

Self-Management Program to Improve Asthma Knowledge and Inhaler Technique among Adult with Asthma

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Abstract:

Background: in spite of the accessibility of effective treatments for asthma disease control is often suboptimal due to the failure of patients to follow prescribed regimes, or to demonstrate competence in the administration of inhaled medications. Poor inhaler technique results in less than optimal delivery of medicine to the lungs and consequent inadequate symptom control. In addition lack of asthma self-management knowledge and skills due to low health literacy put the patient at risk for poor asthma control. So this study **aimed:** to investigate the effect of implementing a self-management program to improve asthma knowledge and inhaler technique among adult with asthma. **Study design;** one group, pre\posttest, quasi experimental research design was used. **Setting;** study was conducted in inpatient departments at Mansoura Chest Hospital and Chest Department affiliated to Mansoura University Hospital. The two settings affiliated to Dakhlia Governorate, Egypt. **Subjects;** A purposive sample of 75 adult Asthma patients, older than 18 years old, diagnosed at least since three months ago, receiving inhaler medications, able and willing to participate in the study. **Tools;** used for data collection in this study consisted of five parts as the following: Frist part; concerned with data related to socio demographic characteristics, second part concerned with medical data of study sample. The third part is a standardized structured asthma knowledge questionnaire is a self- reported instrument and consisted of 18 close-ended questions, presenting yes, no or I don't know options, fourth part is a questionnaire regarding inhaled medications and consists of seven items, Fifth part concerned with assessment of patient inhaler technique using a prepared check-list adapted for each inhaler device. **Results:** almost of the asthma patients claimed to know how to use inhalation devices correctly inspite of more than two thirds of participants had poor inhaler technique pre educational intervention about half (52 %) have not had a training on how to use inhalers devices. The total mean percentage score of asthma knowledge increased significantly from 58.3%(pre intervention) to 90.2% (post intervention). in relation to inhaler technique of pMDI, accuhelar and hand haler 28. 3 %, 10%, 22.2% of the respondents respectively had good technique pre intervention which increase post intervention to 81.1%, 70%, and 88.9% respectively had demonstrated good technique. **Conclusion and recommendation;** findings approved the previously stated research hypothesis and assured that the implementation of self-management program succeed in making remarkable, significant improvement in patient knowledge regarding asthma and improving patients' inhaler technique. Ongoing assessment and monitoring of patient's inhaler technique with regular follow-up using a case management is essential for ensuring asthma control

Keywords: asthma knowledge, self- management program, education, inhaler technique.

I. Introduction

Asthma is a chronic disease of the small airways. The hallmarks of asthma are chronic inflammation, reversible obstruction and airflow limitation¹. Obstructive airway diseases including asthma are leading causes of mortality and morbidity worldwide with profound economic and social burden. The global prevalence of asthma in general population ranges from 1%-18%². Prevalence of asthma among Arabic countries is varied and ranged from 9% to 20%³. However, a little is known about the incidence of asthma in Egypt and most studies estimate the incidence among children and adolescents. However, a study conducted by Zedan et al (2009)⁴ to investigate the prevalence of bronchial asthma among Egyptian school children found that the prevalence of asthma among school children in the Nile Delta region was 7.7%. Asthma represents a worldwide socioeconomic burden on every health care delivery system. In the US, the cost of asthma is estimated to be around \$56 billion each year⁵. In a systematic review of the economic burden of asthma, hospitalization costs up to 86% of all asthma-related cost, and poor asthma control was associated with increased cost of care⁶. Although difficult to measure, the indirect cost of asthma is immense. Missed work days, absence from school, low productivity, emotional and social impacts are examples of indirect costs of asthma⁷.

Long-acting beta agonists and inhaled corticosteroids are the main medication categories used for asthmatics. Inhaled bronchodilators and corticosteroids are provided by inhalation route. This route affords the advantage of direct supply to the aimed organ, therefore ideally increasing the favorite effects and reducing expected side effects linked with systemic absorption⁸. Optimal inhaler technique allows maximal drug delivery

