



Knowledge and Skills Assessment of Inhaler Device Use Among Asthmatic and COPD Adult Patients at the University of Tripoli Hospital and Abu-Sitta Hospital: A Cross-Sectional Study

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ABSTRACT

Respiratory disorders, such as asthma and chronic obstructive pulmonary disease (COPD), are major global causes of morbidity and mortality. Their management relies on medications like bronchodilators and corticosteroids, inhaled pharmaceutical preparations are essential routes of drug administration, and correct inhaler use is a crucial step for treatment effectiveness. Improper inhaler techniques can influence drug delivery to the lung and lead to treatment plan failure and worse disease outcomes. This study aims to evaluate the use of inhaler technique device skills in bronchial asthma and COPD adult patients and assess their knowledge and awareness about inhaler device use at the respiratory department of the University of Tripoli Hospital and Abu Sitta Hospital for Chest Diseases . A cross-sectional study was conducted from October to December 2024 at the University of Tripoli and Abu Sitta Hospitals in Tripoli-Libya. Data were collected from 200 patients using surveys, outpatient records, and direct interviews. Statistical analysis was performed using Excel. A notable percentage of patients (around 48%) who did not consistently rinse their mouths are at higher risk of suffering the previous side effects, most patients demonstrated a good technique for critical inhaler device steps However, a notable proportion of patients (around 15–25% across various steps) display inconsistent practices. Additionally, 6–13% of patients are entirely unaware of certain steps, reflecting an important area for education. While many patients demonstrate proper technique, there are clear gaps in knowledge and practice about inhaler device use, particularly in device maintenance, patient knowledge, skills, and spacer use. Enhanced pharmacist involvement, continuing educational programs, and the use of technology could substantially improve outcomes.

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INTRODUCTION

Respiratory disorders or lung diseases refer to illnesses that damage the lungs and harm their proper functions. These conditions can be acute or chronic and vary from moderate to severe [1]. They are the main cause of morbidity and mortality worldwide. Asthma affects approximately 334 million people, while nearly every year three million people die from moderate to severe COPD, the world's third highest cause of death, and this count is still increasing [2].

Asthma and chronic obstructive pulmonary disease (COPD) represent a class of chronic respiratory disorders that exhibit significant prevalence within the broader population [3]. Asthma is common in all age groups whereas COPD is more common in older adults [4]. Bronchial Asthma constitutes a persistent inflammatory condition that arises from the inflammation of the pulmonary system's bronchial passages. It influences the nerve endings' reactivity in the airways, rendering them more susceptible to irritation [5].

The ethology of asthma is influenced by allergies, environmental factors, physical activity and genetics, the clinical manifestations of this condition are characterized by shortness of breath, tightness or chest pain, wheezing when exhaling, difficulty sleeping due to shortness of

breath and Coughing [6].

Chronic obstructive pulmonary disease (COPD) is a pulmonary disease distinguished by chronic airway obstruction that interferes with physiological respiration and is completely irreversible (5). COPD cannot be treated, but effective symptom control has a crucial role in slowing the progression of the disease and improving the quality of life for these patients [7]. COPD cases can be attributed to many risk factors, including cigarette smoke exposure, smoking status, occupational exposure to gases and fumes, particulate matter, household air contamination from solid fuels, low and high temperatures and ozone pollution [8].

Signs and symptoms of COPD include shortness of breath (dyspnea), particularly during physical activities, wheezing, chest tightness, Chronic cough that may produce sputum, and lack of energy [6].

Pharmacological management of asthma and COPD: The most commonly used medications for managing asthma and COPD are bronchodilators and inhaled corticosteroids. Bronchodilators work by dilating the bronchial airways and relaxing the muscle, while the corticosteroids act by reducing inflammation, the use of two or more drugs may be effective in treating these

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diseases [9]. Although many different types of inhaled pharmaceutical preparations are available, metered-dose inhalers (MDIs) and dry powder inhalers (DPIs) are the most common devices used for drug delivery in the management of asthma and COPD [10].

