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Appropriate Use of Metered- Dose Inhalers Technique And Its Determinants among Asthmatic adult Patients Attending Chest Clinics In Al Noor Specialist Hospital And Hera General Hospital at Makkah Al- Mukarramah, 2018

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ABSTRACT

Background: The most common route for managing bronchial asthma is using inhaled medications. Correct inhaler technique requires steps performed in sequence. However, various studies have reported critical errors in the inhaler technique by patients.

Objectives: To estimate the frequency and identify the determinant of the appropriate use of Metered- Dose Inhaler technique among asthmatic patients attending pulmonary clinics in Al Noor Specialist Hospital and Hera General Hospital, in Makkah Al Mukarramah, 2018.

Material and methods: Cross-sectional study included 145 asthmatic adult patients recruited from 30thSepmber – 30thOctober 2018 from pulmonary clinics at the mentioned hospitals. An Interview validated questionnaire was used-based on Asthma Control Test- for data collection and observational validated checklist.

Results: Among 145 asthmatic patients, the mean age was 48 and standard deviation ±16.1 years. Overall, asthma was controlled among 31.7% of patients, based on the Adult Control Test. The appropriate use of metered-dose inhalers technique by asthmatic patients was observed among 35.2% of them. It was significantly higher observed among patients live in Makkah (p=0.004), single patients (p=0.013), higher education (p=0.006), with income ranged between 9001 and 10000 SR/month (p<0.001) and young (p=0.005). Patients treated regularly by family physicians (p<0.001), those who had no other chronic diseases were more likely to use appropriately inhaler technique, Higher number of use of inhalers per week p=0.029, Patients who trained/retrained on the right way of using asthma inhaler and patients trained through YouTube or relatives p<0.001.

Conclusion: Improper inhaler use is common among adult asthmatic patients in MakkahAl- Mukarramah. However, it was not significantly associated with poor asthma control.

I. INTRODUCTIONS:

1.1 Background: Asthma is a heterogeneous disease, characterized by chronic airway inflammation, hyper-responsiveness and variable reversible and recurring symptoms.(1)

Drug therapy is used to control and relieve asthma symptoms and reserve airflow obstruction. (1, 2)

Asthma is impacted on the patients, their families, and the community by lost work and school days, reduced quality of life, frequent emergency department visits, hospitalizations, and deaths. (1, 3)

Improper inhaler technique and non-adherence to treatment lead to an uncontrolled disease state with all its side effects. (4-6)

Various studies were carried out globally have reported critical errors in the inhaler technique by patients despite the health education they received from their health care providers. (7-14)

The most common route for bronchial asthma medications is inhalation. Correct inhaler technique requires steps performed in sequence, according to the various checklists.(15)

Asthma is a main public health concern in Saudi Arabia, affecting more than 2 million Saudis.(3, 8)

1.2 Literature Review:

Local studies: Faizah Alghamdi et al., published a study in the Egyptian Journal of Hospital Medicine in April 2018 as a cross sectional study to evaluate inhaler use among asthmatic patients. Result showed inhalation technique was unsatisfactory with errors especially in the lower education level. (16)

A cross-sectional observational study was conducted in 47Saudi hospitalized asthmatic and COPD patients using inhaler devices at King Abdulaziz Medical City, Riyadh, Saudi Arabia to assess inhaler technique. Result of study was revealed that 70% of patients made at least one critical error while demonstrating their inhaler technique. (17)

International studies: Manzella BA et al., published an observational study done in Albahama University at Brimingham Asthma Program assessing the metered dose inhaler use by asthmatic patients by checklist showed that most patients used the metered dose inhaler incorrectly, despite the training they received from their physician. (10)

An analytical cross-sectional population-based study (2015), was conducted at Pulmonology Department, Hospital Central do BaixoVouga, Portugal, in 2013showed that early education on inhalation technique is significant to a decreased number of failures.[19]

A Recent study in 2017 compared between computer-based video instruction and traditional written instruction for teaching inhaler technique at the Junta De Beneficencia Hospital, showed that Video training was significantly more useful than written instructions ($p<0.001$), and it improved inhaler technique by 70% ($p<0.001$).[20]

1.3 Rationale: Bronchial asthma is one of the most common chronic problems in the world as well as in Saudi Arabia.

Proper training of patients on how to use inhaler in a correct way is a very cost effective and approachable intervention.