to lungs improving the therapeutic benefit leading to improved symptom control. However several studies have documented that more than 50-80% of patients fail to use their inhaler devices correctly⁽⁹⁻¹²⁾. John and Clare, (2015)¹³ mentioned that disease control is often suboptimal in spite of the accessibility of effective treatments for respiratory disorders due to the failure of patients to follow prescribed regimes, or to demonstrate competence in the often complex steps in the administration of inhaled medications. The cost of poor adherence and in correct use of inhaler medications is significant, both economically and in terms of health-related impact¹³. Misuse of an inhaler is common in clinical practice, and proper training of patients and health care provider is important to ensure the correct use of the device¹⁴. Unfortunately the physician often fundamentally prescribes inhaler therapy, taking for granted that the patient will use it properly, while the majority of patients do not recognize that the efficiency of inhaler therapy often depends on whether it is used correctly¹⁵. Inhalation therapy use necessitates directed continuous training, while patients are often not aware that they use their inhaled medication inadequately, and overestimate their own abilities¹⁶.

Harnett et al, (2014),¹⁷ confirmed in their study on the significance of educating and correctly evaluating inhaler technique in patients with asthma as part of their current clinical examination. The first step to ensure proper management of the disease is therefore to educate patients in inhaler technique. Patient satisfaction is also an essential aspect, as it significantly associated with healthier outcomes¹⁴. Adherence to therapy is likely to be influenced by patients' attitudes and their experience in using the device. If patients feel that treatment is not working, adherence is likely to be poor with consequently reduced efficacy of treatment¹⁸. The availability of several inhaler devices may also confuse the patient. Switching between different inhalers negatively affects care, as inhaler classes and brands differ in design particularly dry powder inhalers (DPIs) and each device has unique required steps and inhalation techniques¹⁹. The key issue in asthma management is therefore to train patients and to verify the correct inhalation maneuver²⁰.

Self-control of asthma and written action plan have become progressively important in asthma management, as the philosophy of treatment moved towards patients' involvement in treating his/her own disease and asthma education has been implemented at different points of care with variable outcomes⁷. Self-management interventions help patients with asthma develop and practice the skills they need to achieve disease-specific medical regimes, direct changes in health behavior and offer emotional support to empower patients to control their disease²¹. Self-management is a term applied to any formalized patient education program aimed at teaching skills to optimally control the disease, behavior change, and coping with the disease. The continuum of self-management programs varies from the provision of written material only, to more intensive patient management, including exercise prescriptions., several studies on the efficacy of self-management education among patients with asthma, have been published²²

II. Significant Of Study

With the changing health care environment, prevalence of chronic health conditions such as asthma increasing challenges of health literacy, self-management maintenance and provides chances for health care providers to enhance efficiency and, at the same time, to involve patients to share in managing their own personal care²³. Daily inhaler therapy is a first-line controller therapy for asthma self-management. Despite its effectiveness, misuse of inhaled medications is common, which results in compromised treatment outcomes and excess health care costs. Madkour and Galal, (2015)²⁴, reported that improper inhaler technique is common among asthma and COPD patients in actual Egyptian pulmonary clinical care practice and there is inconsistency between patients' understanding and actual usage technique of different inhalation devices. Also patients' knowledge is an important variable to consider in self-management of asthma. Furthermore, there was few national studies were done to explore and manage this problem. So this study will be done to examine the effect of implementing a self-management program to improve asthma knowledge and inhaler technique among Egyptian adult with asthma.

III. Methodology

This study aims to investigate the effect of implementing a self-management program to improve asthma knowledge and inhaler technique among adult with asthma

Research hypothesis

Patient's asthma knowledge and inhaler technique will be improved after implementation of the self-management program among patients with asthma when compared with pre implementation levels.

Study design

One group, pre\posttest, quasi experimental research design was used to conduct this study.

Setting

Study was conducted in inpatient departments at Mansoura Chest Hospital and Chest Department affiliated to Mansoura University Hospital. The two settings affiliated to Dakhlia Governorate, Egypt.

Subjects;

A purposive sample of 75 adult patients diagnosed with Asthma. Inclusion criteria include patient older than 18 years old, diagnosed at least since three months ago, receiving inhaler medications, able and willing to participate in the study.

Tools; used for data collection in this study consisted of five parts as the following;

Frist part; concerned with data related to socio demographic characteristics of the study sample such as age, gender, education level, marital status, residence, occupation...etc

Second part: concerned with medical data of study sample such as previous/current history of smoking, duration of disease, type of used inhaler devices, duration of use in months, previous inhaler training, and self-reported adherence to prescribed medication.....etc.

