Asthmatic Patients' Compliance of Inhaler Therapy and its Relation to their Health Beliefs

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Abstract:
Background:Asthma is a common non-communicable inflammatory disease that causes airway hyper-responsiveness, mucosal edema and mucus production. This inflammatory response ultimately leads to recurrent episodes of asthma symptoms. Therefore, asthma needs more attention to control symptoms and prevent exacerbations.The Suppression of inflammation early in the disease may potentially prevent change in lung function. While, noncompliance to inhaler therapy decreases the expected outcome of medication and can lead to poor treatment response, excessive use of medication, unnecessary costs, life-threatening exacerbations, and ultimately death. So, the existence of an association between compliance and outcomes of the therapy deserve attention, particularly by a health care provider. Patient noncompliance is expensive in terms of time, money, and other resources and can be decreased by changing patients' beliefs toward their medications. Objective: study was conducted to assess asthmatic patient compliance of inhaler therapy and its relation to their health beliefs. Setting: The study was carried out in one of the Alexandria University Hospital, Egypt. Subjects: A convenience sample of 100 adult patients with bronchial asthma was recruited to conduct this study. Tools: Two tools were used for data collection; Tool (I): Inhaler therapy compliance observational checklist. Tool (II): consists of two parts; part (1) Socio-demographic Characteristics and Clinical Data of adult patients with bronchial asthma, Part (2) Patients' health beliefs toward inhaled therapy questionnaireStructured Interview Schedule.Results: The main results of this study revealed that 92% of the studied patients were not complied with inhaler therapyand 65 % had negative beliefs toward inhaled therapy. Also, the result specified that there was a highly statistically significant correlation between patients' compliance to inhaler therapy and their health beliefs.Conclusion:It can be concluded that the majority of asthmatic patients have negative beliefs toward inhaled therapy, and incompetent compliance to inhaler therapy.Also, there was a positive significant correlation between compliance toward inhaler therapyand patients' beliefs.These findings highlight the lack of understanding of important role of correct inhaler technique in asthma management. Recommendations: This study recommended that greater emphasis should all patients need face-to-face demonstrate and re demonstrate training instructions for successful inhaler use. Inhaler technique must be rechecked, and education must be regularly reinforced to maintain correct technique. Handouts or videos alone or in combination should be available and distributed to all patients with bronchial asthma.
Key Words:Asthmatic patient, Compliance of inhaler therapy, Health beliefs
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I. Introduction

Asthma is one of the most common chronic diseases, it is estimated that 339 million people suffer from asthma worldwide[1]. The available evidence indicates that the prevalence of asthma has also increased over recent decades throughout the Middle East which has great impact and a significant burden on socioeconomic not only in terms of health care costs but also lost of productivity and reduced participation in the family life[2,3]. As defined by the World Health Organization "bronchial asthma is a respiratory disorder, characterized by recurrent attacks of breathlessness and wheezing, usually of allergic origin, which varies in severity from person to person"[4]. Up till now, inhaled therapy is one of the most effective medications and is recommended for persistent asthma of any severity. Long-term treatment with inhaled therapy markedly reduces the frequency and severity of asthmatic exacerbations[5-7]. So, inhalers are the cornerstone and play a key role in controlling asthma. They are designed to deposit inhaled drug directly to the lungs with minimal systemic side effects.

There are three types of inhaler therapy devices which are; Metered-dose inhaler, dry powder inhaler, and nebulizer all of them are clinically equivalent. However, since many different inhalers are available for inhaled therapy, the choice of the delivery device is important for optimizing the results of aerosol therapy. Traditional press-and-breathe Metered Dose Inhalers (pMDIs) can be used in every clinical and environmental

situation; their dosing is convenient and highly reproducible. Of great concern, that the efficacy of treatment and therapeutic outcomes are dependent on a patient's compliance to their dosing regimen and their ability to use their device correctly[8-11].Despite, the availability of highly effective pharmacotherapy, poorly controlled asthma is reported in up to 70–95% of patients in Western Europe and the Asian-Pacific region[12]. This suboptimal control is a result of poor patients' compliance toward regular use of inhaler therapy. Additionally, a survey in USA showed that four out five people with chronic asthma are not complying to this medicine, which leads to failure of treatment, excessive use of medication, unnecessary costs, life-threatening exacerbations, and ultimately death[13,14].