Additionally, there was no study in Makkah Al Mukarramahwhich assessed the correct use of inhaler technique among adult asthmatic patients. So, this study come to assess appropriate use of inhaler technique and associated factors, which can influence it.

1.4 Aim of the study: To evaluate inhalation techniques and increase awareness about the importance of the correct use of asthma inhalers.

1.5 Objectives

1- To estimate the frequency of appropriate use of Metered- Dose Inhaler technique among asthmatic patients attending pulmonary clinics in Al Noor Specialist Hospital and Hera General Hospital, in Makkah Al Mukarramah, 2018.

2- To identify the determinants of appropriate use of Metered- Dose Inhaler technique among asthmatic patients attending same clinics, 2018.

II. METHODOLOGY

2.1 Study Design: Cross-sectional

2.2 Study Area: This study was conducted in Makkah Al Mukarramah city in Saudi Arabia. The total population of it is 1,675,000 [21]. There are seven government hospitals in Makkah Al Mukrramah.

Data were collected from pulmonary clinics at Al Noor Specialist Hospital as well as Hera General Hospital.

Al Noor Specialist Hospital is in the heart of Makkah. It has multiple facilities and covers several specialties.

Hera General Hospital is in north of Makkah, and it contains all medical specialties.

2.3 Study Population: Adult Asthmatic Patients at tending pulmonary clinics in the mentioned hospitals, during study period (30thSeptember – 30thOctober2018)

2.4 Inclusion criteria

- All asthmatic Patients attending pulmonary clinics in the mentioned hospitals during study period.
- Adult (18 years and older)

2.5 Exclusion criteria

- Children
- COPD without asthma

2.6 Sample size:

The estimated number of the asthmatic patients who attend pulmonary clinics in these hospitals is around 200 patients per month.

Assuming that, from the previous study [5]the prevalence of improper inhaler use in asthmatic patient was 45%. By using Raosoft sample size calculator, margin of error is (5%), confidence level is (95%)and prevalence (45%), thus the sample size will be (132) patients during study period. It was increased by 10% to overcome non-respondent.

2.7 Sampling technique:

The mentioned hospitals were selected by non-probability purposive sampling technique.

Then, each participant was selected by convenience sampling technique by choosing all asthmatic patients who attend the clinic and were eligible during study period till the sample size is covered.

2.8 Data collection tools:

An Interview questionnaire was created by the researcher. Then, was translated and validated by three consultants.

The questionnaire includes:

- Socio-demographic variables
- Associated factor:

Duration of asthma

co morbidity (DM, HTN, CHD, Others)

Previous proper inhaler education if yes, by whom?

Regular clinic follow up

A family member of asthma

Use other medication daily

Do you demonstrate steps of inhaler use in front the doctors? If yes, how many times?

2- Observational validated checklist

Validated checklist based on US (National Heart, Lung and Blood Institute) asthma management guidelines and adapted from the National Asthma Education and Prevention Programmed of America (NAEPP)[22]

1. *Shake the contents well
2. *Remove the cap
3. Hold the inhaler upright

4. Tilt the head back slightly
5. *Breath out slowly
6. *Open mouth with inhaler 1 to 2 inches away or in the mouth with the lips tightly sealed around it
7. *Begin breath in slowly and deeply through the mouth and actuate the canister once
8. *Hold breath for 10–20 sec
9. Exhale & wait one minute before the second dose
10. Shake again before the second dose

After use, replace the mouthpiece cover

***Essential steps**.

The main outcome of questionnaire is divided according to the level of appropriate use of inhaler technique in two categories:

