ROYAL PHARMACEUTICAL SOCIETY

The impact of the clinical pharmacist on the use of inhalers among asthmatic patients in Alkarak region in the South of Jordan

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Abstract

Objectives The main aims of the study were to highlight the impact of clinical pharmacist in patient education on the correct use of inhalers, and its consequences on medication adherence, asthma control and clinical outcomes.

Methods Pre–post-interventional study was conducted over two patient visits in Jordan at Alkarak Governmental Hospital. Inhaler technique evaluation was assessed at first and second visits. All patients received inhaler technique counselling service prior to second visit. Patient adherence was assessed using MMAS-8, and asthma control was assessed by spirometry and ATAQ scale.

Key findings Complete data were available for 100 patients, 52% women, median age 45 (range 18–60) years and median duration of diagnosis 20 (range 2–55) years. Ninety-six per cent of patients ($n = 96$) were previously educated about the correct use of inhalers by different healthcare professionals' specialty. There was a statistically significant improvement in the correct handling of inhalers after patient re-education ($P = 0.000$). There also was a significant improvement in the level of control (from 7% ($n = 7$) to 90% ($n = 90$) of participants had high disease control) and adherence (from 6% ($n = 6$) to 12% ($n = 12$) of participants had high adherence rate) after education ($P = 0.000$ and $P = 0.000$ respectively). Significant number of asthmatic patients uses inhalers incorrectly despite the previous education on the correct inhaler technique. Incorrect use of inhalers is associated with negative outcomes. In this study, the result showed that incorrect handling of MDIs was significantly associated with frequent emergency department (ED) visits and hospitalizations ($P = 0.031$, $P = 0.039$) respectively.

Conclusions The researchers concluded that effective educational intervention to the patients along with reassessment of inhaler technique and re-education by a well-trained clinical pharmacist gave positive impressive outcomes.

Keywords asthma; metered-dose Inhalers; patient education

Introduction

Incorrect use of metered-dose inhalers (MDIs) is a common problem among patients with asthma which can lead to loss of asthma control, increased emergency department visits and asthma exacerbations.[1,2] Therefore, patients using inhalers need careful instruction, including demonstration, observation of their performance and periodic follow-up and reinstruction.[3,4]

In addition of being responsible for supplying medication to patients, pharmacists can be given the opportunity in assessing and educating patients on correct inhaler technique, not only initially but also at subsequent follow-up dispensing.[3] Studies have shown that engaging pharmacists in patient education on correct inhaler technique leads to improved asthma control and quality of life.[5,6] However, pharmacist role in asthmatic patient education was unclear in Jordan. The present study aimed to highlight the impact of clinical pharmacist in patient education on the correct use of inhalers, and its consequences on medication adherence, asthma control and clinical outcomes.

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Method

Study design

This pre–post-interventional study was conducted at the internal medicine clinic – respiratory ward at Alkarak Governmental Hospital, Alkarak, Jordan, from January to June 2017. Ethical approval was obtained from the Institutional Review Committee of the Jordanian Ministry of Health.

Asthmatic patients over 18 but younger than 65 years old who used inhalers for at least 3 months were included in the present study. Patients were excluded if they were newly diagnosed patients, using inhalers for other respiratory diseases, and pregnant or lactating. Eligible patients were informed about the study, and written consents were obtained from all before participation.

Metered-dose inhalers technique assessment

A structured interview was conducted by the study researcher (a clinical pharmacist with experience in asthma management and inhaler technique education) to obtain the demographic information such as age, sex, duration of disease, number and duration of therapy, previous instruction received and source of instruction. Patients were asked to demonstrate their inhalation technique, while the pharmacist observed and evaluate the performance according to nine items checklist in Table 1. A score of 8/8 was classified as correct technique for the MDI, and steps 1 and 5 were classified as 'essential' steps through which medication would reach the patient airway.

Medication adherence assessment

Assessment of patients' adherence on their MDI devices was done using Morisky Medication Adherence Scale (MMAS-8; [7]). This validated scale is frequently used to assess the adherence in chronic illness including asthma and the validated Arabic version of the questionnaire was used in patient with diabetes.[8] This scale consists of eight items, binary score used for all questions except; question three which is a five-point Likert score. Its items contribute a score between zero and one in 0.25-point increments on a five-point scale to assess the frequency of patients who forget take medications given that (never = 1, once in a while = 0.75, sometimes = 0.5, usually = 0.25 and all the time = 0). The total score is a summation of all eight items and it ranged from zero to eight, and the total score is 8;

when the score is 8, it is classified (high adherence), for the score from 6 to 8 (medium adherence) and if <6 (low adherence). The scale was used to assess adherence to controller MDIs ($n = 25$).