The goal of inhalational therapy in pulmonary diseases is to provide a localized treatment that offers many potential benefits while overcoming certain disadvantages. By delivering the medication directly to the lungs, the concentration of the drug at the desired site will be high, with low systemic side effects and a faster onset of action [9]. Inhalers help to prevent the worsening of symptoms; however, they must be employed correctly to achieve the desired therapeutic outcome. There is a possibility for the patient to make errors in the inhalation technique steps, which may stem from an insufficiency of information or guidance [6]. Improper inhaler use is associated with deteriorated health outcomes, such as an increased risk of hospitalization and inadequate disease management [3]. This study aims to evaluate the inhaler technique device skills of adult patients with bronchial asthma and COPD and assess their knowledge and awareness about inhaler device use at the respiratory department at the University of Tripoli Hospital and Abu Sitta Hospital for Chest Diseases.

METHODS

Study design and area

A cross-sectional study with convenient sampling was conducted from October 2024 to December 2024 at the University of Tripoli Hospital and Abu Sitta Hospital for Chest Diseases in Tripoli, Libya.

Data collection

A total of 200 patients from the outpatient clinic diagnosed with asthma/COPD who use an inhaler in their treatment were included in this study. Patient information was collected using specified questions in a survey form, from the outpatient record, and through direct interviews with the patient. Patients were asked about the use of their inhalers, the questionnaire was prepared from a literature review and then approved by our supervisor.

Study Selection

The inclusion criteria used to select patients include all the patients who were diagnosed with bronchial asthma and chronic obstructive pulmonary disease, adult patients, patients who use inhalers, and patients who are willing to participate in the study. Where the exclusion criteria were any patients having other respiratory problems rather than asthma or COPD, patients who are not using inhalers and paediatrics.

Statistical analysis

A statistical analysis was performed by using Excel, Microsoft 365. Descriptive data are expressed as percentages, and the results from the analysis were presented using charts.

RESULTS

Demographic data

The demographic data of all 200 patients that have been studied, which include age, gender, educational level, and demographic characteristics, the majority of patients were females (80%), whereas males represented only 20% (figure 1).

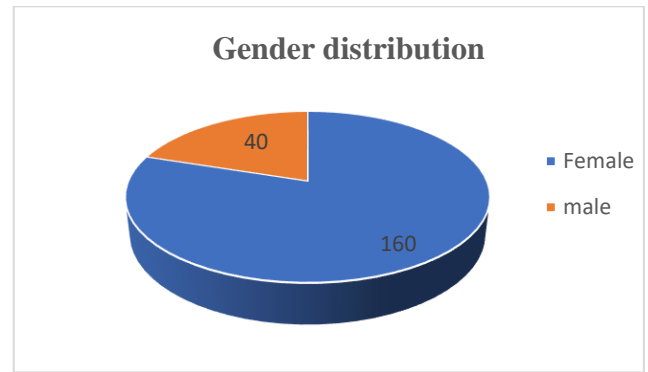


Figure 1: Gender distribution

As shown in figure 2, The most frequent age group involved in the study was between 46 to 60 years.

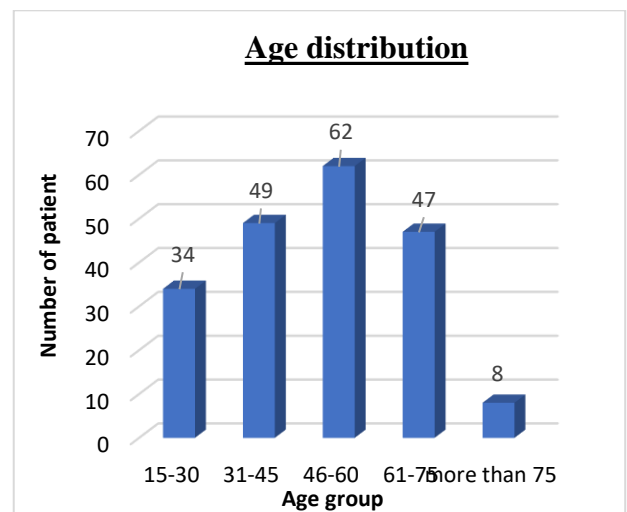


Figure 2: Distribution of patients according to age group

Figure 3 shows that 54% of cases were university graduates, whereas a notable 15% of participants had primary-level education and 21% had secondary-level education.