1- Adequacy of inhalation technique: based on their ability to demonstrate all the essential steps and a total score of ≥seven.
2- Poor inhalation technique: based on not demonstrating all the essential steps correctly and score less than seven, based on previous study.[22]

Asthma control test (ACT) was used to determine the level of asthma control. General scoring system for adult's ACT is: ≥ 20 means controlled and ≤ 19 means not controlled. Scoring system for ACT is: 25 means completely (totally) controlled. 20 – 24 means well controlled.16 – 19 means partially controlled. ≤ 15 means very poorly controlled. [23]

2.8 Data collection technique:

The official acceptance papers from health affairs given to the manager of Al Noor hospital and Hera General Hospital to start the research.

The researcher went to the asthmatic patients' clinic and sit with each of them for 5 minutes after taking a written consent.

The researcher asked the selected patients to participate in the study through a filled questionnaire. Then, she asked them to demonstrate how to use inhaler by using observational inhaler checklist.

2.10 Study variables:

2.10.1 Dependent variable:

Appropriate Inhaler use

1.10.2 Independent:

- Socio-demographic variables such as age, gender, nationality, education, occupation, and income.
- Duration of asthma
- Comorbidity

- Previous inhaler technique education
- Regular follow up
- Family member use inhaler
- Previous demonstrate in front doctors
- Medication use

2.11 Data entry and analysis:

The data were collected and verified by hand then coded before entry. Statistical Package for Social Sciences (SPSS) software, version 25, was used for data entry and analysis. Descriptive statistics were applied. Analytic statistics using Chi-square test was used for the association between categorical values. Abnormally distributed continuous variable, as evidenced by significant Shapiro-Wilk test were compared between two groups by Mann-Whitney test.

A P value < 0.05 was considered for statistical significance.

2.12 pilot study:

It was conducted on10% of asthmatic patients in one hospital (out of the study area) on August 2018 to test clarity of the tool technique. No changes were made on the tool as a result of the pilot study

1.13 Ethical consideration:

- Ethical approval from regional ethical committee in Makkah health affaire was obtained.
- Permission from directorate of health affair in Makkah was taken
- Permissions of the directors of Al Noor Specialist Hospital and Hera General Hospital were obtained.
- Written consents from all participants.
- Full confidentiality of their responses was ensured.

2.14 Budget:

Self-funded.

2.15 Services:

Brochures (How to use Inhaler), were distributed to all patients.

III. RESULTS

Demographic characteristics of the participants

Among 145 asthmatic patients recruited in the study the mean age was 48 and standard deviation ±16.1 years. Demographic characteristics are shown in Table 1

Table 1: Demographic characteristics of adult asthmatic patients, Makkah, 2018

	Frequency N	Percentage %
Gender		
Male	49	33.8
Female	96	66.2
Living place		
Makkah	128	88.3
Outside Makkah	17	11.7
Nationality		
Saudi	133	91.7
Non-Saudi	12	8.3
Social status		
Married	109	75.2
Single	29	20.0
Others	7	4.8
Educational level		
Uneducated	37	25.5
Primary	24	16.7
Intermediate	15	10.3
Secondary	37	25.5
Bachelor	26	17.9
Postgraduate	6	4.1
Functional status		
Unemployed	52	35.9
Employed	44	30.3
Retired	19	13.1
Housewife	28	19.3
Others	2	1.4
Monthly income (SR)		
<3000	27	18.6
3000-5000	47	32.4
5001-8000	50	34.5
9001-10000	15	10.3
>10000	6	4.1

Asthma-related characteristics
The duration of bronchial asthma ranged between one and 63 years with a median value of 10 years. The frequency of using inhaler/week for the management of asthma ranged between one and twenty times with a median value of three times.

Hospitals are the place of following up asthma in 43.4%of patients whereas primary healthcare center was in 13.8%of them. Both places were in 42.8%of patients.