Third part is a **standardized structured asthma knowledge questionnaire** was adopted from Desalu, Abdurrahman, Adeoti, and Oyedepo.(2013)²⁵ and used to assess patient's knowledge regarding asthma. It is a self-reported instrument and consisted of 18 close-ended questions, presenting yes, no or I don't know options. 1 score assigned for each correct answer and 0 for incorrect or I don't know answer, the total score ranged from 0 to 18.

Fourth part (questionnaire regarding inhaled medications) is concerned with collection of data regarding inhaled medication among asthma patients and consists of seven items, the first six items answered by yes or no while the last seventh one (How many times has your physician observed you using your inhaled medication?) answered by never, once, or twice / more times.

Fifth part concerned with assessment of patient inhaler technique; participant inhaler technique has been evaluated in a practical manner, by asking patients to demonstrate their inhaler technique with a placebo device using prepared checklists derived from Global Initiative for Asthma (GINA)(2014)² and the Australian Respiratory Guidelines, (2008)²⁶, a check-list adapted for each inhaler device. One point was allotted for each correct step done, resulting in a maximum score of eight. Three steps for each device were designated essential by the researchers (because it could considerably affect dose supply to the lung). It was considered that even if the overall score was high, if one of these steps was incorrect, then inhaler technique would be poor. Good technique was defined as achieving a minimum score of five; with the three essential steps correct²⁷.

Educational interventions

The educational interventions was designed and prepared by the researchers after reviewing the related literatures. The educational interventions involved notes on general knowledge of disease etiology, pathophysiology, investigations, medications and use of inhaler devices, treatment, and prognosis and folklores. In addition, the subjects also had a physical demonstration and video demonstration of different inhaler technique devices. The subjects were also given colored brochures that contained pictures for different inhaler devices and correct technique for each one for their personal study at home.

Methods;

The study conducted through three phases' preparation, implementation, and evaluation phase.

Preparation phase;

- In this phase the researchers prepare the tools of data collection and educational material (brochures and educational video) after reviewing the related, scientific literatures
- Translation of the tool to Arabic language was done and validity of the translated version was tested by panel of five expertise (3 nursing staff and 2 internal medicine staff), while reliability of asthma knowledge questionnaire was assured through test retest reliability and it was adequate (0.87) for this study.
- The required official permissions to conduct the study were obtained from the ethical committee of Mansoura Nursing College, Directors of the Mansoura Chest Hospital and Director of Chest Department affiliated to Mansoura University Hospital. This was achieved after clear clarification of the aim and nature of the study in addition its expected outcomes.
- A pilot study was carried out on 10 asthma patients to test the clarity and simplicity of the questions. Necessary modifications were done. Subjects who involved in pilot study were excluded later from the main study sample.

Implementation Phase:

- In this phase, the researchers approaching the patients and explain the study purpose and protocol and collect baseline data by using study pre prepared tools.

- For literate subject the researcher provide them the tools except the checklists because all of them were self-reported but in relation to illiterate subjects they interviewed individually and data were obtained through asking the questions and recording the responses by the researchers
- Participant inhaler technique has been evaluated in a practical manner, by asking patients to demonstrate their inhaler technique with a placebo device (or the patients inhalation devices if possible) using prepared checklists. Carrying out the program has been done through providing two educational sessions each one lasted for 50 minutes and included face to face lectures, video demonstration, and physical demonstration by researchers. Study participants have been provided a written colored brochure contained information related to asthma and steps of different inhaler techniques.

Evaluation phase

- By the end of last session posttest were completed for evaluating participants’ asthma knowledge and inhaler technique by using asthma knowledge questionnaire and inhaler technique checklists respectively.

Ethical considerations:

The research ethics panel of the college of nursing, Mansoura University approved the study Protocol. Oral consents were obtained from asthma patients who agreed to participate before his/her inclusion into the study post clarification of intervention and aim of the study. Anonymity and confidentiality were assured to participants. The investigator declared that participation is voluntary and confidential.

Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences (Version 15.0; SPSS) Descriptive and frequency statistics were performed to determine the subject’s distribution according to demographic and medical data. Wilcoxon Signed Ranks Test was used to check the difference between pre and post intervention asthma knowledge and patients’ inhaler technique. $P < 0.05$ was considered to be statistically significant. $P < 0.001$ was considered to be highly statistically significant.

IV. Results

Table I distribution of the study participants according to bio-socio demographic characteristics.