Studies have shown that improved compliance totreatment resulted in better clinical outcomes. However, improving it remains a challenge in practice because the factors contributing to poor compliance are diverse and multifaceted[15-17]. Furthermore, not all factors are modifiable and therefore are not amenable to interventions. One of these factors is patients' health beliefs. A better understanding of patients' beliefs about the disease and treatment plays an important, yet often overlooked role in treatment compliance [18-20]. Patients' decisions to follow recommended treatment are influenced to a large extent by their beliefs concerning the disease and treatment. For instance, patients often do not complywith their long-term treatment regimen due to a misguided belief that it is not necessary to take their medications when they are asymptomatic, or due to concerns with dependency or adverse effects associated with long-term treatment. They are often compliantwith their prescribed medications only when they believe that their treatment provides more benefit than harm[21-25].

However, there is little information available regarding the influence of patient beliefs on asthmatic patients' compliance to inhaler therapy. So, structured interview and observational study of adult patients with asthma was conducted to describe patients' beliefs of their disease and treatments as well as the compliance to inhaler therapyto give an insight about the potentially modifiable beliefs that are related to treatment noncompliance.

The aim of the Study: this study aimedto assess asthmatic patient compliance of inhaler therapy and its relation to their health beliefs.

Research Question: Is there a relationship between patient compliance of inhaler therapy and their health beliefs?

II. Material And Methods

Materials
ResearchDesign:
A descriptive correlational research design.
Sitting:
The study was carried out in the inpatient chest department with bed capacity sixty three beds in one of Alexandria University Hospital, Egypt.

Subjects:
This study comprised a convenience sampling of 100 adult male and female patients with the following inclusion criteria: adult patients, their age range from 21 to 60 years old, Able to communicate verbally, Willing to participate in the study, Had bronchial asthma and on inhaled therapy, and Free from any respiratory disorders such as COPD, ILF, T.B, pneumonia or any other associated disease as heart disease, anemia, musculoskeletal or neurological disorders.
They were recruited to conduct this study based on Epi-Info to estimate the sample size using the following parameters:
1. Population size: 250 patients
2. Expected frequency:50%
3. Acceptable error:10%
4. Confidence coefficient:95%
5. Sample size:100 patients

Tools for data collection:
Two tools were used to collect the necessary data for this study
Tool I: Inhaler therapy compliance observational checklist: this tool was developed by the researcher after review of related literature [26-30]to assess their level of compliance regarding inhaler therapy. It was composed of 14 itemsthat was classified intotwo main categories: Compliance instrument (3 items) and Inhalation techniques (11 items)that focused on steps related to; pre-inhalation, inhalation and post inhalation techniques. The response was measured through three points Likert scale ranging from (1) not done, (2) done incorrectly, and (3)"done correctly". The mean percentage of the total score was classified as follows: 1) mean percent score

less than 50% score means that the patient not compliance with inhaler.2) mean percent score 50% to less than 80% illustrated that the patient partial compliance with inhaler.3) mean percent score equal 80% and more refers to the patient competent compliance with inhaler correctly.

Tool II: Patients'health beliefs toward inhaled therapy questionnaire Structured Interview Schedule: this tool consists of two parts: Part I: Socio-demographic Characteristics; as age, gender, educational level, marital status, occupation, income and residence area. Patients Clinical Data: medical history, duration of disease, type of inhaler used, and duration of inhaler use. This part was developed by the researcher based on review of literature to obtain baseline data. Part II: this part was adapted from HandCH ,et al (2000)[31] to assess patients' health belief regarding inhaled therapy. It consists of 41 items and reverse score was done for negative statements. The response was measured through three pointsLikert scale ranging from (1) strongly disagree to (3) strongly agree. The overall scoring system ranging from 41 to 123 the higher score indicates a positive belief toward inhaler threapy. The total scores of belief were categorized into three levels as follows: Negative belief less than <33.3, Neutral belief from 33.33- 66.67 and Positive belief from 66.67 -100.

