



WWJMRD 2020; 6(12): 14-21  
www.wwjmr.com  
International Journal  
Peer Reviewed Journal  
Refereed Journal  
Indexed Journal  
Impact Factor MJIF: 4.25  
E-ISSN: 2454-6615

**Hellen Kagwaini**  
Master's in nursing student,  
Mount Kenya University  
School of Nursing, Thika,  
Kenya.

**Catherine Syombua Mwenda**  
Associate Professor, South  
Eastern Kenya University,  
Kitui, Kenya.

**Evelyn Gesare Ogugu**  
Ph.D. Ongoing, University of  
California, Davis, California.

**Correspondence:**  
**Hellen Kagwaini**  
Master's in nursing student,  
Mount Kenya University  
School of Nursing, Thika,  
Kenya.

## Adherence to Asthma Control Measures Among Adults: An Assessment of Patient-Based Factors Among Patients in Mama Lucy Kibaki Hospital, Kenya

**Hellen Kagwaini, Catherine Syombua Mwenda, Evelyn Gesare Ogugu**

### Abstract

Non-adherence to asthma control measures arises from different factors such as unintentional non-adherence whereby patients may be faced with financial constraints to purchase medications, inadequate environmental control measures, inadequate knowledge on asthma and poor techniques in using inhalers. Intentional non-adherence to asthma control measures arise from attitude and beliefs. This study assesses patient-based factors that influence adherence to asthma control measures in Mama Lucy Kibaki Hospital, Kenya. The target population was 132 patients registered and attending asthma clinic in Mama Lucy Kibaki Hospital, Kenya. A census was conducted so as to include all the patients in the study. Data was collected from the patient clinic-based adherence data for the past 12 weeks patients' clinical encounters. The data was obtained from electronic data provided by the hospital administration and with the patients' consent. A questionnaire was used to collect data on patients' knowledge, attitude and perceptions. Data collected was entered in SPSS version 26 for analysis. The main finding of the study was that adherence to asthma control measures was not satisfactory. The Chi-square test also revealed that patient-based factors including attitude, knowledge, education, proper use of inhaler and cigarette smoking significantly influenced adherence to asthma control measures. Due to the knowledge gaps identified among the patients on asthma control measures the study recommends that government and non-government factors initiate education and awareness campaigns on asthma medication and other management measures so as to help in creating awareness and thus hasten adherence to asthma control measures.

**Keywords:** asthma, control measures, patient-based

### Introduction

Asthma is expensive to treat considering that it is not curable hence the need to worry about adherence to treatment regimens. The costs vary from one country to another but the available information from USA and Europe indicate that the mean cost of treating Asthma per year per patient has a mean of USD 3,100 and USD 1,900 respectively. Besides, asthma has social implications. In addition to draining individuals, insurance companies and governments financially, it is associated with increased hospital admissions during acute episodes that lead to indirect costs such as loss of working days, low work productivity as well as congestion in hospitals (Nunes, Pereira, & Almeida, 2017). World Health Organization (WHO) in 2014 indicates asthma is a major cause of poor quality of life which impacts on work, recreational, physical activity as well as increased health costs. Indeed, asthma is not curable therefore, the key clinical focus for long term asthma management is to achieve symptoms control, risk reduction, improvement in activity, improved lung function, prevent recurrent attacks and minimize side effects of asthma medications (Global Initiative for Asthma, GIA, 2015).

There are established and effective self-management strategies to help the patient control asthma. As per (GIA, 2015) asthma self-management calls for health care provider to provide asthma action plan, patient regular medical reviews, patient education and patient actively monitoring asthma symptoms. To achieve this, it calls for patient focused care in

asthma which includes tailoring patient needs such as education, support and training needs. Non-adherence to asthma control measures arises from different factors such as unintentional non-adherence whereby patients may have financial constraints to purchase medications, inadequate environmental control measures and inadequate knowledge on asthma and poor techniques while using inhalers. Intentional non-adherence to asthma control measures arise from attitude and beliefs (WHO, 2003). Smits *et al.*, (2017) found that a myriad of factors are responsible for diagnosis of uncontrolled asthma. For instance, poor inhaler techniques can lead to poor administration of medication causing unnecessary of conditions. Existence of comorbidities and other conditions that mimic asthma symptoms can lead to incorrect diagnosis. Besides, persistent exposure to allergens can be responsible for uncontrolled asthma.