Characteristics	No	%
Residence		
Rural	44	58.7
Urban	31	41.3
Age		
21-30 years	6	8.0
31- 40 years	21	28.0
41-50 years	12	16.0
51-60 years	36	48.0
sex		
Male	49	65.3
Female	26	34.7
Marital status		
Married	57	76.0
Single	5	6.7
Widow	13	17.3
Educational level		
Illiterate	29	38.7
Read and write	25	33.3
Secondary	13	17.3
Higher education	8	10.7
Occupation		
Office work	21	28.0
Manual work	30	40.0
House wife	24	32.0
Activity level		
Mildly active	24	32.0
Moderately active	42	56.0
Highly active	9	12.0

Table I show distribution of the study participants according to bio-socio demographic characteristics. It was clear that more than half of participants (58.7%) were from rural area, 48% of them their age ranged from 51-60 years, 65.3% were male, 76.0% were married, illiterate were constituted approximately 38.7 %, and manual work was found to be most prevailing job 40.0 %. Finally for their activity level more than half of participants 56.0% were moderately active.

Table 2 distribution of the study participants according to medical characteristics N = 75.

Characteristics	No	%
Smoking history		
No	54	72.0
Yes	21	28.0
Duration of disease in years	M±SD 12.49 ± 8.69	
Duration of inhaler use in months	M±SD 7.22±5.15	
Frequency of inhaler use		
Once	18	24.0
Two	39	52.0
Three	12	16.0
Four	6	8.0
Type of inhaler used*		
PMDI	53	70.6
Diskus	20	26.7
Aerolizer/ handhaler	18	24
Hospitalization during last year due to disease condition		
Yes	39	52
No	36	48
Received health education related to disease condition		
Yes	18	24
No	57	76
Asthma triggers as reported by the study participants*		
Smoke	39	52
Dust	57	76
Cold	11	14.7
Exercise	8	10.7
Sprays and Perfumes	14	18.6

*Number is greater than the total number of participants (N=75) as some patients were using more than one type of inhaler device

Table 2: represent distribution of the study participants according to medical characteristics. It is shown that, 72.0% of the study participants had no smoking history, 70.6% of the study participants were used PMDI. 26.7% of them were used Diskus inhaler while Aerolizer/ handihaler were used by 24% the study participants. In relation to asthma triggers reported by the study participants it was noticed that, 76% were relate to dust and 52% related to smoke.

Table 3; Percentage of positive responses to questionnaire regarding inhaled medications among study participants N=75

Questions	Positive responses	
	No	%
Q. 1: Do you know how to use the inhaled medication prescribed	66	88
Q. 2: Do you think that inhaled medications yield good results?	67	89.3
Q. 3: Do you think that your inhaler technique or the way you use your inhaled medication is important?	67	89.3
Q. 4: Has your physician (or another health care professional) taught you how to use your inhaled medication yet?	36	48
Q. 5: Has your physician ever observed you using your inhaled medication?	32	42.7
Q. 6: Does your physician re-evaluate how you use your inhaled medication at every medical visit?	16	21.3
Q. 7: How many times has your physician observed you using your inhaled medication?		
(a) Never	43	57.3
(b) Once	30	40
(c) Twice or more times	2	2.7

Table 3; represent the percentage of positive responses to questionnaire regarding inhaled medications among study participants as shown nearly almost participants claimed they knew how to use their inhaled medication, believe that inhaled medications yield good results, and think that their inhaler technique or the way they use their inhaled medication is important, the percentages were 88%, 89.3%, and 89.3% respectively. However, only 52% of study participants didn't receive education related to their inhaled medication, and when they asked how many times has your physician observed you using your inhaled medication? 57.3% of them answered with (never).

Table 4 Causes of missed doses of inhaled medication as reported by study participants.

Questions	Positive responses	
	No	%
1. Have you missed any regular doses of the medicines due to cost?	26	34.6
2. Have you missed any regular doses of the medicines due to embracement from others?	37	49.4
3. Have you missed any regular doses of the medicines for any psychosocial reason?	40	53.3

Table 4 represents different causes of missed doses of inhaled medication as reported by study participants. As revealed more than half of participants (53.3%) mentioned psychosocial reasons, 49.4% mentioned embracement from others, and 34.6% declared that they missed doses of inhaled medications due to cost or financial aspect.