Method
- An official letter from the Faculty of Nursing was submitted to the general director of Alexandria University Hospital and to the Head of the Chest Department of the above mentioned hospital for obtaining permission to carry out the study after complete explanation of the study aim.
- Development of the study tools; Tool I(Inhaler therapy compliance observational checklist) was developed by the researcher based on the recent relevant literature review[26-30] to assess their level of compliance regarding inhaler therapy. Tool II (Patients'health beliefs toward inhaled therapy questionnaire Structured Interview Schedule) was adapted by researchers from Hand CH, et al (2000) [31] and translated into Arabic by researchers to assess patients' health belief regarding inhaled therapy.
- All tools were submitted to seven experts in the field of Medical Surgical Nursing to test its clarity and contentvalidity index for tool I(0.85) and tool II was (0.83) and the necessary corrections and modifications were carried out accordingly.
- Reliability of tools was tested by Cronbachs alpha coefficient test tool I was (0.803), tool II was (0.801) which means all tools were reliable.
- A pilot study was carried out on 10% of the study subjects (n=10) patients with bronchial asthma and meet inclusion criteria to test the clarity, applicability, relevance and feasibility of the tools. Necessary modifications were done prior to data collection for the actual study and those patients were excluded from the study sample.

Data collection:
- **Inhaler therapy compliance observational checklist**; this tool was collected through observing every patient by the researcher three consecutive times during using the inhaler therapy to measure their level of compliance and data was documented in observational checklist according to the pre-determined score. Total observation is (300 observations).
- **Patients' health beliefs toward inhaled therapy questionnaire Structured Interview Schedule:** this tool was collected by the researcher using structured face to face interviews based on a questionnaire. Each interview took about 20 to 30 minutes to be completed. The participants were asked about baseline data as age, gender, educational level, marital status, occupation, income and residence area. Patients Clinical Data: medical history, duration of disease, previous hospitalization due to asthma, associated disease and family history. Also, patients' health belief regarding inhaled therapy and it was recorded.

Collection of data covered a period of nine months, from the beginning of November 2018 till the end July 2019.

Ethical considerations:
Written informed consents were obtained from patients after explaining the aim of the study. Confidentiality and privacy of collecting data were assured. Anonymity and right to withdraw from the study was respected.

III. Indentations and Equations

Statistical Analysis:
After data collection, data were fed to the computer and analyzed using Statistical Package for Social Sciences (SPSS) version 23.Tabulated frequency and percentages were calculated. Descriptive statistics as frequency distribution, means, and standard deviation was used to describe different characteristics. Analytical statistics,which include Chi-square test, Monte Carlo test and Pearson coefficient test were used for testing relationships between categorical variables. Significant difference was considered if $p \leq 0.05$.

IV. Results

Table (1): Shows the frequency distribution of the studied patients with bronchial asthma, according to their socio-demographic characteristics.In relation to sex, the majority of the studied patients (83.0%) were female. Concerning, their age more than one third of patients (44%) were in the age group of 41-50 years and mean age were 44.60 ±9.23. It can be noticed that, slightly more than half (56, 0%) of them were illiterate.However, the lowest percentage (7%) holds bachelor degree. Also, more than two third of them (72%) were married. Nearly two third (62%) were house wife and the majority (88%) had not enough income. Also, (84%) of them live in urban area.

Table (1): Frequency distribution of the studied patients with bronchial asthma according to their socio-demographic characteristics.

Socio-demographic characteristics		Frequency of the studied patients(n=100)	
		No	%
Sex	Male	17	17.0
	Female	83	83.0
Age(years)	21-30	11	11.0
	31-40	18	18.0
	41-50	44	44.0
	51-60	27	15.0
	Min –Max	21.0 –60.0	
	Mean ±SD.	44.60 ±9.23	
Education	Illiterate	56	56.0
	Primary	12	12.0
	Intermediate	8	8.0
	Secondary	17	17.0
	Bachelor degree	7	7.0
Marital status	Single	13	13.0
	Married	72	72.0
	Widow	9	9.0
	Divorced	6	6.0
Occupation	Unemployed	9	9.0
	Employed	29	29.0
	Housewife	62	62.0
Income	Not enough	88	88.0
	Enough	12	12.0
Residence	Urban	84	84.0
	Rural	16	16.0

Table (2):Shows the frequency distribution of the studied patients with bronchial asthma according to their clinical data. The results illustrated that slightly more than half of patients (54%) had an asthma duration from 1 to less than 5 years. Also, nearly two third (60%) had five to ten of previous hospitalizations due to asthma. Furthermore, 78% of them had no associated disease and 75% had no family history of asthma.