Asthma control assessment

To assess asthma control in the study sample both subjective and objective methods were used. Asthma Therapy Assessment Questionnaire for adult (ATAQ) scale consists of two questions; the first question divided into 3 parts that explores information in the past 4 weeks about the following: missing any work, school, or normal daily activity, wake up at night due to asthma, and if the patients believe that their asthma was well controlled. In the second question, the questionnaire asks about the use of rescue medications in the past 4 weeks. The first two parts of the first question scores given (one to Yes and zero to No) and the last part (zero to Yes and one to No). For the second question, do you use an inhaler for quick relief from asthma symptoms? If yes, what is the highest number of puffs in 1 day you took of this inhaler? Scores given (1 point for more than 12 zero to others). Total summation of the scores = 0–4, patients get score ≤2 considered controlled and if score ≥3 not controlled.

Spirometry is the most frequently recommended type of the pulmonary function test. It measures the function of the lung, specifically the volume and/or flow of air that can be inhaled and exhaled by the patient. It is used in many respiratory conditions such as asthma, COPD and pulmonary fibrosis to assess the breath pattern. The result of this test appears in pneumotachographs. This test was adapted to assess the level of pulmonary function and lung response to medication therapy in our study. The clinical pharmacist in the present study recorded FEV1 value for the each patient at the first and second visits.

Data analysis

Analysis was performed with statistics software (SPSS version 20; Chicago, IL, USA). Descriptive analysis was used for the demographic data and patient characteristics. Factors correlated with the correct use of devices were analyzed by using the Spearman rank correlation. A P-value of ≤0.05 was considered statistically significant. Normality of data was tested using Kologrrov–Simirnov and Shapiro–Wilk tests. The significant value for both tests was below 0.05; therefore, nonparametric tests were used; inter group differences were assessed using Mann–Whitney and Kruskal–Wallis tests.

Results

Patients' demographics

A total of 110 asthmatic patients were invited and agreed to participate in this study. Only 100 patients were approached in the follow-up visit and were included in the final analysis. Table 2 shows the participants' demographic data and their inhaler education. DPI (either Turbuhaler or Diskus)

Table 1 Checklist for assessment of MDI technique

1. Shake the inhaler and remove protective cap.
2. Hold inhaler upright.
3. Exhale to residual volume.
4. Place mouthpiece between lips and teeth and tightly close your mouth on it.
5. Inhale slowly and simultaneously active the canister.
6. Continue slow and deep inhalation.
7. Hold breath for 5–10 s then take inhaler out of mouth.
8. Wait for one minute between two actuations.

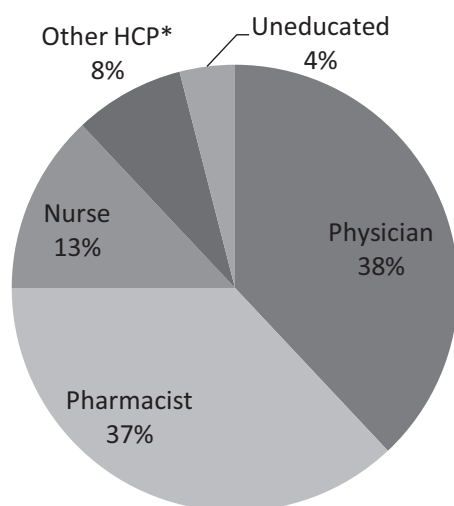**Table 2** Baseline demographics and characteristics for study participants (n = 100)

Variable	Percentage (Frequency)
Gender	
Male	48% (48)
Female	52% (52)
Age groups	
Younger than 33 years	29% (29)
33–45 years	24% (24)
46–55 years	24% (24)
Older than 55 years	23% (23)
Smoking status	
Smokers	13% (13)
Non-smokers	87% (87)
Clinic visit	
Regular	23% (23)
Irregular	77% (77)
Duration of asthma disease (Median ± SD, range)	20 ± 12.2, 2–55 years
Emergency department visit in the past year	68% (68)
Hospitalization in the past year	49% (49)
Previous education about the correct use of inhalers	96% (96)

Table 3 Percentage of correct and incorrect inhaler technique

Device type	Performance	Visit one (%)	Visit two (%)	Significance
MDIs ($N = 100$)	Correct use	5	90	$Z = -9.22^*$
	Incorrect use	95	10	$P = 0.000^*$

*P value <0.005.

MDI device between the two visits. And this difference attributable to the second visit since the percent of correct use is higher in the second visit, that is the percentage of patients who demonstrated correct inhaler technique was increased by 85% ($n = 85$) at the second visit.

Figure 2 shows the percentages of participants who wrongly demonstrated the steps in the first visit and the second visit after re-education. In both visits, the most common errors were step 7 (hold breath for 5–10 s) and step 8 (waiting one minute between puffs) both of them not considered as critical errors. Around half of the patients performed step 1 and 5 (55%, $n = 55$; and 52%, $n = 52$ respectively) at the first visit. Each of these two later steps is considered as essential step.

and MDI devices were the used inhalers among participants with 16% ($n = 16$) used only MDI, and the majority (84%, $n = 84$) used a combination of DPI and MDI.