Table 5; Distributions of the correct responses to the questionnaire regarding knowledge about asthma among study participants before and after intervention N=75

Question on asthma knowledge	% of true answer		P*
	Before	after	
1. Is asthma an inflammatory disease of the airway?	65.3	89.3	.001
2. Is asthma a contagious disease?	52	88	.001
3. Is asthma a hereditary disease?	45.3	89.3	.001
4. Dose asthma inflammation cause constriction in the airway?	49.3	94.7	.002
5. Symptoms of asthma include coughing, wheezing, dyspnea, chest tightness?	78.7	94.7	.007
6. Are there aspirin, some rheumatism drugs, and some antihypertensive drugs cause asthma symptoms?	44	90.7	.002
7. Dose smoking increase asthma?	84	96	.045
8. Dose exposure to other people tobacco smoke or other smoke increase asthma?	66.6	94.3	.001
9. Is asthma a disease that cannot be treated and which continuous throughout one's life?	46.7	88	.001
10. Could asthma be completely controlled with a continuous and regular treatment and can the patient continue a normal life?	64	98.7	.001
11. Should asthmatic patient use the prophylactic treatment regularly even if they feel well?	53.3	86.7	.001
12. If an asthmatic patient does not use the treatment regularly, do asthma attacks threaten life?	62.7	97.3	.001
13. Do inhaled drugs reach the airway directly?	64	93.3	.001
14. Does the effect of inhaled drugs disappear quickly and enter the circulation system in very small amounts?	30.7	84	.001
15. Are there any harmful side effects of the inhaled medications?	64	76.7	.046
16. Do inhaled medications cause addiction?	68	72	.612
17. Can asthmatic patient do sports?	37.3	93.3	.001
18. Can asthmatic patient become pregnant?	73.3	96	.005
Total percentage of true answers	58.3	90.2	.001

*Wilcoxon Signed Ranks Test was used to check the difference

Table 5; represent distributions of the correct responses to the questionnaire regarding knowledge about asthma among study participants before and after intervention. As shown there is a significant improvement of total asthma patients' knowledge after implementation of the self-management program as revealed by (P =.001). The assessment of asthma knowledge showed that before educational intervention 65.3% of the subjects knew asthma to be an inflammatory disease of the airways and 44% also were aware that aspirin, some rheumatism drugs, and some antihypertensive drugs cause asthma symptoms. These significantly increased to 89.3% and 90.7 % respectively after education intervention. In addition, before educational only 37.3% of study participants knew that asthmatic patient can do sports also 30.7% were aware that the effect of inhaled drugs disappear quickly and enter the circulation system in very small amounts. These significantly improved to be 93.3% and 84% respectively after intervention.

Fig 1 represents inhaler technique of study participants before and after implementation of self-management program, as showed there is great increase in the percentage of participants who have good technique after implementation of self-management program for all types of inhaler devices. In relation to PMDI percentage of good technique was 28.3% which became 81.1 after intervention while accuhaler inhaler technique (Diskus) the percentage of good technique increased from 10% to 70% after intervention and hand haler technique percentage of good technique increased from 22.2% before to be 88.9 after intervention