Table (2): Frequency distribution of the studied patients with bronchial asthma according to their clinical data.

Clinical data		Frequency of the studied patients(n=100)	
		No	%
Asthma duration (years)	1 to less 5	54	54.0
	5 to less 10	23	23.0
	10 to less 15	6	6.0
	15 to less 20	12	12.0
	20 to more	5	5.0
Previous hospitalization due to asthma	No	19	19.0
	Less than 5 times	14	14.0
	5-10 times	60	60.0

	More than 10 times	7	7.0
Associated disease	No	78	78.0
	DM	3	3.0
	HTN	12	12.0
	Liver and kidney disease	3	3.0
	Cancer	4	4.0
Family history of asthma	Yes	25	25.0
	No	75	75.0

Table (3):Represents thestudied patients with bronchial asthma related to health beliefs regarding inhaler therapy. It can be noticed that Patients'beliefs perceive low mean percent score of inhaler therapy that means negative belief toward inhaler therapy.

Table (3): Distribution of the studied patientswith bronchial asthma related to health beliefs regarding inhaler therapy (n = 100).

Patients' health belief regarding inhaler therapy	No.	%
Negative <33.3	65	65.0
Neutral 33.33-66.67	35	35.0
Positive <66.67	0	0.0

Total score
  Min. –Max.
  Mean ±SD.
	60.0 –95.0
	71.62 ±12.06	

Mean percentage scores
  Min. –Max.
  Mean ±SD.
	23.17 –65.85
	32.34 ±14.71	

Table (4):Represents thestudied patientswith bronchial asthma related tocomplianceregarding inhaler therapy. It can be noticed that low mean percent score of patients compliance toward inhaler therapy, which represent that the majority of patients' not compliance with the inhaler therapy.

Table (4): Distribution of the studied patients with bronchial asthma related to complianceof inhaler therapy(n = 100)

Patients' compliance of inhaler therapy	Average observation	
	No.	%
<50% (non-compliance)	92	92.0
50–<75 (partial compliance)	8	8.0
≥75 (compliance)	0	0.0

Total score
  Min. –Max.
  Mean ±SD.
	22.0 – 54.0
	30.0 ± 6.83	

Mean percentage scores
  Min. –Max.
  Mean ±SD.
	28.21 - 69.23
	38.46 ± 8.75	

Tables (5):Reflect the correlation between compliance of inhaler therapyand health beliefs among the studied patients. According to this table, there is a positive significant correlation between compliance of inhaler therapy and the health beliefs of the patients where r =0.705* p<0.001*.

Table (5): Correlation matrix between compliance of inhaler therapyand health beliefs regarding inhaler therapy among the studied patients.

		Patients' belief regardinginhaler therapy
Patients'compliance of inhaler therapy	r_s	0.705[*]
	P	<0.001[*]

r: Pearson coefficient
*: Statistically significant at p ≤ 0.05

Tables (6):Reflect Correlation between socio-demographic ,clinical data, health beliefs and compliance of inhaler therapyamong the studied patients. According to this table, there was a positive significant correlation between age, education, asthma duration and the health beliefs. Also, there was a positive significant correlation between education, asthma duration of the patients and compliance of inhaler therapy where p<0.001*. On the other hand, there was a significantnegative correlation between previous hospitalization and the patient health belief and compliance of inhaler therapy where p<0.001*.

Table (6): Correlation matrix between Socio-demographic, clinical data, health beliefs and compliance of inhaler therapyamong the studied patients.

Socio-demographic, clinical data		Health belief	Compliance
Age	r_s	0.267*	0.104
	p	0.017*	0.304
Education	r_s	0.503*	0.663*
	p	<0.001*	<0.001*
Income	r_s	0.063	0.122
	p	0.531	0.226
Asthma duration	r_s	0.311*	0.540*
	p	0.002*	<0.001*
Previous hospitalization	r_s	-0.234*	-0.508*
	p	0.019*	<0.001*