Thoracic physician treat most of patients regularly 70.7%, followed by general practitioner 15.1% and family physician 8.5%and then the internal medicine physician 5.7%.
History of other chronic diseases was reported by 64 of the patients.

-Factors related to the use of asthma inhalers
Table 2showsthose factors.

Among patients who visited the emergency department due to asthma crisis during the past year, the frequency was more than twice among almost one third of them.

Overall, asthma was controlled among 31.7% of patients, based on the Adult Control Test.

Table 2: Factors related to the use of asthma inhalers among asthmatic patients, Makkah, 2018

	Frequency N	Percentage%
Having mouth or jaw problems		
Yes	2	1.4
No	143	98.6
Believing that asthma medications are addictive		
Yes	32	22.1
No	113	77.9
History of regular follow-up		
Yes	106	73.1
No	39	26.9
History of training on the right way of using asthma inhaler		
Yes	125	86.2
No	20	13.8
Re-training on the correct use of asthma inhaler from time to time		
Yes	37	25.5
No	108	74.5
Using any other medications		
Yes	74	51.0
No	71	49.0
Having family member using asthma inhaler		
Yes	56	38.6
No	89	61.4
Visiting emergency department due to asthma crisis during the past year		
Yes	63	43.4
No	82	56.6

Level of Asthma control is mentioned in Figure 1

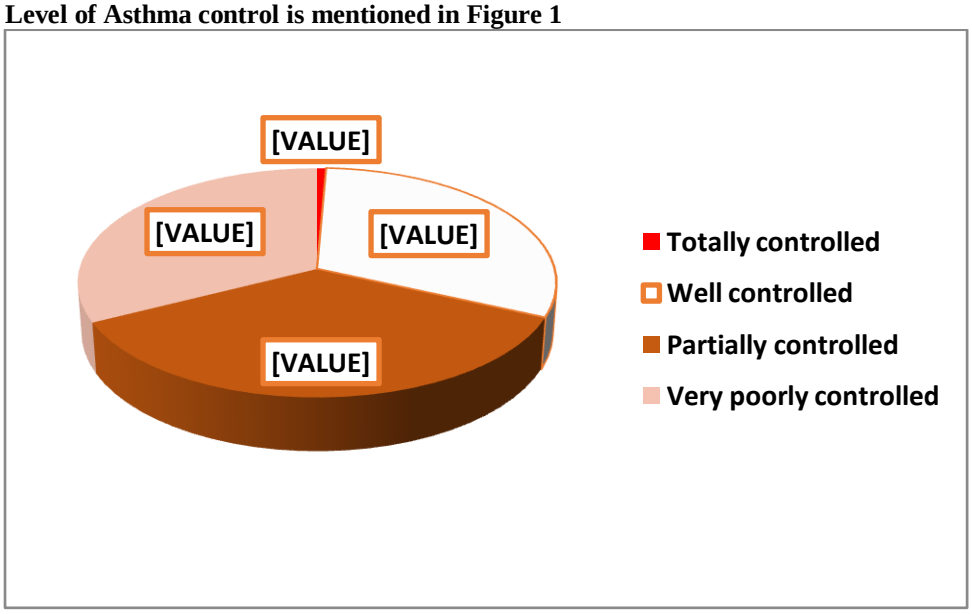

Figure 1: Level of asthma control among the participated asthmatic patients

-Observation of use of inhaler technique

Table 3 summarizes the results of observing the use of metered-dose inhalers technique utilizing the observational inhaler checklist.

Overall, the appropriate use of metered-dose inhalers technique by asthmatic patients was observed in35.2%.

