b>		
<b>10. Choice of the most appropriate inhaler for patients with inspiratory flow greater than 30 L/min and adequate coordination:</b>		
DPI	349	63.0
pMDI activated with inspiration	157	28.3
pMDI with inhalation chamber	48	8.7
<b>11. Choice of the most appropriate inhaler for patients with inspiratory flow greater than 30 L/min and poor coordination:</b>		
DPI	190	34.3
pMDI activated with inspiration	101	18.2
pMDI with inhalation chamber	263	47.5
<b>12. Choice of the most appropriate inhaler for patients with acute exacerbations:</b>		
DPI	87	15.7
pMDI activated with inspiration	64	11.6
pMDI with inhalation chamber	403	72.7
<b>13. Do you consider the impact on the carbon footprint caused by the inhaler at the time of prescription?</b>		
Always (100%)	37	27.6
Usually ( $\geq 70\%$ )	84	33.7
Sometimes ( $>30\%$ $<70\%$ )	93	16.8
Occasionally ( $\leq 30\%$ )	187	33.7
Never (0%)	153	27.6
<b>14. What signals indicate that the inhalation maneuver was successful?</b>		
Acoustic (audible click)	18	3.2
Visual (change of display color from green to red)	110	19.9
Acoustic and visual	398	71.8
Change in the counter of remaining doses	23	4.2
No signals available	5	0.9
<b>15. How does the device indicate that it is empty?</b>		
When shaken, no sound of the contents is heard	3	0.5
The display above the nozzle turns red	156	28.2
The display above the nozzle turns green	3	0.5
Locks for non-use	273	49.3
Only for the dose counter, which is set to 0	119	21.5
<b>16. When is the dose ready for inhalation?</b>		
When the pushbutton remains fixed at the bottom	15	2.7
When the display is red	11	2.0
When the display is green	472	85.2
When the side lever is pressed	21	3.8
When the protective cap is removed from the nozzle	35	6.3
<b>17. What happens or means that after inhalation the display is still green?</b>		
The patient should breathe again more slowly	14	2.5
The device is empty	1	0.2
Inhalation is correct	53	9.6
Inhalation is not effective and must be repeated	470	84.8
Dose has not been loaded	16	2.9

**Abbreviations:** DP, dry powder inhaler; pMDI, pressurized metered-dose inhaler.

**Table 3** Patient Preferences and Satisfaction (N = 554)

<b>Patient Preferences and Satisfaction</b>		
<b>18. How important do you consider the patient's opinion in the selection of the most suitable inhaler?</b>		
It is essential	275	49.6
It is important	242	43.7
May be indicative	35	6.3
I do not usually request it	2	0.4
<b>19. When a patient reports difficulties in managing an inhaler, how do you usually proceed?</b>		
I proceed according to the degree of control of the disease	4	0.7
I change the inhaler for another one with different characteristics	22	4.0
I change the inhaler for another one with similar characteristics	2	0.4
I refer the patient to the nurse's office for assessment of the technique	38	6.8
I review the inhaler technique to identify and solve the problems detected	488	88.1
<b>20. In relation to patients' perceived satisfaction with their device, what would you ask as a priority?</b>		
Perceived ease of performing inhalation correctly	281	50.7
Possibility of forgetting in a short period the instructions received	13	2.3
Possibility to easily view the dose counter	12	2.2
Overall satisfaction with its use	242	43.7
Economic sustainability for the patient	6	1.1
<b>21. Do you use any questionnaire to know the patient's opinion about the prescribed inhaler?</b>		
I do not use any questionnaire	278	50.2
No, but it would be interesting to have a very precise one	236	42.6
Yes, I use FSI 10	25	4.5
Yes, I use PASP Q	6	1.1
Yes, I use SAT Q	9	1.6
<b>22. In a patient over 70 years of age with mild cognitive impairment, which feature do you consider most suitable?</b>		
Highly visible dose counter	142	25.6
Device ergonomics	89	16.1
Lactose flavor to confirm inhalation	70	12.6
Acoustic signal of correct flow	133	2.3
No need for external loading (DPI unidosis)	120	21.7

