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Analysis of inhaler treatment in patients with asthma and chronic obstructive pulmonary disease (COPD): The INTEDA-2 study

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Abstract:

BACKGROUND AND AIM: Noncompliance with inhaler treatment among patients with asthma or chronic obstructive pulmonary disease (COPD) remains a significant issue. This study aims to identify issues related to inhaler use and to propose potential solutions.

METHODS: Patients aged 18 and older who had been receiving inhaler therapy for at least one year for asthma or COPD were included. The study was conducted across nine centers located in different geographical regions of Türkiye. Data were collected through face-to-face interviews, during which patients were asked about their demographic characteristics and history of inhalation therapy.

RESULTS: A total of 256 patients, 179 (69.92%) male and 77 female (30.08%), from 44 different cities were included in the study. Among the participants, 54.40% were former smokers, and 17.92% were current smokers. Annual physician visit rates were three or more times in 55.73% of patients, twice in 24.77%, and once in 13.62%; additionally, 5.88% reported not attending any check-up visits. The hospitalization rate in the past year was 28.53%. Among those hospitalized, 46.07% were admitted once, 30.34% twice, and 23.59% three times or more. The mean number of hospitalizations during the previous year was 2.27. Participants reported that education on inhaler device use had been provided by physicians (83.50%), pharmacists (10.36%), and nurses (2.27%). Regarding the method of education, 77.52% received only verbal instructions, 20.13% received verbal instructions along with their device usage, and 2.35% were trained with a brochure. Among the patients, 45.43% stated that device usage was not assessed during outpatient visits, while 40.20% reported at least one change in their inhaler device.

CONCLUSIONS: Although most patients stated that their initial education on device use was adequate, significant issues with noncompliance remain. These issues include providing only verbal inhaler device training and failing to assess patients' inhaler technique during outpatient visits. Training respiratory nurses specifically for inhaler device education, as well as certifying family medicine specialists and nurses working in family health centers in this area, may help minimize these problems.

Keywords:

Asthma, chronic obstructive pulmonary disease (COPD), inhaler treatment

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Introduction

Asthma and chronic obstructive pulmonary disease (COPD) are significant public health concerns due to their high prevalence and the associated healthcare costs.[1,2] Inhaler treatments play an essential role in managing both conditions. Numerous inhaler devices are available on the market, each with different usage techniques. Proper patient education and correct use of the device are key factors in achieving the desired therapeutic outcomes of inhaler therapy. Incorrect use of inhalers leads to noncompliance and treatment failure.[3–5] As with all chronic diseases, patient education and the enhancement of self-management skills are critical for the successful treatment of asthma and COPD.[6] The rate of noncompliance with inhaler treatment among patients with asthma and COPD is unacceptably high worldwide, including Türkiye.[4,7,8]

A prospective, cross-sectional survey study (INTEDA-1) was conducted by the Turkish Respiratory Research Society (TRS) Inhalation Therapy Group (INTEDA) between February 2010 and February 2011, involving 10 different centers.[9] This study collected data through a detailed questionnaire on the problems 684 physicians encountered in inhalation therapy. A multicenter study was designed to conduct a survey assessing inhaler treatment among patients with asthma and COPD as part of the INTEDA-2 study. The aim of this study was to raise awareness of issues related to inhaler treatment and to develop new solution proposals.

Materials and Methods

The INTEDA-2 study was a nationwide, cross-sectional, multicenter, and non-interventional questionnaire-based survey conducted by the Turkish Respiratory Society Inhalation Therapy Group (INTEDA) between September 2017 and March 2018. The study was conducted in nine centers representing all geographical regions of Türkiye. Selcuk University Faculty of Medicine Non-interventional Clinical Research Ethics Committee (Approval Number: 2017/317, Date: 08.11.2017) approved the study protocol, and the study was conducted in full accordance with the principles of the Declaration of Helsinki.

Study population

Patients aged over 18 who had been receiving inhaler treatment for at least one year for asthma or COPD were included in the study. Only patients who could understand and accurately respond to the questionnaire were eligible. A total of 256 patients from nine different geographical regions participated, with the highest number of participants from Istanbul, accounting for 35.18%.