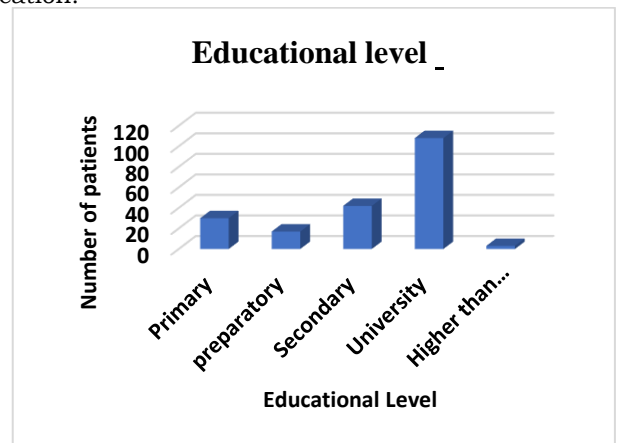


Figure 3: Educational level

Clinical characteristics and Inhaler device knowledge results:

The results of this study showed that a high proportion of patients were diagnosed with asthma (92%), and only 5% were COPD patients, the duration of asthma and COPD from diagnosis were more than 10 years (55.5%), which the highest percentage that reflects their respiratory chronic diseases. Regarding the type of inhaler used by patients, most of them were prescribed two types of

inhalers (dry powder inhalers and metered dose inhalers) whereas only 32% of patients received DPI alone, and 24.5 % MDI alone, the patients stated that they were knowledgeable about asthma and COPD inhaler device use, 92% reported that they discussed how to use the device during a patient’s first visit to the doctor, whereas, only 4% discussed this use with the pharmacist. The majority of patients used their inhaler medication twice per day. In this survey, most patients had sufficient knowledge when replacing their inhaler devices, with a percentage of 82%, most asthma and COPD patients are unaware of how to clean their inhaler devices, while only 44 % have knowledge about proper cleaning methods, most asthma and COPD patients (58.5%) lack awareness of the side effects of inhaler devices, with only 41.5% being informed about them. Most patients have sufficient knowledge about the proper storage of inhaler devices (64,5%), while a notable percentage do not have this knowledge (35,5%). The results indicate that 52% (104 patients) consistently rinse their mouth after using the inhaler, but there are some patients 28.5% (57 patients) are unaware of the importance of rinsing their mouth or do not have a consistent practice. (Table 1).

Table 1: Clinical characteristics and Inhaler device knowledge

Clinical characteristics	No. (%), total n=200
Diagnosis of disease	
Asthma	184 (92)
COPD	10 (5)
Both of them	6 (3)
Duration of diagnosis of asthma and COPD	
Less than one year	11 (5.5)
From 1-5	29 (14.5)
From 6-10	49 (24.5)
More than 10	111 (55.5)
Types of inhalers used	
DPI	64 (32)
MDI	49 (24.5)
Both of them	87 (43.5)
Inhaler technique education	
Doctor	184 (92)
Nurse	1 (0.5)
Other sources	7 (3.5)
Pharmacist	8 (4)
Frequency of inhaler use per day	
As needed	11 (5.5)
Once	7 (3.5)
Twice	153 (76.5)
Three times or more	29 (14.5)
Inhaler devices Replacement knowledge	
yes	164 (82)
No	36 (18)
Inhaler devices cleaning knowledge	
yes	88 (44)
No	112 (56)
Inhaler devices side effects knowledge	
yes	83 (41,5)
No	117 (58,5)
Proper storage of inhaler devices	
yes	129 (64,5)
No	71 (35,5)

Rinse mouth with water after finishing using the device	
Always	104 (52)
Sometimes	16 (8)
Rarely	23 (11,5)
Don't know	57 (28,5)

Inhaler Devices Skills

Breath out fully before using the device

Our findings show that 63.5% of patients consistently exhale fully before using their inhaler device, and 21% sometimes exhale fully, indicating a need for further reinforcement of this step to ensure consistency. Conversely, 12% don't know about this step, which means failure to exhale before inhaling through a device, which highlights inhalation errors (Figure 4).