Poor adherence to asthma medications have been replicated in many studies. Chiu *et al.*, (2014) found that only half of the patients who were adherent to medications had good treatment outcomes. More emphasis has been put on reinforcing inhaler technique maintenance during continuous therapy due to instability in use of inhaler devices (Azzi *et al.*, 2017). Azzi *et al.*, (2017) further echoes that patients with high self-adherence are able to maintain correct inhaler techniques. In Africa, low adherence to medications have been reported, Cameroon 44.8 % and Nigeria 80.4 % (Ngahane *et al.*, 2016; Desalu *et al.*, 2012).

Additional studies have showed that uncontrolled asthma is associated with incorrect use of inhalers, poor adherence to inhaled corticosteroids and use of oral medications to treat symptoms (Desalu *et al.*, 2012). Conversely, asthma control was more than half of the patients in Italy (Allegra *et al.*, 2012). In Kenya, Dale (2010) in his study in a teaching and national referral hospital chest Clinic-Kenyatta National Hospital found non-adherence to asthma prescribed drugs at 14.2% with high percentage of poorly controlled asthma 64.7 %. The non-adherent patients cited lack of money and forgetfulness as a major contributor to this. There are no recent researches done on asthmatic patients to establish adherence and asthma control. Therefore, this research aims to assess the determinants of adherence to asthma control measures which the adult asthmatic clients attending chest clinic at Mama Lucy Kibaki hospital employ in order to control the asthma symptoms and exacerbations.

### Statement of the Problem

Globally, asthma treatment adherence rates vary. For instance, in Brazil the self-reported adherence rate was high 83.9% (Forte *et al.*, 2016). While in Northern Ireland an adherence rate of 88% was observed on patients after initiation therapy due to denial of asthma diagnosis (Gamble *et al.*, 2009). In Africa adherence was reported in Nigeria at 80.4 % (Desalu *et al.*, 2013). In Kenya adherence as reported by Dale (2010) on asthma medications was high at a rate of 85.8% with poor asthma control. However, in Mama Lucy Kibaki hospital the records showed an upward trend of asthmatic attack cases being treated in the accident and emergency unit according to medical records quarterly report. Between September and December 2016, 80 asthmatic attack cases were treated in the emergency department (MOH 204B, 2016). According to annual

medical report, prevalence of asthma was 4.7% in 2014 and by December 2016 the prevalence had risen to 6.14 % (MOH 204B, 2014, 2016). Follow up of the patients has also been a challenge although since August 2016 asthmatic patients are being followed up in chest clinic once a week. Research on assessing determinants of adherence on asthma control measures has not been carried out in the facility. It is therefore important to find out the patient-related factors asthma treatment adherence as a chronic condition and how to manage and control asthma exacerbations.

### Objective of the Study

The objective of the study is to assess the patient-related factors that influence adherence to asthma treatment among patients in Mama Lucy Kibaki Hospital, Kenya.

### Empirical Literature

#### Adherence to Asthma Control Measures

According to World Health Organization, adherence refers to the extent in which the patient's behavior while taking medication and executing lifestyle changes corresponds with agreed recommendations from a health care provider (WHO, 2003). Adherence to medications and asthma control measures poses a great challenge in management of asthma. There are no standardized methods to measure adherence and in most cases patients over report adherence to treatment in clinical practice. To improve adherence, the health care providers need to tailor the needs of patient on health and device methods of effective communication (Bender, 2016).

According to the Kenya National Asthma Guidelines (2011), two classes of drugs used to treat asthma are classified into two groups i.e. Relievers (bronchodilators) and controllers (anti-inflammatory drugs). Relievers are used as-needed for rapid relief of asthma symptoms and these include inhaled short-acting beta-2 agonists (SABAs) and inhaled anticholinergic. However, controllers have anti-inflammatory effects are used on a daily basis to keep asthma under control. These include (inhaled corticosteroids (ICS) and leukotriene modifiers) and long-acting bronchodilators (long-acting beta-2 agonists (LABAs) the ideal route of administration of most of these medicines is inhalation since the drug is directly delivered in the airways. Inhaled corticosteroids (ICS) form the 'backbone' of asthma control.