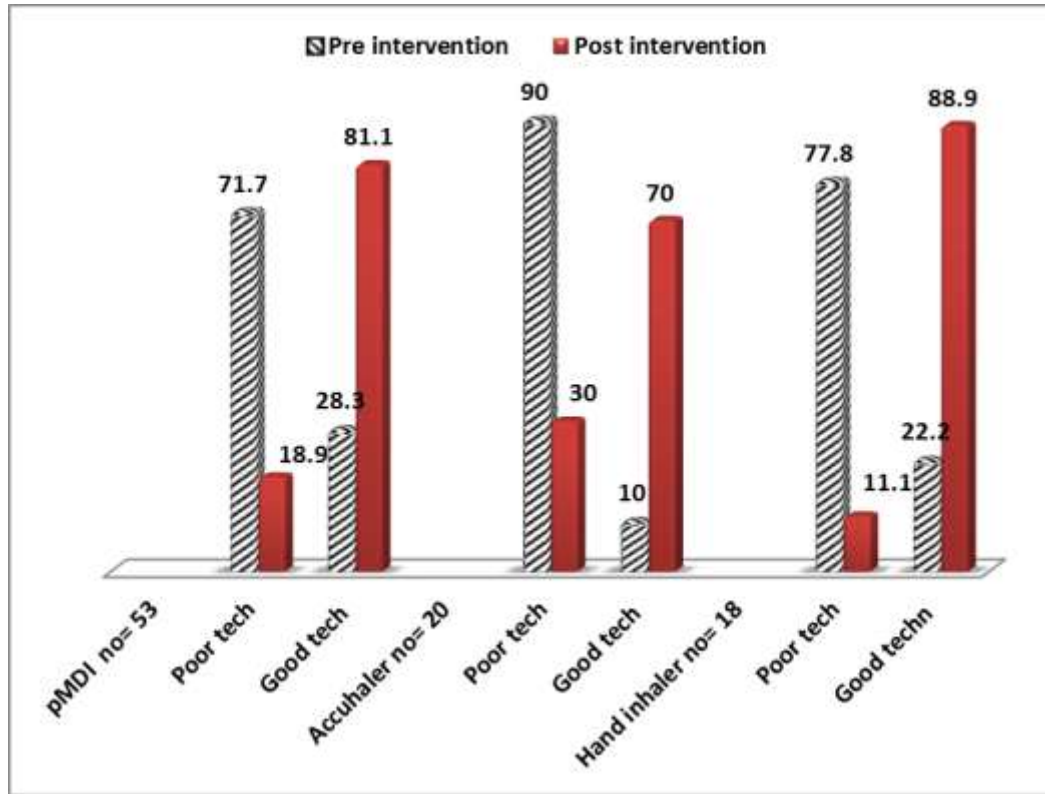


Fig 1: represents Inhaler technique of study participants before and after intervention

Table 6 Percentage of mistakes / step of use in metered dose inhaler (MDI) before and after intervention no = 53.

Checklist Steps	Mistakes per step (%) n=53		p*
	Before	After	
1. Remove the cap from the inhaler	1.9	0	.317
2. Shake the inhaler	28.3	0	.001
3. Hold inhaler upright	18.9	1.9	.002
4. Exhale to residual volume	32.1	3.8	.001
5. Place mouthpiece between lips and teeth to seal the mouthpiece	18.3	0	.046
6. Inhale slowly and simultaneously and activate the canister	24.5	5.7	.002
7. Continue slow and deep inhalation	54.7	11.4	.003
8. Take inhaler out of mouth and hold breath for 10 seconds	66.	15.2	.001

*Wilcoxon Signed Ranks Test was used to check the difference

Table 6 represents the percentage of mistakes per step of use in metered dose inhaler (MDI) before and after intervention. As shown there is a significant reduction in participants' mistakes after intervention in all steps of metered dose inhaler except first one. Also the most prevalence errors before intervention were inability of the participants to take inhaler out of mouth and hold breath for 10 seconds (66. %) followed by failure to continue slow and deep inhalation (54.7%).

Table 7 Percentage of mistakes / step of use in Accuhaler Inhaler Technique (Diskus) before and after intervention no = 20

Checklist Steps	Mistakes per step (%) n=20		p*
	Before	After	
1: Keep Diskus horizontal	40	0	.001
2: Prepare Diskus	20	0	.045
3: Exhale to FRC/RV	45	10	.001
4: Position mouth piece between lips	40	5	.001
5: Inhale forcefully and deeply	30	0	.046
6: Remove the device from mouth before exhale	60	10	.014
7: Hold breath for 10 s	60	5	.001
8: Exhale and wait 20 s for 2nd use	100	20	.001

*Wilcoxon Signed Ranks Test was used to check the difference

Table 7: represents the percentage of mistakes per step of use in Accuhaler Inhaler Technique (Diskus) before and after intervention. It was clear from table that there is a significant reduction in participants' mistakes after intervention in all steps of inhaler technique. However, the most prevalence errors before intervention were failed to exhale and wait 20 s for 2nd use (100%), failed to remove the device from mouth before exhale and hold breathe for 10 s (60% of study participants).