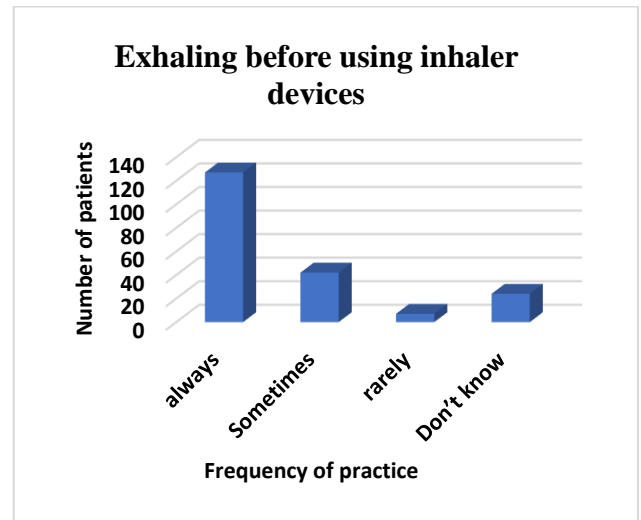


Figure 4. Exhaling before using an inhaler device

Close lips tightly after inhaling

The results show that 77% of patients close their lips tightly, demonstrating strong adherence to this important step, and 6.5% are unaware of this requirement, pointing to a lack of understanding about its importance (figure 5).

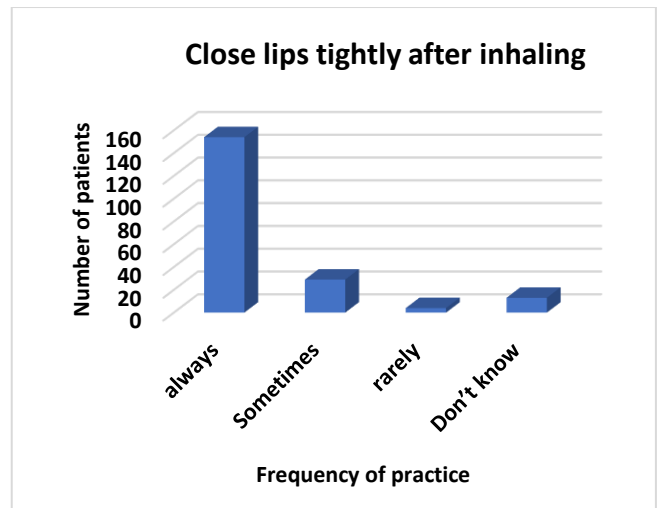


Figure 5. Close lips tightly after inhaling

Breathing deeply after inhaling

Figure 6 shows that 71.5% of patients breathe deeply after inhaling, indicating good compliance with this critical step of inhaler usage. While 11 % lack an understanding of the importance of this technique.

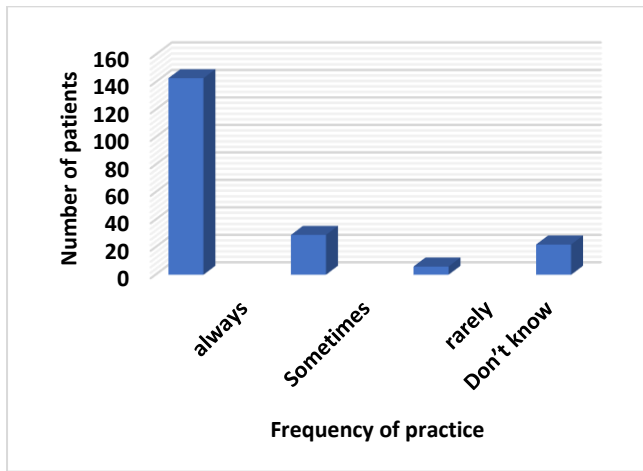


Figure 6. Breathing deeply after inhaling

Holding breath after inhaling

A significant number of patients (73.5%) always hold their breath, demonstrating a strong understanding of this key inhaler technique, but several patients need clearer instructions or reminders about this step (Figure 7).