Questionnaire

The study questionnaire was revised by a dedicated panel of 12 specialists and was designed in two parts. The first part collected data on the participants' age, sex, date of graduation, field of specialty, and contact information. The second part focused on their disease history and inhalation therapy. A total of 27 questions were asked face-to-face to gather demographic information and details about patients' inhaler treatment histories. All researchers involved in administering the survey were pulmonologists, and the surveys were conducted face-to-face. Written and signed informed consent was obtained from each patient prior to participation. The completed survey forms were evaluated by an independent informatics company (BTM Research and Development Communication Informatics Technologies, Konya, Türkiye). This study was financed by the Turkish Respiratory Society.

No artificial intelligence (AI)-assisted technologies (such as Large Language Models [LLMs], chatbots, or image generators) were used in the production of this submitted work.

Statistical analysis

All statistical analyses were performed using SPSS 15.0 software (SPSS, Chicago, IL, USA). Descriptive statistics were expressed as mean±standard deviation and as numbers (n) and percentages (%).

Results

Among the 256 patients who participated in the survey, 179 (69.92%) were male and 77 (30.08%) were female. The overall mean age of the patients was 60.81±15.37 years (63.81±13.46 years for males and 54.80±19.82 years for females). Regarding education level, 72.27% of patients were primary school graduates, 17.97% were high school graduates, and 9.77% were university graduates. The distribution of patient diagnoses was 30.74% with asthma, 60.87% with COPD, and 8.39% with asthma-COPD overlap (ACO). The mean duration of disease was 10.79±4.72 years overall (8.15±3.68 years for asthma, 12.17±5.92 years for COPD, and corresponding values for ACO). Diagnoses were made by pulmonary disease specialists

Table 1: Institutions of initial diagnosis and follow-up

Institution	Initial diagnosis (%)	Follow-up (%)
State hospital	39.44	26.84
Training and research hospital	27.64	29.47
University hospital	23.60	33.68
Private hospital	9.01	8.68
Family healthcare center	0.31	1.32

Table 2: Source of initial inhaler device training

How did you receive your first inhaler device training?	%
Physician	83.50
Pharmacist	10.36
No education received	2.91
Nurse	2.27
Device brochure	0.64
Device manual/Instructions	0.32

in 96.56% of cases and by internal medicine specialists in 3.44%. Most initial diagnoses were made at state hospitals, while follow-up care after diagnosis was predominantly conducted at university hospitals (Table 1).

Hypertension (28.95%), cardiovascular disease (15.79%), and diabetes mellitus (15.41%) were the most common comorbidities among patients, aside from lung disease. The mean number of medications used by the patients was 4.31±1.14.

The rates of patients who had quit smoking, were current smokers, and had never smoked were 54.40%, 17.92%, and 27.67%, respectively. The mean smoking history among current and former smokers was 40.28±12.29 pack-years.

Initial training on inhaler use was provided by the prescribing physician in 83.50% of cases, by pharmacists in 10.36%, and by nurses in 2.27% (Table 2). No education was received by 2.91% of patients. Training methods included verbal instruction only (77.52%), verbal instruction plus demonstration with a similar device (20.13%), and training via brochure (2.35%). The proportion of patients who did not receive face-to-face inhaler device training during follow-up visits was 45.43%.

Responses to the question "What did you do when you realized you were not using the inhaler device correctly?" are presented in Table 3. The rate of switching inhaler devices was 40.20%, and in 90.24% of these cases, the change was made by a physician. The proportion of

Table 3: Patient responses to realizing incorrect inhaler use

What did you do when you realized you were not using the inhaler device correctly?	%
I consulted a physician	44.89
I consulted a pharmacist	29.13
I received no education	8.66
I read the device manual	6.30
I read the device brochure	4.72
I asked another patient	3.15
I consulted a nurse	2.36
I searched for information online	0.79

Table 4: Reasons for discontinuing inhaler use without physician knowledge

Why did you stop using the inhaler device without informing your physician?	%
My symptoms improved	62.50
I did not see any benefit	9.72
My cough worsened	8.33
I experienced side effects	8.33
I was afraid of the side effects	6.94
I felt I couldn't inhale the medication	4.17

patients who reported using their medications regularly was 85.91%. However, only 54.57% stated that their compliance with inhaler use was assessed during follow-up visits. The rate of patients who discontinued inhaler use without informing their physician was 21.25%. Reasons for discontinuing inhaler treatment are shown in Table 4.