Table 8 Percentage of mistakes /step of use in aerolizer/ hand haler Technique before and after intervention no = 18

Checklist Steps	Mistakes/step (%)		p*
	Before	After	
1. Open cap and mouthpiece	0	0	1.000
2. Remove capsule from blister and put in chamber	0	0	1.000
3. Close mouthpiece until you hear the 'click'	0	0	1.000
4. Press green piercing bottom in once and release.	22.2	0	1.000
5. Exhale to residual volume away from mouthpiece	77.8	22.2	.002
6. Place mouthpiece between lips and teeth to seal mouthpiece	22.2	0	1.000
7. Inhale forcefully and deeply, so capsule vibrates.	66.7	11.1	.005
8. Continue to breathe in as long as comfortable.	11.1	0	1.000
9. While holding breath for 5–10 seconds remove Inhaler from the mouth	88.9	11.1	.001
10. Breathe out gently away from mouth piece.	66.7	22.2	.005
11. Open mouthpiece and remove capsule.	16.7	0	1.000
12. Close inhaler.	0	0	1.000

*Wilcoxon Signed Ranks Test was used to check the difference

Table 8; represents the percentage of mistakes /step of use in aerolizer/ hand haler technique before and after intervention. As shown there are no errors in the first three steps of hand haler technique among study participants before and after intervention. It was clear from table that there is a significant reduction in participants' mistakes after intervention. However, the most prevalence errors before intervention were failed to while holding breath for 5–10 seconds remove inhaler from the mouth (88.9%), failed to exhale to residual volume away from mouth piece (77.8%), and breathe out gently away from mouth piece and inhale forcefully and deeply, so capsule vibrates. (60.7% of study participants).

V. Discussion

Inhaled therapy is the cornerstone and a major component of asthma management in that it optimizes the delivery of the medication to the site of action as opposed to systemic administration of the drug². However, the prevalence of inadequately controlled asthma is high. A main reason for this is poor inhalation technique and inhaler choice. Insufficient inhaler technique in people with asthma is reported in up to 85% of people²⁸. Also, low health literacy has been well documented with asthma patients to be related to more hospitalizations, more emergency visits, poorer physical function, poorer QOL, and lower medical decision making. Patients with low health literacy are at risk for poor asthma control due to their lack of asthma self-management knowledge and skills²⁹⁻³⁰. So this study done to investigate the effect of implementing a self-management program to improve asthma knowledge and inhaler technique among patients with asthma. The researchers hypothesized that Patient's asthma knowledge and inhaler technique will be improved after implementation of the self-management program among patients with asthma when compared with pre implementation levels. Actually the findings of the present study prove the previously stated hypothesis through marked improvement in patient's knowledge and their inhaler techniques.

Schaffer & Yarandi, (2007)³¹, reported that patients with lower asthma knowledge scores showed less management skills consequently, patients' knowledge is an important variable to consider in self-management of asthma. The present study revealed that, there was a significant improvement in patient knowledge regarding asthma after implementation of the self-management program when compared with pre implementation level. This may be due to individualization of education and using more approaches of teaching such as face to face interaction, video presentation and providing written handouts. Also there is empirical support that asthma knowledge improved with educational intervention sessions³². Poureslami et al, (2012)³³ in their study concluded that short, simple, culturally, and linguistically appropriate interventions can promote knowledge gain about asthma and improve inhaler use that can be sustained over the short term. Such interventions that provide reliable learning materials that draw on patients' life experiences and sociocultural context can overcome certain limitations of conventional patient education approaches. In a sample of 200 adults with asthma, more asthma knowledge was related to better self-management of the disease as measured by fewer physician visits, improved lung, and improved symptom scores³⁴. In addition, Coffman et al, (2009)³⁵ reviewed 25 randomized controlled trials of school-based asthma education program and found that the majority of studies reported

significant improvement in self-efficacy, self-management and knowledge about asthma of school-age asthmatics as compared to control group.

Regarding inhaler technique, in agreement with³⁶ nearly almost of the asthma patients claimed to know how to use inhalation devices correctly. However, the fact that, the majority of study participants showed poor technique with all inhaler devices used, this means that there is a discrepancy between understanding and practice and not enough for health care providers to ask patient if he knew how to use the inhaler or not, they should ask the patient to demonstrate the technique in front of them to be sure from his or her performance. In addition, the present study found that more than half of the study participants have not received education related to how to use their inhaler devices. This was in agreement with Madkour, and Galal, (2015)²⁴, they found that 30% of the patients have not been ever taught how to use their inhaler devices. Also Al Jahdali et al, (2013)¹⁰, in their study In Saudi Arabia found that, 40% of asthmatic patients do not receive any formal education on how to use their medications. While Bjermer, (2014)¹⁴ reported that about 39–67% of nurses, doctors, and respiratory therapists are not able to adequately train patients on the correct use of the device. In accordance with²⁹ the present study revealed that, the common mistakes were due to the inability to coordinate breathing with pressing of inhaler canister, failure to remove inhaler from mouth after actuation and failure to breathe out slowly after the removal of inhaler from the mouth and more than half of the subjects correctly demonstrated the initial steps 1-4.