r_s: Spearman coefficient
*: Statistically significant at p ≤ 0.05

III. Discussion

Inhaled therapy is an effective treatment for asthmatic patients. It reduces the severity of asthma symptoms, improve peak flow measurements and other measures of lung function, prevent exacerbations and possibly prevent long-term lung remodeling **Quirt et al. (2018)**[32]. However, the effectiveness of inhaler therapy depends very closely on patients' health beliefs and levels of their compliance regarding such treatment.In this respect, the result of the present study revealed that patients beliefs perceive low mean percent score of inhaler therapy that means negative belief toward inhaler therapy. This may be attributed to that, slightly more than half of patients were females, old age, illiterate, housewives and the majority of them reported that they had not enough income. This result is in harmony with **Rahim et al. (2013)**[33]who found that patients had a negative belief to inhaled therapy and use for a longtime. Also, another study demonstrated the same result, as low socioeconomic areas; older with low levels of literacy was negative inhaler therapy beliefs with asthma include the fear of being overmedicated, developing tolerance or an addiction to inhaler therapy, or serious side effects and concerns that inhaler therapy is a form of medical experimentation **(George et al. 2014)**[34].

The results of the current study are in agreement **Taot Le et al. (2014)**[35] who was proved that negative beliefs about asthma therapy were more prevalent among minority patients and partially mediated the relationship between minority status and compliance to therapy.In this context, **Brown and Bussell (2011)**[36]mentioned that patients often do not complywith their long-term treatment regimen due to a misguided belief that it is not necessary to take their medications when they are asymptomatic. Also, **Foster et al. (2012)** [37]declared that, patients often compliantwith their prescribed medications only when they believe that their treatment provides more benefit than harm.

Inhalation devices are part of the mainstay of management in bronchial asthma, during the long-term treatment, however, their effectiveness largely depends on the inhalation technique. A variety of different complex factors which include psychological, social, and medical issues can influence compliance with asthma therapy. Poor handling and wrong inhalation technique are associated with decreased medication delivery and poor disease control,**Melani et al. (2011)** [38] **and Arora et al. (2014)**[39]. Accordingly, the result of the present study showed that the majority of the study sample was not compliant with the use of inhaler therapy and observed among most of the patients 92%. This may be attributed to that, slightly more than half of patients were older, illiterate, house wives and had inadequate income, nearly more than half of patients had asthma duration from one to less than five years, two third of them had previous hospitalization less than 10 times and the majority of them had no family history of bronchial asthma.The deficit in proper inhaler therapy can be

attributed to lack of education provided by physicians, nurses and pharmacists as they often did not have sufficient time to train patients regarding proper technique of inhaler used.

The results of the present study go on the same line with **Tageldin et al. (2015)** [40]**,** who mentioned that despite that inhalation devices are a mainstayin themanagement of asthmatic patients, inhalationtechnique is very poor among asthmatic patients while accounts for poor control of asthma.Furthermore,**Baddar et al. (2013)** [27]**,** reported that the majority of the asthmatic patients did not use their inhalers correctly. **Jahedi et al. (2017)** [41]stated also that the majority of asthmatic patients did not use their inhalers correctly, despite having confidence in their technique. Additionally, these results supported by **Tariq et al.(2019)** [42], who showed that the inappropriate use of metered-dose inhalers was observed among most of the patients 64.8%. Furthermore, **Pothirat et al. (2015)** [43] clarified that inhalation technique in chronic obstructive pulmonary disease (COPD) patients without face-to-face training was mostly unsatisfactory compliance, especially in patients with low education levels.Moreover, **Gamble et al. (2009)** [44]stated that a significant proportion of patients with difficult asthma did not satisfactory compliantto the prescribed inhaled and oral corticosteroid therapy.

This result contradicted with the study conducted withŞen et al. (2018) [45] which illustrated that the overall proper inhaler technique rate was 65.5% in outpatient and hospitalized groups, the most selected forms of inhaler therapy was metered dose inhaler (MDI).**Coelho et al. (2011)** [46]**,PurohitAet al. (2017)** [47] reported that the majority of patients had appropriate inhaler techniqueafter educational interventions,especiallydemonstration of the technique that reduces the errors in inhalation technique. Also, a study from Brazil documents that an appropriate inhalation technique is associated with the control of asthma symptoms. However, **Ca´rdenas et al. (2012)** [48]argue that more evidence is required in order to state with certainty that inhaler technique is associated with asthma control.