**Abbreviation:** DPI, dry powder inhaler.

**Table 4** Specific Aspect of Inhalers in COPD (N = 554)

<b>Specific Aspect of Inhalers in COPD</b>		
<b>23. Specifically related to the COPD patient, when choosing an inhaler device, which variable do you consider most important?</b>		
Cultural level of the patient	17	3.1
Age of the patient	19	3.4
The patient's previous experience using a specific inhaler	265	47.8
COPD severity	132	23.8
The patient's preference	121	21.9
<b>24. Which characteristic of the inhaler device do you consider most important for its choice in a COPD patient?</b>		
Oropharyngeal reservoir	7	1.3
Pulmonary reservoir	211	38.1
Inspiratory flow	308	55.6
Particle size	22	3.9
Emission rate	6	1.1

(Continued)

**Table 4** (Continued).

Specific Aspect of Inhalers in COPD		
<b>25. Select which inhaler is most appropriate for most COPD patients:</b>		
Breezhaler®	17	3.1
Ellipta®	143	25.8
Genuair®	118	21.3
Respimat®	97	17.5
pMDI	46	8.3
pMDI with inhalation chamber	133	24.0
<b>26. When you prescribe a new inhaler, do you or another healthcare professional train the patient in its correct use?</b>		
Always	393	70.9
Usually	122	22.0
Sometimes	32	5.8
Occasionally	7	1.3
<b>27. Who trains the patients on the inhaler device technique at your center?</b>		
Physician	174	31.4
Nurses	90	16.3
Either the nurse or the physician, depending of the circumstances	278	50.2
Nobody, but we provide written information	8	1.4
Nobody, and we do not give written information	4	0.7

**Abbreviation:** COPD, chronic obstructive pulmonary disease.

## Results

A total of 554 experts from all over Spain completed the questionnaire. Most respondents were female (60.8%) and were between 51 and 60 years old (33.2%). Regarding medical specialty, 45.7% were Primary Care physicians, 23.1% intrahospital pulmonologists, 11.6% general nurses, 10.3% respiratory nurses, and 4.9% were outpatients pulmonologists. Respondents came from the following areas of Spain: 29.3% were from the north, 28.9% from the central area, 20.2% from the eastern regions, 18.4% from the south, and 3.2% were from the Canary Islands and Ceuta y Melilla cities (Table 1).

Regarding the technical knowledge of the inhalers (Table 2), only 69% and 56.5% of the respondents could identify, respectively, which were the critical steps for correct inhalation of the pressurized cartridge (pMDI) and the multidose dry powder inhaler (DPI). Conventional pMDIs were considered by 64.1% of respondents to be the devices that provide greater oropharyngeal deposition and less pulmonary deposition; 58.5% considered pMDI with chamber the most appropriate for patients with inspiratory flow < 30 L/min and good coordination; 63% considered DPI the most appropriate for patients with inspiratory flow > 30 L/min and adequate coordination; 47.5% and 34.3% considered pMDI with chamber and DPI respectively the most appropriate devices for patients with inspiratory flow > 30 L/min and poor coordination; and 72.7% considered pMDI with chamber the most appropriate for acute exacerbations. About Genuair®, most participants knew when the device was ready and if inhalation has been ineffective, but showed imprecision about the empty device indication.

About patient preferences and satisfaction (Table 3), the majority of respondents considered essential (49.6%) or important (43.7%) to take into account the patients' opinion in selecting the inhaler. To know the satisfaction of the patient with the inhaler, 50.7% of respondents ask as priority about the perceived ease of performing inhalation correctly and 43.7% about overall satisfaction with its use. However, 50.2% do not use any questionnaire to know patient's opinion about the inhaler, but 42.6% would be interested in having a precise questionnaire about that. When a patient reports difficulties in managing an inhaler, 88.1% prefer to review the inhalation technique rather than change the device.

Finally, the main criteria for the choice of inhaler in the COPD patient were previous experience (47.8%), patient severity (23.8%), and patient preferences (21.9%). In these patients, 55.6% considered inspiratory flow and 38.1%

pulmonary reservoir as the most important characteristics for the inhaler device. With a wide dispersion of results, Ellypta® (25.8%), pMDI with inhalation chamber (24%), Genuair® (21.3%), Respimat® (17.5%), and pMDI (8.3%) were the inhaler devices selected for COPD patients. Near 71% of respondents always train the patient in the correct use of a new prescribed inhaler device, and 50.2% answered that either the nurse or the physician are the healthcare professional who train the patient depending the circumstances (Table 4).