In relation to asthma triggers, in accordance with³⁷, the most common asthma triggers reported by study participant in the current study were dust, smoke, cold, and spray & perfume. Health care providers may need to educate adults with asthma about identifying their specific asthma triggers and minimizing exposure³⁸. Regarding different causes of missed doses of inhaled medication as reported by study participants, more than half of the participants relate the causes to psychological aspect. This is in accordance with³⁹, who found depression complicates therapy adherence among COPD patients. However, Howell G. (2008)⁴⁰ reported that, high treatment cost is one of the major contributors to non-adherence and patients may skip daily inhaled corticosteroid steroids doses in an attempt to stretch out their medication and to reduce financial burden. In the present study more than the third of study participant reported they missed their inhaler medication due to cost. Frequent misuse of inhaler devices has been documented for patients prescribed metered-dose inhalers (MDIs) as well as those using dry powder inhalers (DPIs)⁴¹. In addition, Rootmensen, van Keimpema, Jansen A, and de Haan, (2010)⁴², found that overall, 40% of the patients made at least one essential mistake in their inhalation technique. Patients who never received inhalation instruction and patients who used more than one inhaler device made significantly more errors. Comparison between devices showed that a correct inhalation technique most likely occurred with the use of prefilled dry powder devices. While the present study found that, in accordance with other studies²⁷⁻²⁸, more than two thirds of participants had poor inhaler technique pre educational intervention and participants using an accuhaler demonstrated poorer technique compared to those using a pMD or hand inhaler (prefilled dry powder inhaler).

The major avoidable factor for improper device use was the lack of education of how the patient uses the inhaler device correctly²⁴. Providing education on correct inhaler technique is an integral component of asthma education plans and has been shown to improve symptoms, self-management and adherence to therapy⁴³⁻⁴⁴. This supports the findings of the present study which revealed significantly improvement in inhaler technique of the study participants after implementation of the self-management program. Also Takemura et al (2010)⁴⁵ tested the effect of a structured educational programme on the use of inhalation devices and reported that implementation of the programme for asthmatic patients led to proper use of inhaler devices and better adherence to treatment. However, Dalcin, etal (2011)⁴⁶ disagree with the present study findings; they found that the educational intervention had no improving effect on the inhalation technique. Also, Crompton 2004 reported that, 50% of adults continue to use inhalers improperly after providing needed instruction.

VI. Conclusion

The findings of present study revealed that nearly almost of the asthma patients claimed to know how to use inhalation devices correctly inspite of more than two thirds of participants had poor inhaler technique pre educational intervention and participants using an accuhaler demonstrated poorer technique compared to those using a pMD or hand inhaler (prefilled dry powder inhaler). Also more than half of the study participants have not received education related to how to use their inhaler devices. Finally, the findings assured that the implementation of self-management program succeed in making remarkable, significant improvement in patient knowledge regarding asthma and improving patients' inhaler technique. Health care providers play a critical role in educating patients about the importance of adherence to prescribed treatment. Tailored asthma education using individualized information including treatment plan and feedback is effective. The key issue in asthma management is to train patients and to verify the correct inhalation maneuver. Ongoing assessment and monitoring of patient's inhaler technique with regular follow-up using a case management is essential for ensuring asthma control.

VII. Recommendation

Several recommendations can be made for clinical practice, particularly for asthma self-management education.

1. Health care provider need to shape patient health education to the need of individuals with asthma and assess its effectiveness through continuous follow up
2. Regular training sessions should be provided at each visit and patients should be encouraged to bring their inhalers to provide demonstration of competence in inhalation technique
3. Certified respiratory educators such as nurses, respiratory therapists, physiotherapists and pharmacists supply services traditionally delivered by physicians. This may include patient education, with an emphasis on patient self-management and instruction in proper inhaler technique.
4. Inhaler technique education is best delivered by verbal instructions and physical demonstration of the technique by a skilled educator, either face to face or by video.
5. Further study using larger representative sample including all types of inhaler devices is recommended.

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