Table 3: Observation of use of inhaler technique among the asthmatic adult patients using the observational inhaler checklist, Makkah, 2018

	Frequency N	Percentage %
Shake the contents well	104	71.7
Remove the cap	145	100
Hold the inhaler upright	126	86.9
Tilt the head back slightly	76	52.4
Breath out slowly	94	64.8
Open mouth with inhaler 1 to 2 inches away or in the mouth with the lips tightly sealed around it	123	84.8
Begin breath in slowly and deeply through the mouth and actuate the canister once	123	84.8
Hold breath for 10–20 sec	85	58.6
Exhale & wait one minute before the second dose	67	46.2
Shake again before the second dose	31	21.4
After use, replace the mouthpiece cover	139	95.9

Factors associated with adequacy of use of inhaler technique

-Socio-demographic factors

Appropriate use of metered-dose inhaler technique was significantly higher observed among patients live in Makkah compared to those living outside Makkah. Single patients expressed more appropriate use of inhalers compared to married patients. The highest level of appropriate use of inhaler technique was observed among postgraduate patients whereas the lowest was reported among intermediate school graduated and uneducated patients. The highest level of appropriate use of inhaler technique was observed among patients whose income ranged between 9001 and 10000 SR/month whereas the lowest was reported among those whose income was below 3000 SR/month. Younger patients were more likely to express appropriate use of inhalers compared to older patients. Patients` gender, nationality and functional status were not significantly associated with adequacy of inhaler use.

Table 4: Socio-demographic factors associated with adequacy of use of inhaler technique among asthmatic patients, Makkah, 2018

	Adequacy of use of inhaler technique		p-value
	Poor N=94 (%)	Appropriate N=51 (%)	
Gender			
Male (n=49)	35 (71.4)	14 (28.6)	
Female (n=96)	59 (61.5)	37 (38.5)	0.234*
Living place			
Makkah (n=128)	78 (60.9)	50 (39.1)	
Outside Makkah (n=17)	16 (94.1)	1 (5.9)	0.004**

Nationality			
Saudi (n=133)	84 (63.2)	49 (36.8)	
Non-Saudi (n=12)	10 (83.3)	2 (16.7)	0.137**
Social status			
Married (n=109)	78 (71.6)	31 (28.4)	
Single (n=29)	13 (44.8)	16 (55.2)	
Others (n=7)	3 (42.9)	4 (57.1)	0.013*
Educational level			
Uneducated (n=37)	30 (81.1)	7 (18.9)	
Primary (n=24)	17 (70.8)	7 (29.2)	
Intermediate (n=15)	13 (86.7)	2 (13.3)	
Secondary (n=37)	20 (54.1)	17 (45.9)	
Bachelor (n=26)	12 (46.2)	14 (53.8)	
Postgraduate (n=6)	2 (33.3)	4 (66.7)	0.006
Functional status			
Unemployed (n=52)	27 (51.9)	25 (48.1)	
Employed (n=44)	28 (63.6)	16 (36.4)	
Retired (n=19)	15 (78.9)	4 (21.1)	
House wife (n=28)	23 (82.1)	5 (17.9)	
Others (n=2)	1 (50.0)	1 (50.0)	0.053
Monthly income (SR)			
<3000 (n=27)	23 (85.2)	4 (14.8)	
3000-5000 (n=47)	36 (76.6)	11 (23.4)	
5001-8000 (n=50)	28 (56.0)	22 (44.0)	
9001-10000 (n=15)	4 (26.7)	11 (73.3)	
>10000 (n=6)	3 (50.0)	3 (50.0)	0.001
Age (years)			
Mean±SD	50.8±15.2	42.9±16.6	0.005˚

* Chi-square test **Fischer exact test ˚Student`s t-test

-Asthma-related factors

Patients treated regularly by physicians have appropriate use of inhaler technique, p<0.001. Patients who had no other chronic diseases were more likely to use appropriately inhaler technique than those with other chronic diseases 44.4% versus 23.4%, p=0.009. Other factors such as place of following up asthma, treated regularly by thoracic physician, medical doctor or general practitioner, visiting of emergency department due asthma crisis and its frequency were not significantly associated with appropriate use of inhaler technique.

Higher number of use inhaler techniques per week was significantly associated with appropriate use of the technique, p=0.029. However, duration of asthma was not significantly associated with appropriate use of the inhaler technique.

