

# Errors in the Administration of Single-Dose Dry Powder Inhalers in Patients with Chronic Obstructive Pulmonary Disease (COPD) <sup>†</sup>

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**Abstract:** Checking the effect of a therapeutic education program on the number of errors during the use of two single-dose dry powder inhalers in patients with chronic obstructive pulmonary disease and whether there are differences in the number and type of errors in inhalation technique after an education session, between the Aerolizer<sup>®</sup> and Handihaler<sup>®</sup> inhalers, validated using a specific checklist. The sample included 24 users, 17 men and 7 women, with an average age of  $68 \pm 11$  years. It was found, for all the usual significance levels, that the education program contributed to a reduction in errors in administration procedures.

**Keywords:** chronic obstructive pulmonary disease; dry powder inhaler; error; inhaler technique



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## 1. Introduction

Errors associated with the inhalation technique are significant and are the reason for research and the development of instruments capable of verifying the rigor of the procedures carried out [1,2].

Chronic obstructive pulmonary disease (COPD) is the third leading cause of death worldwide, and in Portugal, the prevalence is 14.2%, with a high number of under-diagnosed cases. The National Plan for Respiratory Diseases encourages improvements in diagnosis and good care practices, particularly in the effectiveness of the inhalation technique [3].

Dry powder inhalers (DPIs) are used in the treatment of COPD, and the difficulty in using them is recognized and reinforced by the wide range of devices on the market [4,5].

Therapeutic education programs should be a priority for health professionals in order to achieve greater cooperation, adherence, and accountability on the part of the patient.

The objective of the study was to find if there are errors in the administration of the different single-dose DPIs and if these change after a therapeutic education program, as well as to check if there are differences in the error procedures between the two inhalers.

## 2. Materials and Methods

This was a quasi-experimental, longitudinal study. The inhalation procedure was observed using two different dry powder inhalers, the Handihaler<sup>®</sup> and the Aerolizer<sup>®</sup>. The inhalation technique was observed at two points in time, before and 15 days after the therapeutic education program.

The therapeutic education program lasted between 60 and 90 min, during which the procedures of the device were explained, and the steps of the inhalation technique were demonstrated. Everyone present had to repeat each step correctly in order to complete

the training. The participants came from the pulmonology consultation at the Centro Hospitalar e Universitário do Algarve.

The study instruments were a sample characterization form, the Mini-Mental State Examination [6], and an Inhalation Technique Checklist [7].

The study lasted 2 months, and the data were collected before and 15 days after the therapeutic education session.

The difference between the two moments was tested using the Wilcoxon test, and the Kolmogorov–Smirnov test was used to measure the difference in the number of errors between inhalers.

### 3. Results

The sample consisted of 24 users, 17 men and 7 women, with an average age of  $68 \pm 11$  years. The level of education was 87.5% with the minimum level and 58.3% with only 4 years of education. The average cognitive level was 26.5 points, according to MMSE, reflecting a high degree of ease of retention, orientation, and communication.

The data collected were 32 observations resulting from the sum of 14 Aerolizer® and 18 Handihaler® from a total of 24 users; some people had a prescription for more than one inhaler.

It was found, for all the usual significance levels, that the therapeutic education program contributed to a reduction in errors in administration procedures.

For the Aerolizer® inhaler, in 14 observations, there were always errors in the first assessment; only two users (14.3%) made just one error in procedures. After the training session, four users completed all the procedures correctly (28.6%), and seven made only one error (50%).

With the Handihaler® inhaler, in 18 observations, the first assessment showed that everyone made errors, and only two users (11.1%) made one error. After the program, five users completed all the procedures correctly (27.8%), and five made only one error (27.8%).

After the training program, no significant difference was observed in the number of correct procedures between the two inhalers.

The number of errors and level of education were negatively associated ( $p \leq 0.05$ ), while the number of correct procedures and cognitive level were positively associated ( $p \leq 0.01$ ).

### 4. Conclusions

Therapeutic education programs are an important strategy for reducing errors in the administration of inhalers, regardless of their type.

There were no significant differences in the number of errors between the Aerolizer® and Handihaler® inhalers, either in the initial assessment or after the therapeutic education session.

A lower level of education contributed significantly to a greater number of incorrect procedures, a characteristic common to both inhalers.

A lower cognitive level is associated with a greater number of errors in the Aerolizer® inhalation technique.

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**Data Availability Statement:** Raw data can be made available on request, it is archived at the hospital where the research was carried out.

**Conflicts of Interest:** The authors declare no conflicts of interest.

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