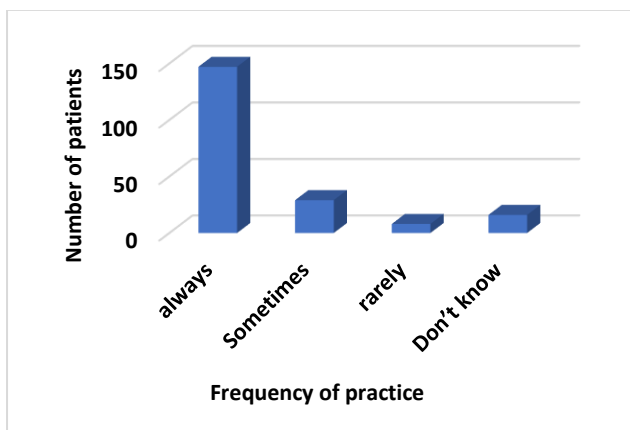


Figure 7. Holding breath after inhaling

Breath out slowly after finishing inhaling

A majority of patients (65.5%) practice this step, which supports effective inhaler use, whereas there is a number of patients (13%) who lack proper guidance about this skill (figure 8).

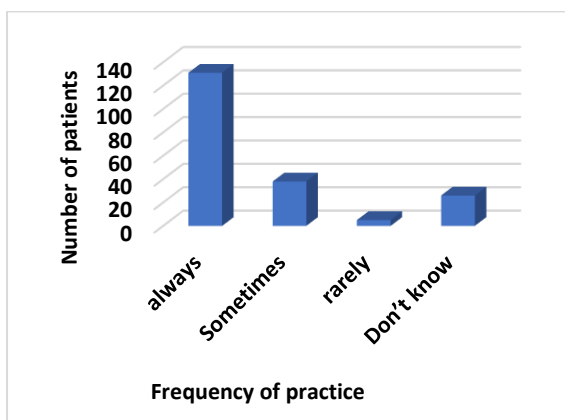


Figure 8. Breath out slowly after finishing inhaling

Use a spacer device with the inhaler

Figure 9. Demonstrates that a large majority of patients (72.5%) are not using a spacer device

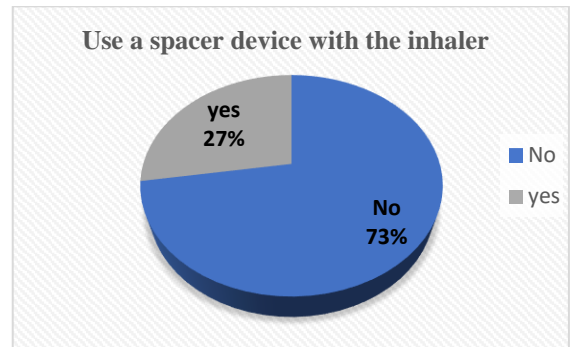


Figure 9. Use a spacer device with the inhaler

Challenges and difficulties in using inhaler devices

Most patients reported that they do not face any difficulties when using their inhaler devices, however, the second most common challenge was remembering the correct dosage time (Figure 10).