The frequency of annual physician visits was three or more in 55.73% of patients, twice in 24.77%, and once in 13.62%. The proportion of patients who never attended follow-up visits was 5.88%. The rate of patients hospitalized in the past year was 28.53%. Among these, 46.07% were hospitalized once, 30.34% twice, and 23.59% three or more times.

Discussion

Inhaler treatment is a cornerstone in the management of chronic airway diseases. The key to successful inhaler therapy lies in selecting the appropriate device for the patient, ensuring adherence to the treatment protocol, and correct usage of the device. Despite this, deficiencies in inhaler treatment practices are evident both nationally and globally. This study revealed significant issues related to improper inhaler practices in our country. The most critical problems identified were inadequate patient training, frequent changes in inhal-

er devices during treatment, and premature discontinuation of treatment by patients.

Incorrect inhaler use is a widespread issue worldwide.[10,11] Numerous studies have assessed inhaler use in various populations, reporting diverse results. For example, an observational study involving 120 patients found that at least one error occurred in 94.2% of cases.[12] In a French study of 552 asthma and COPD patients, at least one error was identified in 76% of metered dose inhaler (MDI) users, with 28% of these classified as critical errors.[13] Another study involving 4,078 asthma patients reported that 71% used their MDIs incorrectly.[14] A study conducted in our country involving 300 patients revealed error rates of 87% for MDI users and 47% for those using dry powder inhalers.[8]

Beyond selecting the appropriate device, patient education plays an important role in minimizing errors in inhaler use. Although initial education on the use of the prescribed inhaler device was provided by a physician in 83.50% of cases, only 20.13% of patients received a demonstration, which is considered the ideal method of education. It seems unlikely that physicians in this country can allocate time for inhaler demonstrations due to their heavy workload, which may explain why verbal-only instruction was the most commonly used training method.

About half of the patients reported being asked about their treatment compliance and inhaler technique during follow-up visits; however, they stated that they had not received any booster education on proper device use. Merely asking patients whether they know how to use inhaler devices during follow-ups is insufficient. When incorrect use is suspected, direct observation of inhaler technique is necessary. Some patients may develop poor technique over time, even if they were properly trained in the past.[15] In a study involving 93 patients with COPD and asthma who had no prior MDI experience, only half were found to be using the correct technique 10 days after receiving inhaler education.[16] Patients are often unaware of their incorrect usage; in fact, slightly less than half reported uncertainty about their technique and stated that they consulted their physician for further guidance.

As with all chronic diseases, patient education and self-management play a crucial role in treatment success. Providing education tailored to each patient's needs before starting inhaler treatment, and repeating this education as needed during follow-up visits, can reduce errors in device use. In the present study, 72.27% of patients had only a primary school education. A study conducted in our country reported a significant correlation between education level and errors in inhaler device use.[8] It is unrealistic to expect individuals with this level of education to learn the necessary skills for correct device use on their own. Therefore, more intensive education should be provided to patients with lower education levels.

The initial diagnoses of patients were most frequently made at state hospitals, while follow-up care was primarily conducted at university hospitals and education and training hospitals. The optimal approach would be to follow up such patients at family health centers, due to the heavy workload in hospitals, and refer them to hospitals only when necessary. To implement this model effectively, family physicians and nurses should be trained in inhalation treatments. A study conducted in our country found that family physicians had inadequate knowledge of inhaler device use.[17] In another survey involving physicians from various medical specialties (pulmonary diseases, internal medicine, pediatrics, and family medicine), only 18.5% of participants reported having adequate knowledge of inhaler devices.[9]