## Discussion

The present study shows that the knowledge on inhaled therapy currently used in COPD treatment remains poor in Spain. Moreover, importance of this study lies in its ability to identify possible gaps in knowledge, thus allowing the development of specific strategies to improve the competence of health professionals in the management of inhaled therapy in patients with COPD. With the information obtained, it will be possible to implement educational and awareness interventions that lead to a more effective and personalized management of the disease, improving in turn the clinical outcomes and quality of life of patients affected by this chronic lung disease.

Despite the good answers of most of the respondents, there is a significant and important lack of knowledge in key aspects on the use of inhaler devices: 31% and 43.5% of the respondents could not identify, respectively, which were the critical steps for correct inhalation of pMDI and DPI. Even there was no broad agreement on the selection criteria for inhalation devices. This lack of knowledge among healthcare professionals involved in the treatment of COPD has important implications for patient education on the use of inhalers and, therefore, for adherence to treatment and disease control outcomes.

Most of the studies performed to evaluate the inhalation therapy highlight that the majority of patients do not adequately use inhalation devices and the healthcare personnel involved in their treatment and monitoring do not have sufficient knowledge or skills in the use of these devices.<sup>13–30</sup> A meta-analysis evaluated patients' inhaler technique skills over the past 40 years (from 1975 to 2014).<sup>22</sup> It described that the use of inhalers (MDI or DPI) in patients with asthma or COPD had not improved in all that time. The inhalation technique was correct in only 31% of patients, acceptable in 41%, and poor in 31%.<sup>22</sup> In another meta-analysis with the same methodology, studies assessing the inhaler technique proficiency of health care professional in using pMDI and DPI inhalers over the past 40 years were evaluated.<sup>30</sup> As in the case of patients, healthcare professionals demonstrated an inadequate knowledge of the proper use of inhalers. The inhaler technique was considered correct in 15.5% of cases, decreasing over time from 20.5% from the early period (defined as 1975–1995) to 10.8% (95% CI, 7.3–14.8) during the late period (1996–2014).<sup>30</sup>

Of these studies, it is worth mentioning one conducted more than 10 years ago in the same environment and by practically the same team as the current study, which makes it possible to compare its results with ours.<sup>29</sup> The results of that study are very similar to the current study, which means that in more than 10 years the use of inhalation devices has not improved. However, it is interesting to highlight some of them. Regarding the technical knowledge of inhalers, it seems that that the knowledge of pMDI has decreased (from 72.3% to 69%) and that of DPI has improved (from 46.1% to 56.5%). Concerning the factors considered when prescribing the inhalation device, the previous study gave priority to the patient's experience (38.8%), the disease to be treated (25.7%), and the patient's preferences (12.3%). In the current study, the importance of the patient's experience (47.8%) and, especially, the patient's preferences (21.9%) has increased. Ten years ago, only 27.7% of healthcare professionals "always" assessed the inhalation technique of patients, whereas now 70.9% do so. Finally, previously, patient training on the use of inhalers was carried out by the physician (34.6%), nursing (22.4%) or either (38.8%). Currently, 50.2% of respondents considered that training is done by either the nurse or the physician depending on the circumstances. Very few thought that only the nurse (16.3%) or the physician (31.4%) would do it.

The main limitation of our study is related to the method used. The data are based solely on the results of a survey on self-perceived knowledge and may not reflect respondents' behavior in actual clinical practice.

## Conclusions

Despite the efforts made to improve inhalation technique by both patients and healthcare professionals, these efforts do not seem to have been sufficient. However, despite the lack of knowledge about the correct use of inhalation devices,

there is a greater awareness of their importance. Now more than before, any healthcare staff member, depending on the circumstances, always teaches patients the correct inhalation technique. In any case, it is necessary to continue promoting training programs for both patients and healthcare personnel in inhalers and inhalation techniques.

## Ethics Approval and Informed Consent

In agreement with the clinical research ethics committee of the Hospital Universitario Gregorio Marañón (Madrid, Spain), the study did not require its approval because it did not involve patients, but rather health professionals who accepted the conditions of the survey by participating in it. This ethics committee has provided the authors with a certificate accrediting this decision.

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## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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