Recent research has begun to explore relationships between patient beliefs about their asthma medications and compliance to prescribed inhaler therapy. In a study of adults with asthma, positive beliefs regarding inhaler therapy were associated with greater compliance, whereas concerns about safety and addiction were correlated with non-compliance**Chiu C et al. (2014)** [49] **and Rahim et al. (2013)** [33]. Accordingly, the result of the present study showed a positive significant correlation between compliance of inhaler therapyand the health beliefsof the patients. They found that while asthma patients generally believed the use of medications was necessary to control their disease. The results of the current study are in agreement with **Tavasolil S et al. (2014)** [50] reported that there was a significant correlation between asthmatic patient's compliance of inhaler therapy and their belief. Also, **Taot Le et al. (2014)** [35]concluded that there were multiple negative asthma medication beliefs were associated with lower adherence.

Tavasoli1 et al. (2014) [50]**and Pothirat et al. (2015)** [43] reported that low education level was a statistical significant factor associated with incorrectly performing the inhalation technique which means that there was a significant correlation between compliance and patient's literacy level. Also, they specified that patients' age not significantly correlated with patients' belief or compliance.This result goes in the same line with the result of the present study where there was a significant positive correlation between patients' health beliefs as well as compliance toward inhaled therapy and educational level, asthma duration. Also, there was no statistically significant correlation regarding patients' age and income with beliefs and compliance. More and more, the present study showed a significant negative correlation between pervious hospitalization due to asthma disease and beliefs and compliance of inhaled therapy. This result was contradicted by **Pothirat et al. (2015)** [43]who explained that there was no correlation between the patients' compliance and length of time having adiagnosis of asthma. Also, Şen et al. (2018) [45]concluded that there was a significant relation between the number of hospitalizations and correct inhaler application technique, awareness of the diagnosis and maintenance of inhaler therapy was significant in hospitalized patients. Patients who know their diagnosis, were using inhaler devices correctly.

In the light of this, it was noticed that patients have diverse beliefs concerning their disease and inhaler therapy compliance, which are significantly influenced by their personal, cultural and socioeconomic environment.Inhaler devices are an important part of the armamentarium of clinicians who treat pulmonary diseases. The effectiveness of inhaled drugs depends on the patient's ability to use the inhaler device correctly and theircompliance to the treatment regimens. Also, it is likely to be influenced by their opinions and feelings about the use of the inhaler as a mode of therapy. The patients' beliefs about their illnesses and therapy, play a key role in determining their compliance to the treatment. So, it isn't surprising that nursing understanding of patient' belief of the disease and treatment can increase the chances of achieving better treatment outcomes

IV. Conclusion

This study emphasizes on patients' beliefs of their disease and treatments as well as the compliance to inhaler therapy to give an insight about the potentially modifiable beliefs that are related to treatment noncompliance. So, this study concluded that the majority of asthmatic patients have negative beliefs toward

inhaled therapy, and incompetent compliance to inhaler therapy. Also, there was a positive significant correlation between compliance toward inhaler therapy and patients' beliefs.

Recommendations
These findings highlight the lack of understanding of the important role of correct inhaler technique in asthma management through:
- Reinforce the need for nurses to actively explore patients' beliefs about their medications on a regular basis and to address misperceptions or concerns directly as these may be important barriers to treatment compliance.
- Educational programs should be developed and implemented to dispel the misconceptions and inadequateknowledge, beliefs, attitudes, perceptions of the patients towards inhaler therapy.
- Conduct face-to-face demonstrates and redemonstrate for an asthmatic patient about correct steps of using inhaler therapy.
- Establish training instructions / program bout inhaler therapy benefits, drawback form not compliance with inhaler therapy.
- Provide each patient with handouts or videos, alone or in combination about inhaler technique.

