**ABSTRACT.** Objective: To evaluate the correctness of metered-dose inhaler (MDI) technique in a sample of healthcare providers practicing in Oman, considering that poor inhaler technique is a common problem both in asthma patients and healthcare providers, which contributes to poor asthma control.

Method: A total of 150 healthcare providers (107 physicians, 33 nurses and 10 pharmacists) who were participants in symposia on asthma management conducted in five regions of Oman, volunteered for the study. After the participants answered a questionnaire aimed at identifying their involvement in MDI prescribing and counselling, a trained observer assessed their MDI technique using a checklist of nine steps.

Results: Of the 150 participants, 148 (99%) were involved in teaching inhaler techniques to patients, and 103 of 107 physicians (96%) had prescribed inhaled medications. However, only 22 participants (15%) performed all steps correctly. Physicians performed significantly better than non-physicians (20% vs. 2%, p < 0.05). Among the physicians, internists performed better (26%) than general practitioners (5%) and accident and emergency doctors (9%).

Conclusion: The majority of healthcare providers responsible for instructing patients on the correct MDI technique were unable to perform this technique correctly indicating the need for regular formal training programmes on inhaler techniques.

Key Words: metered-dose inhaler, asthma management, inhaler technique

**Asthma is one of the most common chronic conditions affecting both adults and children and there is evidence that its prevalence and severity are increasing.** Despite the recent advances in the understanding of its pathophysiology and the availability of effective treatment, asthma continues to be a major cause of morbidity leading to a significant economic burden to individuals and societies. Poor asthma control has been related to several common and important problems. These include: underdiagnosis and inadequate treatment, poor patient understanding of the disease and its treatment, noncompliance, and incorrect use of inhaler devices.

Inhaled medications form the cornerstone of asthma treatment. However, incorrect patient inhaler technique has been identified as a common and persistent problem by many studies worldwide. Up to 90% of adult patients have been reported to have inadequate inhaler technique with higher rates of errors in children and old patients. Poor inhaler technique reduces the drug delivery to the airways, decreasing the efficiency of the inhaled drug.
healthcare providers do not spend sufficient time educating patients on the correct use of the inhalers. Another problem is the lack of regular periodic assessment of patients' inhaler technique, essential to ensure proper use. More importantly, studies show that most providers themselves have poor inhaler technique. Thus, they may give incorrect instructions to patients. In addition, the correct use of inhalers has been shown to be influenced by patients' characteristics, such as their age, literacy, and their understanding of asthma and its treatment. Therefore, the magnitude of the problem may vary in different populations. Furthermore, formal training and demonstration of the correct use of inhalers have been shown to improve the skills of inhaler use in both patients and healthcare providers. Local baseline information is, therefore, essential for each country to develop its own asthma care services and educational programmes targeted at their specific problems and needs.

Asthma is common in Oman and most inhaler devices including MDI and dry powder inhalers (rotahalers, diskhalers and turbohalers) are available for its treatment. However, there are no published data on the ability of patients and healthcare providers in Oman to use these inhalers correctly.

This study, accordingly, aimed to evaluate the ability of healthcare providers in Oman to demonstrate the correct MDI technique.

**METHOD**

**THE PARTICIPANTS**

Between December 1998 and November 1999, the respiratory units at Sultan Qaboos University Hospital and Royal Hospital conducted a series of symposia on asthma management guidelines in five different regions of Oman (Muscat, Dakhiliya, North Batinah, South Batinah, and Dhofar). All healthcare providers were invited to attend. Attendees included physicians (general practitioners, internists, paediatricians, and accident and emergency doctors), nurses and pharmacists. As part of the symposia activities, all attendees were asked and encouraged to volunteer to demonstrate their inhaler technique without prior knowledge of the purpose of the study.

**PROTOCOL**

After answering a brief verbal questionnaire aimed at identifying involvement in asthma management and MDI technique counselling, each participant was asked to demonstrate the use of the MDI by taking two puffs from a placebo MDI device (Glaxo/Welcome Inc. UK). One trained observer (a respiratory nurse with extensive involvement in the assessment and teaching of inhalers technique to both patients and healthcare providers) using a checklist of nine steps graded the correctness of each participant technique. The nine steps [Table 2] were based on manufacturer's instructions and international clinical guidelines on the MDI technique. Steps 1 and 4–6 were considered essential for proper delivery of the inhaled medications and the remaining steps were classified as recommended for optimal delivery but not essential.

**Verbal questionnaire**

This consisted of three questions: (1) What is your specialty? (2) Do you counsel patients on the use of inhalers? (3) Do you prescribe inhaler medications?

**Steps of MDI technique**

The acceptability of each step was defined as follows: the participant must shake the canister vigorously and breathe out slowly and completely before each puff. Positioning was considered correct if the canister was held in the upright position and either inserted between closed lips or up to four centimetres in front of the open mouth. The participant must then begin a slow inhalation just before depressing the canister once (actuation). The timing of actuation (co-ordination) was considered correct if it occurred anywhere during the first third of the slow inspiration including simultaneously with the start of inhalation. The slow inspiration must continue to total lung capacity after which the inhaler is removed and the lips kept closed, with breath-holding for at least ten seconds. Finally, the participants must wait at least 30 seconds before starting the second puff.