Global Initiative for Asthma (2015) recommends a stepwise approach to pharmacologic treatment to achieve control of asthma while attempting to minimize adverse effects. The use of low dose ICS is the first line controller medication even to those with infrequent symptoms to reduce the risk of serious exacerbations. Even though there are asthma guidelines from GIA (2015, 2017) adult asthma remain inadequately managed with many patients receiving improper treatment. With increasing morbidity and mortality international guidelines have been developed for use both for admitted patients and outpatients (GIA, 2015). Non adherence to these guidelines has been reported in different studies and is a major cause for poor controlled asthma, frequent emergency department visits and hospitalization (El Sony *et al.*, 2013).

Sastre *et al.* (2016), reported half of the patients were using controller medications and out of this only 18% had controlled asthma, 58% were partially controlled and

24% had uncontrolled asthma. More than half of the patient agreed that it was not necessary to take daily medication if the symptoms were not regular. In a similar study, Alzahrani *et al.* (2015) found that 55.2% patients were using metered dose inhalers, with 72.2% using relievers alone. In a different study in Kerala 76% asthmatic patients were unable to demonstrate correct use of inhalers despite 91% indicating that they had acquired the proper inhaler technique (Sulaiman & Panicker, 2017).

Apart from medication adherence various factors need to be adhered to, in order to control asthma exacerbations such as control allergens, avoidance of smoke, dust, pollen and animal fur and control of frequent colds and rhinitis.

Allergic rhinitis is an immunological response modulated by immunoglobulin E (IgE) and is characterized by rhinorrhea, sneezing and nasal congestion with postnasal drip commonly occurring. It occurs due to organic triggers such as dust mites, mold, pollen allergens and animal dander's. Presence of allergic rhinitis increases asthma exacerbations, emergency department visits and hospitalizations due to asthma (Ozdoganoglu & Songu, 2012).

### Patient-Based Factors and Adherence to Asthma Control Measures

Patient-based factors as discussed in Kaptein *et al.*, (2013) relate to knowledge, attitude, perceptions and other personal characteristics such as age, education, gender amongst others that are specific to the patient under asthma treatment. A study by Alzahrani *et al.* (2015) despite asthma patient stating that they had received asthma education, knowledge on asthma triggers was inadequate with 56% and 93.5% unaware that active smoking and passive smoking were triggers to asthma exacerbations respectively. The researchers also found that most of the patients did not know that bedroom carpet (87.8%), unsealed mattress (88%) and workplace triggers (71.2%) could trigger asthma. Alzahrani *et al.* (2015) added that majority of patients who had received asthma education as demonstrated by 79.5% had stopped asthma therapy once they felt better, 62.2% initiated or increased the steroid therapy and 92% increased or initiated relievers once the asthmatic attack was perceived.

According to Hamdan *et al.*, (2013), there is evidence that improper use of inhaler devices observed among patients was highly significant in association with patients who had not received asthma education and had no regular clinic follow up. Conversely, in England, Nguyen *et al.*, (2011) reported that 89% of patients reported receiving some form of self-management education on asthma with 48% of patient having been taught how to use peak flow meter to adjust their daily medication and 29% with written asthma action card. According to Nguyen *et al.*, (2011), face to face education was also demonstrated to improve asthma medication adherence with improved symptom management by the patients.

In Zambia, Marsden *et al.* (2016), carried out a cross sectional study among 1540 participants on asthma knowledge and perception. In their study, asthmatic patients had more knowledge on symptoms like chest tightness (90.5% versus 75.1%) and wheezing (91.4% versus 77.7%) compared to non-asthmatics. Asthmatic participants were 7.6% (n 116), adult asthmatics on treatment 78.5%. Among the asthmatic patients, 71.1%

were on oral SABA, while 7.7% on antihistamines. Only 18.2% were using inhaled steroids with 41% on inhaled SABA. Only 2.6% were using LABA. Asthmatic patients had more knowledge on symptoms like chest tightness (90.5% versus 75.1%) and wheezing (91.4% versus 77.7%) compared to non-asthmatics.