References

[1]. Global Asthma Network. The Global Asthma Report. Auckland, New Zealand: Global Asthma Network 2018.
[2]. Global Initiative for Asthma (GINA). Global strategy for asthma management and prevention 2014. Retrieved from http://www.ginasthma.com. [Accessed on: Oct, 2019]
[3]. Nunes C, PereiraM ,Morais M. Asthma costs and social impact .Asthma Research and Practice 2017; 3: 1.
[4]. WHO. Adherence to Long-term Therapies: Evidence for Action. World Health Organization. Geneva, Switzerland 2003. http://www.who.int/en/ [accessed 25 November 2008].
[5]. Jamee R, Castillo MD, Stephen P .Asthma exacerbations: pathogenesis, prevention and treatment .J Allergy Clin Immunol Pract 2017; 5(4): 918–927.
[6]. Stein S W & Thiel C G. The History of Therapeutic Aerosols: A Chronological Review. Journal of aerosol medicine and pulmonary drug delivery 2017; 30(1): 20-41.
[7]. Rogueda P & Traini D. The future of inhalers: How can we improve drug delivery in asthma and COPD? Expert review of respiratory medicine 2016; 10(10):1041-1044.
[8]. Andrea S Melani. Inhalatory therapy training: A priority challenge for the physician 2015; 78: 000. at: https://www.researchgate.net/publication.
[9]. Barber P, Roberston D. Essentials of pharmacology for nurse.3rd.USA:Elsevier 2015;139-42.
[10]. Worsnop C. Combination inhalers for asthma. Australian prescribe 2015:28(2):26-8
[11]. Badrul A, Chowdhury M. The FDA and Safe use of long acting Beta agonists in the treatment of asthma.N EngI J Med 2010;362(2):1169.
[12]. Al-Jarky FA, Al-Musallam SS. Use of Controller Medications among Asthmatic Patients: A Family Medicine Centre based Study. Kuwait Medical Journal 2007; 39 (3): 238-242.
[13]. Schayck CP, Heijden FM, Boom G, et al. Under diagnosis of asthma: is the doctor or the patient to blame? The DIMCA project. Thorax 2000; 55:562-565.
[14]. Boulet LP. Perception of the role and potential side effects of inhaled corticosteroids among asthmatic patients. Chest 1998; 113:587-592.
[15]. Bonini M & Usmani O.S. The importance of inhaler devices in the treatment of COPD. COPD Research and Practice 2015; 1(1): 9.
[16]. Boulet LP, Vervloet D. Adherence: the goal to control asthma. Clinics in chest medicine 2012; 33(3):405-417.
[17]. Usmani OS. New developments in inhaled drugs: within and beyond the lungs. Respiration 2014; 88(1): 1-2.
[18]. Chiu KC, Boonsawat W, Cho SH ,et al. Patients' beliefs and behaviors related to treatment adherence in patients with asthma requiring maintenance treatment in Asia. The Journal of asthma 2014; 51(6): 652-659.
[19]. Foster JM, Smith L, Bosnic-Anticevich SZ, et al. Identifying patient-specific beliefs and behaviors for conversations about adherence in asthma. Internal medicine journal 2012; 42(6): e136-e144.
[20]. Brandstetter S, Finger T, Fischer w, et al. Differences in medication adherence are associated with beliefs about medicines in asthma and COPD. Clinical and translational allergy 2017; 7, 39.
[21]. Brown MT & Bussell JK. Medication adherence: WHO cares? Mayo Clinic proceedings 2011; 86(4): 304-314.
[22]. Moroni-Zentgraf P. Impact of patient needs on design and usage of an inhalation device in respiratory medicine. Respiratory Drug Delivery Europ. 2013; 1: 141-152.
[23]. Goodwin R & Heraghty J. Do healthcare professionals understand asthma devices? Archives of disease in childhood. Education and practice edition 2015; 100(6): 302-305.
[24]. Simpson AJ, Honkoop PJ, Kennington E, et al. Perspectives of patients and healthcare professionals on Health for asthma self-management. The European respiratory journal 2017; 49(5): 1601966.
[25]. Takaku Y, Kurashima K, Ohta C, et al. How many instructions are required to correct inhalation errors in patients with asthma and chronic obstructive pulmonary disease? Respiratory medicine 2017;123: 110-115.
[26]. Salama E. Effect of implementing self-management protocol on asthma control level and activities of daily living among patients with bronchial asthma Unpublished Doctorate thesis, Faculty of Nursing, Alexandria University 2018.
[27]. Baddar S ,Jayakrishnan B.Asthma control: importance of compliance and inhaler technique assessments. J Asthma 2014; 51 (4):429-34.
[28]. Soussan D, Liard R, Zureik M, Touron D, Rogeaux Y, Neukirch F. Treatment compliance, passive smoking, and asthma control: a three year cohort study. Arch Dis Child 2003; 88(3):229.
[29]. Linder P,Linder A.Gender differences in asthma inhaler compliance. Conn Med2014;78(4)207-10.
[30]. Bras J.Assessment of inhaler technique employed by patients with respiratory disease in southern.Brazil Pneumol 2014;40(5):513-20.