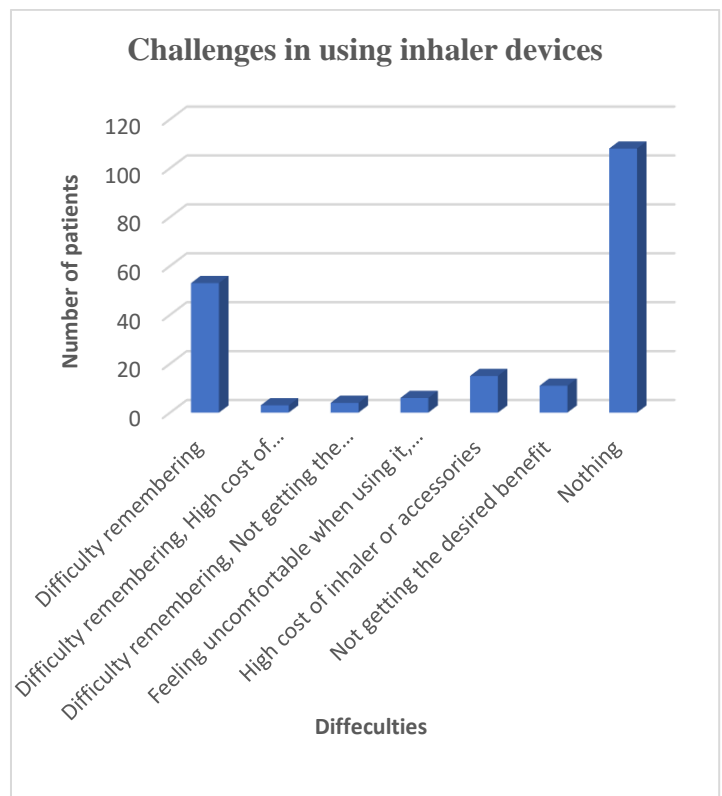


Figure 10. Challenges in using inhaler devices

Suggestions for improving inhaler device usage

The majority of asthma and COPD patients expressed a need for more detailed explanations from their doctors (60%), indicating that better guidance could enhance their understanding and usage of their inhaler devices (figure 11).

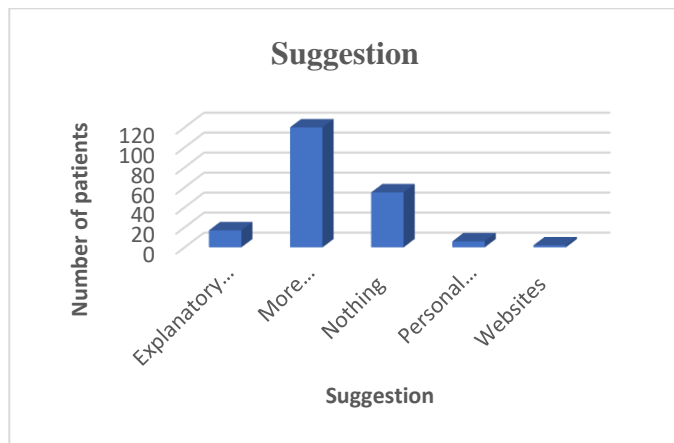


Figure 11. Suggestions for improving inhaler device usage

DISCUSSION

In clinical practice, asthma and COPD continue to be poorly controlled illnesses that impair patients' quality of life. These diseases have a significant impact, commonly leading to frequent hospitalizations due to poor disease management and exacerbations [11].

Inhalation is the main route recommended for administering medications to treat asthma and COPD. However, various factors can affect the effectiveness of inhaled drugs, including the inhalation technique and the type of inhaler employed. Suboptimal inhalation techniques may reduce treatment efficacy and impair symptom control. Therefore, clinical guidelines recommended the importance of regularly assessing inhalation techniques and correcting any errors in their application [11].

During the study period, a total of 200 patients were included, diagnosed with asthma (184 cases), 10 cases of COPD and 6 cases suffering from both diseases. The age and gender distribution of patients in these groups revealed that 80% were female patients and only 20% were males. The number of female patients exceeds male patients in these hospitals-based surveys, which may be attributed to that woman are more likely to seek medical advice and adhere to follow-ups, the highest age group ranging from 46-60 years old, which doesn't work. Asthma and COPD management in middle-aged patients is crucial as this group often deals with lifestyle changes that may complicate treatment. Education and support strategies for this age group could improve outcomes. In comparison, a study conducted in India in 2019, which included a total of 500 cases, revealed 300 cases diagnosed with asthma and 200 with COPD, the highest age group of the patients was 40-49, the study showed that the percentage of males (62.2%) more than female (37.8%) [6].