Smoking has been associated with reduced lung function due to destruction of lung parenchyma and was associated with new onset of asthma for participants with atopy (Anto *et al.*, 2010). Polosa & Thomson (2013) revealed that cigarette smoking affects asthma severity with increased hospital visits and reduced quality of life. They also argued that poor control of asthma was attributed to chronic inflammatory response and airway remodeling due to oxidative compounds. This further leads to non-response to inhaled corticosteroids. Persistent airflow obstruction develops in smokers due to accelerated loss of lung function in adulthood and this could also be worsened by other environmental factors (Thomson & Spears, 2011). In Singapore Tan *et al.* (2012) carried a study on nonsmokers and smokers. This study showed that smokers presented with more nocturnal symptoms like wheezing, persistent cough and altered quality of sleep than nonsmokers.

In spite of good knowledge of asthma management by patients several studies have revealed various adherence issues on asthma medications. In Brazil, Forte *et al.*, (2016) examined 275 patients and 86.9% reported high self-adherence with 13.1% having poor adherence. Compared to an earlier study carried out by Souza-Machado *et al.*, (2010) good adherence was lower 70.9% with non-adherent patients citing limited resources due to lack of transport and adverse effects of asthma medications. In India low adherence was reported in males 91.25% compared to females 71.6%. Knowledge on asthma among patients was 66.8%, with 51.94% aware smoking worsens asthma and 44.8% stopping controller therapy (Shamkuwar *et al.*, 2016). In a cross sectional study carried out in Cameroon with asthmatic patients (n= 201) revealed low adherence of 81.1% was reported, with females (58.6%) having better adherence compared to males (48.5%) (Ngahane *et al.*, 2016).

For a patient who perceives his asthma as episodic in nature will not see the need to take preventive asthma medications and this leads to uncontrolled asthma. Patients' beliefs on what has caused the illness, how long it will last and whether it is curable or controllable shapes coping behavior and in turn determines the self-management behavior (Kaptein *et al.*, 2013). Misconceptions on inhalers being addictive have been reported in many studies. In a study conducted by Alzahrani *et al.* (2015), in Riyadh found that 34.5% of asthmatic adults felt that therapy was addictive whereas 37.2% indicated it was not safe to use inhalers for long term therapy. In Australian study among ninety-nine asthmatic patients, 33% reported they took the controller medications when they experienced acute symptoms. About 48% disliked ICS while 24% were not on treatment for asthma. With 33% reporting fearing steroid therapy side effects and 33% thought the ICS therapy was addictive and they would become dependent on them (Foster *et al.* 2011). Among Zambian asthmatics participants, 45.7% perceived that oral medicines are better than inhalers in asthma management and 37% of participants perceived that inhalers are addictive. More than half of participants (60.4%) felt that asthma was a serious health problem in

Zambia, 36.9% reported that hospitalization was preventable whereas 54.7% stated that symptoms are preventable (Marsden *et al.*, 2016).

Merghani *et al.* (2012), investigated patients on attitude towards asthma in two tertiary hospitals in Sudan. Among the patients, 62% accepted their diagnosis, and 27% felt they had a combination of allergy and asthma while 27% did not accept their diagnosis as asthma. The patients who used inhalers when prescribed were 54% and 12% declined to use inhalers and were afraid to get long-term dependence from inhalers. The other 44% used non-medical methods such as honey, cigarettes, Quran and acupuncture to treat their asthma symptoms. In a cross sectional study carried out in Kenyatta national hospital chest clinic on adherence to medications. It was found that despite 85.8% of patients being adherent to treatment, the control of asthma was poor at 64.2 % (Dale, 2010). Dale (2010) further found that among the patients with non-adherence cited different reasons such as lack of money to buy drugs 83.7%, stopping medication due to side effects 14% and forgetfulness at 16.3%.