**Table 1. Participants' specialties and involvement in MDI prescribing and counselling**

| Total number of participants | 150 |
| A. Physicians | 107 |
| Adult internists | 27 |
| Paediatricians | 19 |
| General practitioners | 39 |
| Accident and emergency physicians | 11 |
| Other physicians | 11 |
| Number of physicians prescribing MDI | 103 (96%) |
| B. Non-physicians | 43 |
| Nurses | 33 |
| Pharmacists | 10 |
| Total number of participants who counsel patients on MDI use | 148 (99%) |
Data presentation and analysis

Data were analysed using a statistical software (SPSS for Windows) and presented in terms of frequencies. The different groups of participants were compared using the chi-square ($\chi^2$) test and $p < 0.05$ was considered significant.

**RESULTS**

**THE PARTICIPANTS**

Table 1 shows the number of participants and their specialties. 148/150 (99%) participants reported involvement in teaching patients on the use of inhalers. The entire group consisted of three categories of healthcare providers: 107 physicians (71%), 23 nurses (22%) and 10 pharmacists (7%). Because of their small number, the nurses and the pharmacists were analysed as a single group: ‘non-physicians’. The physicians group was heterogeneous consisting of internists, paediatricians, general practitioners, and A&E doctors. Ninety-six percent of the physicians acknowledged having prescribed inhaled medications.

**INHALER TECHNIQUE**

Table 2 lists the nine steps of correct MDI technique and the percentage of healthcare providers who had the correct technique for each step. Except for step 3 (holding the inhaler in upright position), the frequency of correct technique was low (27–67%). The frequency of participants who made errors was similar for both essential and preferred steps. Of the essential steps, shaking the inhaler and co-ordination (steps 1 and 6) had the highest frequency of errors (41 and 40% respectively), whereas inadequate breath-holding and waiting before starting a second puff (steps 8 and 9) were the most frequent non-essential (preferred) steps in error (36 and 27% respectively).

Figure 1 shows the frequency of participants’ correct inhaler technique. Only 22/150 (15%) participants performed all steps correctly. When only essential steps were considered, the overall performance increased to 28/150 (19%). Physicians performed significantly better than non-physicians for all steps (20% vs. 2%, $p < 0.05$) and essential steps (22% vs. 9%, $p < 0.05$). Only one of the 43 non-physicians performed all steps correctly.

Figure 2 shows the frequency of physicians with correct inhaler technique according to their specialty. While the overall performance was very poor, internists (in both general medicine and paediatrics) performed relatively better...
... (26% each) than accident and emergency physicians (9%) and general practitioners.

**DISCUSSION**

The change from oral to inhaled medications as the preferred route of administration has been one of the most important developments in asthma treatment. Inhaler therapy is now the preferred mode of delivery of many drugs used in the treatment of asthma and chronic obstructive pulmonary disease. It is the only way to deliver some drugs such as anticholinergics and sodium cromoglycate and is the preferred mode of delivery for B-agonists and corticosteroids. The major advantage of inhalation therapy is the direct delivery of medications in much smaller effective doses compared to systemic routes, thus reducing side-effects. In addition, inhaled bronchodilators act more quickly. The important limitation of inhaler devices is that they are more difficult to use and less convenient than tablets. Each inhaler device has its own specific sequence of steps for optimal drug delivery and it is therefore necessary to give careful and correct instruction to patients. MDI, the most commonly used device, requires the patient to co-ordinate inhalation with action of the device (actuation) which can be difficult for some.

Patients with asthma have been shown to have poor inhaler technique, an important cause of poor asthma control. The problem is common in both children and adults affecting as many as 60 to 90% patients. As a result, international asthma management clinical guidelines emphasise the importance of demonstrating the correct inhaler technique at initial diagnosis and correcting patient performance at each follow-up visit. Unfortunately, numerous studies consistently show that healthcare providers have poor inhaler technique. The reported rate of correct inhaler technique among various groups of physician is in the range of 28–69% in different studies with respiratory specialist and internists performing relatively better than others. For nurses, the reported rate of correct inhaler technique is in the range of 15–66%. In one study, asthma patients performed better than physicians. In another study, respiratory therapists performed better than physicians. However, this universal problem has been shown to improve by formal and regular training of both patients and healthcare providers. Asthma is common in Oman. The present study is part of a comprehensive project evaluating the different aspects of asthma in this country to design a national programme for the management of asthma. The results of this study show that poor MDI technique was very common in this sample of healthcare providers. Despite being involved in patients counselling on inhalers, only 15% of the participants were able to perform all steps correctly, which was substantially lower than reports from the literature. In addition, errors were equally frequent for both essential and non-essential (preferable) steps. Of the essential steps, the greatest number of errors occurred in shaking the inhaler and co-ordination (steps 1 and 6), whereas inadequate breath-holding and waiting before a second puff (steps 8 and 9) were the most frequent non-essential steps in error.

Although internists performed relatively better than other participants (26% had correct technique), this was still unacceptably low. Of special concern was the very poor performance of general practitioners, accident and emergency doctors, nurses and pharmacists. The burden of asthma has become so big that general practitioners and accident emergency doctors are the frontline physicians looking after asthmatic patients with the responsibility to teach them the correct use of inhalers. Because of their position, nurses and pharmacists also have opportunity to educate patients on this. It is therefore essential that all providers master the correct technique.

Training programmes involving instructions and demonstration of the inhaler technique have been shown to improve the skills of patients and providers. The very poor inhaler technique observed in our study is most probably due to the lack of any formal training for healthcare providers on the correct use of inhalers.

**CONCLUSION**

Healthcare providers’ skill in the MDI technique in Oman is very limited, indicating the need for establishing regular educational programmes for both patients and providers. In addition, our results indicate that inhaler technique training programmes for healthcare providers must include not only the specialist, but also general practitioners, accident and emergency physicians, nurses, pharmacists and health educators. Special attention should be given to correct the errors in the essential steps of inhaler technique.

**REFERENCES**