A high percentage of patients (90%) received education on inhalation techniques from doctors and less percentage (4%) from pharmacists. This is consistent with a study conducted in Iraq in 2023 where 60% of patients received instructions from their physician, 15% from their nurses and 4% from their pharmacists [11]. Expanding the role of pharmacists may increase patient understanding and knowledge.

A combination of MDI and DPI was the most common type of inhaler being prescribed to 87 patients for maintenance therapy, indicating that many patients benefit from the use of both types of inhalers together to manage their condition effectively. The second most commonly prescribed type of inhaler was DPI, used by 64 patients. This suggests that DPI alone is the widespread type of medication delivered by such inhalers, the twice-daily

frequency of inhaler use per day reflects standard practices in the management of asthma and COPD. However, the type of inhaler and frequency of use may vary based on the patient's condition, in some cases, individuals may need to use the device three times a day. Only 44% of patients know proper cleaning procedures for their inhalers, while 56% of the patients do not have this knowledge, which could lead to hygiene problems or device malfunction. 58.5% lacked awareness of potential side effects. This reflects the need for comprehensive patient education. Proper storage knowledge is slightly well, with 64.5% demonstrating understanding, but more efforts are needed to educate the remaining 35.5%.

Corticosteroid-containing inhalers are mostly associated with side effects such as fungal infections (oral thrush), dry mouth and voice hoarseness. These side effects occur due to remaining medication deposited in the mouth or throat, to reduce these side effects, the mouth must be rinsed with water [12]. A notable percentage of patients (around 48%) who did not consistently rinse their mouths are at higher risk of suffering the previous side effects, this could be attributed to the lack of awareness about the connection between rinsing the mouth and preventing side effects, as well as insufficient instructions during training. A study conducted in Turkey in 2019, showed that the patient who used the inhaler did not rinse their mouths after the procedure for MDI (18.1%), Turbohaler (20%), and DPI (22.6%) [13].

Most patients demonstrated a good technique for critical inhaler device steps such as exhaling before the used inhaler (63.5%), closing lips tightly (77%), breathing deeply (71.5%), holding their breath (73.5%) and breathing out slowly after inhalation (65.5%). However, a notable proportion of patients (around 15–25% across various steps) display inconsistent practices, such as sometimes or rarely performing key actions like breathing out fully or breathing deeply. Additionally, 6–13% of patients are entirely unaware of certain steps, reflecting an important area for education.

Spacers help ensure correct medication delivery, especially for patients with poor technique or coordination problems. Only 27.5% use a spacer device, while 72.5% do not, this result indicates a significant lack of awareness or accessibility to this important aid.

The most common difficulty reported was remembering dosage times (26.5%), while 7.5% stated the high cost of inhalers as a barrier. These difficulties may lead to poor adherence and suboptimal disease management. This result was in line with the previous study performed in Turkey in 2023, which demonstrated several methods contributed to increasing the success rate of technical education for inhalers, including video, multimedia or internet education programs [14].

To enhance their understanding, most patients (60%) suggested more detailed explanations from doctors. Additionally, visual aids like explanatory videos (8.5%) and personal training sessions (3%) were recommended.

CONCLUSION

The results of this research highlight a mixed level of knowledge and skills in using inhaler devices among the surveyed adult patients in the respiratory department at the University of Tripoli Hospital and Abu Sitta Hospital for Chest Diseases. While many patients demonstrate proper technique, there are clear gaps in knowledge and practice about inhaler device use, particularly in device maintenance, awareness of patients' skills and spacer use, enhanced pharmacist involvement, and the use of technology could substantially improve outcomes. Continuing educational programs, particularly for

undergraduate populations, are essential for achieving optimal disease control. In addition, they should also re-evaluate their knowledge and skills at regular intervals, to provide effective instructions on the correct inhaler technique

Conflict of interest. Nil

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