The majority of the participants (96%, $n = 96$) were educated previously on the correct use of MDI inhalers by healthcare professionals. Physicians were responsible on educating most patients with asthma (Figure 1).

Metered-dose inhalers technique assessment

Table 3 shows that there are statistically significant differences in the total score of the correct inhaler technique for
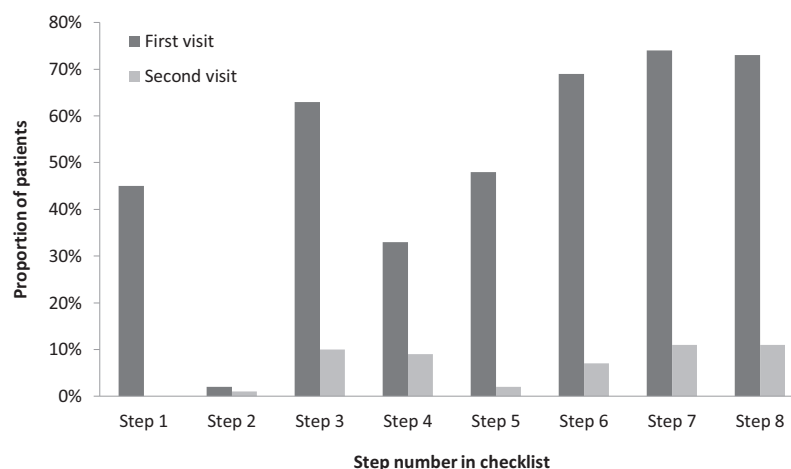
Medication adherence assessment

The patients were divided into three categories according to the total score of MMAS-8: high adherent, medium adherent and low adherent. High adherent patients at the first and second visits were only 2% ($n = 2$) and 22% ($n = 22$) respectively. By using the Wilcoxon rank test to ensure the significance of differences between the total score of MMAS-8, the mean rank at the second visit was 53.75 higher than first visit 42.74 which means that there is an improvement in the adherence after education where this improvement was statistically significant and ($Z = 0.798$, $P = 0.000$).

Asthma control assessment

It is expected that the correct use of inhalers will be reflected on the asthma control; in this study, the level of control among the participant was determined, after they completed 100 ATAQ at the first visit before education and at the second visit after education. Percentage of patients against the level of control is illustrated in Figure 3 at both visits. The result showed that there was a significant difference in the improvement of asthma control level at the second visit compared with the first visit ($z = -8.271$, $P = 0.000$). Median score was decreased from $4 ± 1.015$ to $0 ± 0.892$; this means that, the education about the medication use and the disease is very helpful, in asthma control. Moreover, according to the result of Spirometry it was observed that the FEV1 increased in 93% of patients ($n = 93$), while decrease in only 7% of patients ($n = 7$).

Factors correlated with correct use of inhaler technique

In this study, the effect of gender, age, years of diagnosis and number of inhalers was assessed in relation to the

Figure 1 Healthcare educator for the participant patients. *Other HPC include pharmacist technician, nurse assistant, respiratory technician, or the internet.

Figure 2 Proportion of patients who incorrectly performed the individual steps of metered-dose inhalers.
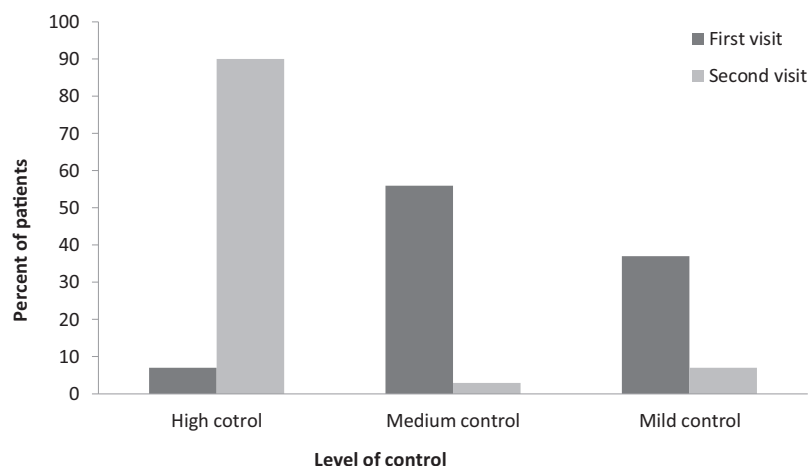
Figure 3 Level of asthma control at the first and second visits.

correct use of inhalers among the study sample. The result showed that there were no statistically significant differences between the correct inhaler techniques at both visits in terms of age, gender, number of inhalers or years of diagnosis. However, there was a positive and strong correlation between number of hospitalizations and the correct use of MDIs, which was statistically significant ($rs = 0.678$, $n = 100$, $P = 0.039$). The results also indicate that emergency department visits by the patient is positively and moderately correlated to the correct use of MDIs ($rs = 0.549$, $n = 100$, $P = 0.031$).