[31].   Hand CH , Morley S , AdamsM . Developing a questionnaire to measure patients' beliefs about inhaler treatment: a pilot study. Asthma Gen Pract2000;8(1):9–11
[32].   Quirt J, Hildebrand KJ, Mazza J, et al. Asthma. Allergy, asthma, and clinical immunology 2018; 14(2): 50.
[33].   Rahim A, Abuduli M , Ahmed Z. Noncompliance with inhaled corticosteroid (ICS) among asthma patients in Yazd city, Iran. Malaysian Journal of Public Health Medicine 2013; 13: 77-87.
[34].   GeorgeM,Topaz M &Rand C, Inhaled corticosteroid beliefs, complementary and alternative medicine, and uncontrolled asthma in urban minority adults. J Allergy Clin Immunol 2014; 134(6): 1252–1259.
[35].   Tao T . Le, Bilderback A, et al. Do Asthma Medication Beliefs Mediate the Relationship Between Minority Status and Adherence to Therapy? Journal of Asthma 2014;45:33–37.
[36].   Brown MT & Bussell JK. Medication adherence: WHO cares? Mayo Clinic proceedings 2011; 86(4): 304-314.
[37].   Foster JM, Smith L, et al. Identifying patient-specific beliefs and behaviors for conversations about adherence in asthma. Internal medicine journal 2012; 42(6): e136-e144.
[38].   Melani AS, Bonavia M, Cilenti V, Cinti C,et al. Inhaler mishandling remains common in real life and is associated with reduced disease control. Respiratory medicine 2011; 105(6): 930-938.
[39].   Arora P, Kumar L, Vohra V,et al. Evaluating the technique of using inhalation device in COPD and bronchial asthma patients. Respiratory medicine 2014; 108(7): 992-998.
[40].   Tageldin MA, Wagih K , Maher O. Study the pattern of bronchial asthma among outpatients clinic at Sohag and Akhmeem Chest Hospitals. Egyptian Journal of Chest Diseases and Tuberculosis 2015; 64(2); 313-323.
[41].   Jahedi L, Downie SR, Saini B, et al. Inhaler Technique in Asthma: How Does It Relate to Patients' Preferences and Attitudes Toward Their Inhalers? Journal of aerosol medicine and pulmonary drug delivery 2017; 30(1): 42-52.
[42].   Tariq A, Mohammad K & Saqib F . 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. International Journal of Current Medical Science and Dental Research 2019; 1 (3) :12-22.
[43].   Pothirat C, Chaiwong W , Phetsuk N et al. Evaluating inhaler use technique in COPD patients. International Journal of COPD 2015;10: 1291–1298.
[44].   Gamble J, Stevenson M, McClean E et al. The prevalence of non-adherence in difficult asthma. Am J Respir Crit Care Med 2009 ; 180(9):817-22.
[45].   Şen E, Gönüllü U, Ekici Z & Kurşun N. Assessment of inhaler technique and treatment compliance of hospitalized patients and outpatients in a university hospital. Journal of Ankara University Faculty of Medicine 2018;59:1–6.
[46].   Coelho A C, Souza-Machado A, Leite M, et al. Use of inhaler devices and asthma control in severe asthma patients at a referral center in the city of Salvador, Brazil. Jornal brasileiro de pneumologia 2011; 37(6): 720-728.
[47].   Purohit A, Patel A M, et al. An evaluation of impact of educational interventions on the technique of use of metered-dose inhaler by patients Indian J Pharmacol 2017; 49(2): 194–200.
[48].   Cardenas G V, Daniel S H, et al. The Inhaler Technique Associated with Asthma Control? Article in Journal of Asthma 2012;49(2):170-1.
[49].   Chiu K C& Boonsawat W. Patients' beliefs and behaviors related to treatment adherence in patients with asthma requiring maintenance treatment in Asia J Asthma 2014; 51(6): 652–659.
[50].   Tavasoli S, Heidarnazhad H & Kazemnejad A. Factors Affecting Patients' Compliance to Metered-Dose Inhaler Drugs in Two Asthma Clinics in Tehran, Iran. J Allergy Asthma Immunol 2014; 5(4): 187-193.