Current data also suggest that healthcare workers' knowledge of inhaler device use is insufficient in other countries as well. In a Spanish study involving 466 nurses and 428 physicians, only 15% of nurses and 28% of physicians were familiar with the correct technique for using metered dose inhalers.[18] Similarly, a study conducted in Brazil reported that knowledge of metered dose inhaler use among healthcare professionals was inadequate.[19] In another study conducted in Brazil, only 30% of patients with uncontrolled asthma were found to use an MDI with the correct technique.[20] The error rate associated with inhaler device use was reported to be between 39% and 67% in studies involving nurses, physicians, and respiratory therapists, according to one publication.[4] A study published in the United States found that many medical personnel providing support to patients on inhaler treatment lacked the basic skills necessary for correct device use and had received insufficient education in this regard.[21]

Another important finding was that 40.20% of inhaler devices in use were replaced by physicians. In asthma patients, a positive correlation was identified between satisfaction with inhaler devices and improvements in the EuroQol 5 Dimensions (EQ5D) quality of life measurement.[22] For this reason, the treatment regimen of patients who are satisfied with their inhaler should not be changed unless there is compelling medical reason. Otherwise, such changes may lead to decreased treatment adherence.[23,24]

The rate of at least one follow-up visit in the past year was 94.12%. About one-fifth of patients discontinued inhaler use without informing their physician, with the most commonly reported reason being a regression of respiratory symptoms. The hospitalization rate over the past year was 28.53%, and 53.93% of those hospitalized had been admitted two or more times. The mean number of hospitalizations in the past year was 2.27, which is considered quite high. These findings indicate that chronic airway diseases are not being adequately controlled. Failure to control the disease may be attributed to inadequate patient education, incorrect inhaler use, and continued smoking among patients.

Since the responses regarding inhaler compliance rely on patient self-reporting, their subjective nature may be considered a limitation. Another limitation is that the diagnoses of COPD, asthma, and ACO diagnoses were not reviewed using objective criteria and were based solely on the physician's statement.

Conclusion

In conclusion, teaching patients the correct use of inhaler medications should be a primary responsibility of healthcare professionals. The Inhalation Therapy Group (INTEDA) recommends implementing a respiratory training nursing system to minimize errors in inhaler device use. These nurses should be capable not only of educating patients on inhaler devices but also of providing instruction in respiratory rehabilitation and the use of all respiratory therapy equipment. Additionally, physicians and nurses working in primary healthcare centers should receive training in inhalation treatments. Patients should receive detailed education before starting inhaler therapy, and their inhaler technique should be regularly assessed during outpatient visits.

Ethics Committee Approval

The study was approved by the Selcuk University Faculty of Medicine Non-interventional Clinical Research Ethics Committee (No: 2017/317, Date: 08/11/2017).

Informed Consent

Written and signed informed consent was obtained from each patient prior to participation.

Conflicts of Interest Statement

The authors have no conflicts of interest to declare.

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Use of AI for Writing Assistance

No artificial intelligence (AI)-assisted technologies (such as Large Language Models [LLMs], chatbots, or image generators) were used in the production of this submitted work.

Author Contributions

Concept – M.S., E.C., F.C., L.D., M.D., S.D., B.D., S.T., S.Ö., M.O.T., E.E.Y., B.Yi, B.Yo.; Design – M.S., M.O.T.; Supervision – M.S., M.O.T.; Resource – M.S., E.C., F.C., L.D., M.D., S.D., B.D., S.T., S.Ö., M.O.T., E.E.Y., B.Yi., B.Yo.; Materials – M.S., E.C., F.C., L.D., M.D., S.D., B.D., S.T., S.Ö., M.O.T., E.E.Y., B.Yi., B.Yo.; Data collection &/or processing – M.S., E.C., F.C., L.D., M.D., S.D., B.D., S.T., S.Ö., M.O.T., E.E.Y., B.Yi., B.Yo.; Analysis and/or interpretation – M.S., E.C., F.C., L.D., M.D., S.D., B.D., S.T., S.Ö., M.O.T., E.E.Y., B.Yi., B.Yo.; Literature search – M.S., E.C., F.C., L.D., M.D., S.D., B.D., S.T., S.Ö., M.O.T., E.E.Y., B.Yi., B.Yo.; Writing – M.S., M.O.T.; Critical review – M.S.

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