-Factors-related to asthma inhaler

Patients who trained on the right way of using asthma inhaler were more likely to use them appropriately compared to those not trained 40.3% versus 4.8%. The difference was statistically significant, p<0.001. Also, patients who retrained in the correct use of asthma inhaler from time to time expressed higher rate of appropriate use of inhaler technique than those who not retrained 59.5% versus 26.9%, p<0.001. Other factors such as having mouth or jaw problems, believing that asthma medications are addictive, history of regular follow-up, using any other medication, and having family member using asthma inhaler were not significantly associated with adequacy of use of inhaler technique.

Fisher exact test showed that patients trained through YouTube or relatives had a higher rate of appropriate technique compared to others, p<0.001.

Association between adequacy of use of inhaler technique and control of asthma

The rate of the appropriate use of inhaler technique was higher among patients with controlled asthma compared to those with uncontrolled asthma 41.3% versus 32.3%. However, the difference was not statistically significant.

IV. DISCUSSION

The inappropriate use of metered-dose inhalers in the treatment of bronchial asthma decreases its delivery, impacts patient's health and sequence of uncontrolled asthma.[6,24-31]

In the present study, based on the observational inhaler checklist, the inappropriate use of metered-dose inhalers was observed among most of the patients 64.8%. In a study carried out in Riyadh, 70% of patients made at least one critical error while demonstrating their inhaler technique[17]as well ASIN other international studies.[5-6,10-20,24, 26- 34)

In the current study, factors associated with inappropriate use of asthma inhalers were living outside Makkah, being married, low socio-economic status, being older, having other chronic diseases and using higher number of inhalers per week whereas being trained and retrained on the right way of asthma inhaler, trained by physicians or having training through YouTube or relatives were associated with appropriate use of asthma inhalers.

In a similar Brazilian study,[33]the factors that were associated with the inappropriate application of inhaler technique were being widowed, using metered dose inhalers, having a monthly family income of fewer than three times the national minimum wage, and having two or more chronic co-morbid diseases.

In agreement with our finding, Yawn et al (2012) has suggested that to improve appropriate management of asthma, it is mandatory to provide more intense training to low socio-economically patients.[35] The role of training and retraining on the right way to use inhalers is evidenced in this study. Moreover, finding that patients from outside Makkah were more likely to use inhalers inappropriately supported the role of training and retraining as those patients usually receive less or no training and retraining on the correct way of using inhalers. In contrast to our study that reported that married patients were more likely to inappropriately use inhalers, other studies have shown that widowed patients were more likely to use inhalers inappropriately. They explained that to lack of family support and social isolation.[36, 37]The fining of our study could be explained by the fact that in our culture, married persons may have more responsibilities that hinder their training.

Although the frequency of inappropriate use of inhalers was higher among patients with uncontrolled asthma in this study, it was not significant. However, in another study carried out in Brazil,[38]relationship between inappropriate use of inhaler and asthma control was approved. Other numerous previous studies confirmed the association between inappropriate use of inhalers and poor asthma control.[4, 24-26, 28-31, 39)

V. CONCLUSION

The present study revealed that that improper inhaler use is common among adult asthmatic patients in Makkah. However, it was not significantly associated with poor asthma control. Appropriate use of metered-dose inhaler technique was higher among patients live in Makkah, single patients, higher educated patients, those with income ranged between 9001 and 10000 SR/month, younger patients, those treated regularly by family physicians, those who had no other chronic diseases, patients with higher number of use inhaler techniques per week, those who trained/retrained on the right way of using asthma inhaler and patients trained through YouTube or relatives compared to their peers.

VI. RECOMMENDATIONS

1. Organizing an educational program for asthmatic patients on how to properly use asthma inhalers with specific emphasis on older, low educated, low-income patients and those from outside Makkah.
2. Healthcare staff should pay more attention in training patients how to use inhalers in a proper way, they might utilize videos and posters in this regard.
3. Further study is recommended including asthmatic patients from other health facilities in Makkah.

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