Discussion

This pre–post-interventional study revealed that few asthmatic patients at internal medicine – respiratory clinics had correct inhaler technique at the first visit. Although the majority of patients (86%) reported that they had previously received inhaler technique training by one of the healthcare professionals, patient performance was still not correct at the first visit assessment. However, inhaler technique was significantly enhanced through reinstruction provided to the patients. Incorrect inhaler usage was confirmed by the fact that patients forget the correct technique after a short period of time.[9,10] Besides, the high rate of incorrect use despite of previous education may be explained by the possibility that physicians and pharmacists may not spend enough time during a busy outpatient clinic or outpatient pharmacy to teach their patients the proper use of the inhaler device. Also, the education techniques are inadequate or done without demonstration device. Studies said that high percent of healthcare providers, including physicians, pharmacist, nurses and respiratory technicians, cannot demonstrate correct device handling.[1,9,11]

Patients' previous main source of inhaler technique education was their physicians, followed by the pharmacists; this finding was consistent with previous studies.[12,13] Despite differences in the health education between

participants, certain of the steps were problematic in the majority of patients.

In this study, nearly half of the patients do not perform the essential steps for MDIs correctly (shake the inhaler and remove the protective cap, inhale slowly and simultaneously active the canister), and this result is in agree with what others found.[14,15] One of the most common problems was failure to hold breath for 5–10 s. This finding on an essential step was also seen in previous studies.[15,16] The errors in these steps will affect the air flow in the lung and reduce the percent of drugs deposited in the lung. That explains the low level of control among the sample patient at the first visit before re-education.

Studies worldwide showed that the prevalence of asthma control was not optimal in large per cent of asthmatic patients, per cent of poor controlled asthma were ranging from 44% to 57%, and there were a high percent of rescue medication usage.[17,18] In Jordan, one study showed that 71% of asthmatic patients poorly controlled.[19] One prominent reason of poor asthma control is the poor inhaler technique, since by performing incorrect inhaler technique substantial reduction in lung deposition of the drug, and as consequence reduction in the effectiveness of the treatment and control.[20,21] In our study, there is significant improvement in the level of control after education ($P = 0.000$). However, in this study there was no significant correlation between the total score of correct use of MDI and level of control. This result agrees with the result presented by Basheti *et al.* (2016; [19]).

In this study, 68% of patients were frequent visitors to the ED, this high ratio also was presented by AlZabadi and ElSharif (2007) where they found that patients who reported difficulties in using inhalers were more attendance to ED. Therefore, it is not surprising to find similar findings on a significant correlation between the correct use on inhalers and number of hospitalization and ED visits.[22]

Again, correct inhaler use and its positive consequences on patient outcome needs proper education. The educational intervention used in the present study was performed by a well-trained clinical pharmacist and included face-to-face interview, and all patients were given written instruction about inhaler use. The findings indicated that educational intervention on inhaler technique at the first visit postassessment was feasible and was successful in significantly improving inhaler technique as assessed at the follow-up visit. Considering previous studies, it was not surprising to find such an outcome; Basheti *et al.* (2018; [12]), for example, found that pharmacist educational intervention had a role in improving inhaler technique at three months following discharge. Rahmati *et al.* (2014; [23]) found that there is significant improvement in usage of MDIs after education ($P = 0.001$). In Belgrade, Dudvarski *et al.*[21] (2016) conducted a study on patients who used DPIs, who exposed to three educational sessions on inhaler technique and they found a significant statically improvement in the correct use of DPIs at the second and third visit.

Limitation in the present study includes lack of a universal accordance on the steps (and essential steps) of good inhaler technique for MDIs.

Conclusion

Significant number of asthmatic patients uses inhalers incorrectly despite the previous education on the correct inhaler technique. Incorrect use of inhalers is associated with frequent ED visit and hospitalization. An effective diversified educational intervention to the patients along with reassessment of inhaler technique and re-education by a well-trained clinical pharmacist gave positive impressive results. Therefore, it is more effective when the responsibility of patient education about the correct inhalation technique of different inhaler devices is added to clinical pharmacist duties.

Declarations

Conflict of interest

The Authors declares that they have no conflicts of interest to disclose.

Authors' contributions

Tahrir Alnawayseh designed the research tool, collected the data and performed the data analysis. Ahmad Naddaf conceived and designed the research, contributed in data analysis and revised the manuscript. Esra' Taybeh helped in research design and wrote and revised the manuscript.

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