Age has been reported to be a factor that affects adherence. For instance in Egypt, Rifaat *et al.*, (2013) found that older patients had better adherence to asthma treatment. Use of combined therapy in one device improved adherence compared to multiple devices. Similarly in Korea the younger asthmatic patients had a higher loss to follow up and discontinuing treatment citing improved symptoms (Kang *et al.*, 2013).

**Methodology**

The study was conducted in Mama Lucy Kibaki Hospital Asthma Clinic in Kenya. An analytical cross-sectional study was used to conduct the study. The target population was 132 patients registered and attending asthma clinic in Mama Lucy Kibaki Hospital, Kenya. A census was conducted so as to include all the patients in the study. Data was collected from the patient clinic-based adherence data for the past 12 weeks patients’ clinical encounters. The data was obtained from electronic data provided by the hospital administration and with the patients’ consent. A questionnaire assessing the patients’ knowledge, attitude and perceptions was administered to the patients in the duration of the 12 weeks during their visit to the clinic. Data collected was entered in SPSS version 26 for analysis.

**Results and Discussion**

**Results**

**Characteristics of the Patients**

From the data provided majority of the patients attending the clinic were female as shown by 58.3% (77). A large number of the patients were aged above 50 years as shown by 27.3% (36) and most of the patients had college level of education as shown by 30.3% (40). The findings also show that 63.3% (62) of the patients are married (see table 1).

**Table 1: Patients’ Characteristics**

	Variable	Frequency	Percentage
Gender	Male	55	41.7
	Female	77	58.3
Age	20-30 Years	33	25.0
	31-40 Years	28	21.2
	41-50 Years	35	26.5
	Above 50 Years	36	27.3

Education	Primary	32	24.2
	Secondary	36	27.3
	College	40	30.3
	University	24	18.2
Marital status	Married	62	63.3
	Separated	15	15.3
	Single	20	20.4

**Source:** Mama Lucy Kibaki Hospital (2019)

**Adherence to Asthma Control Measures**

From the data provided, an evaluation was conducted on adherence to various asthma control measures by the patients and the findings are as reported in Table 2.

**Table 2: Patient’s Adherence to Asthma Control Measures.**

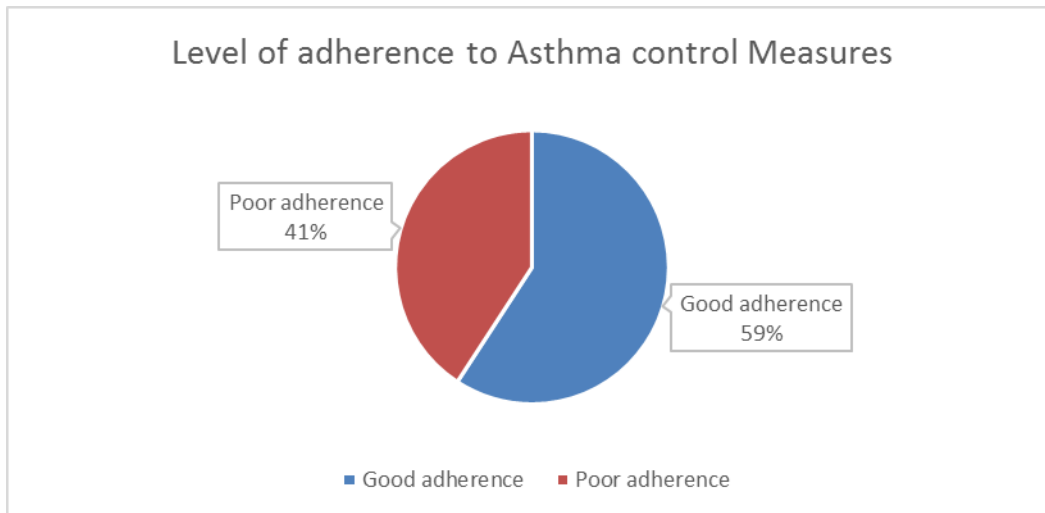
Variable	Frequency	Percentage	
Patient takes asthma medication on regular basis	No	64	48.5
	Yes	68	51.5
Patient forgets to take asthma medicines	No	38	28.8
	Yes	94	71.2
Patient ever stopped controllers without a doctor’s advice	No	44	33.3
	Yes	88	66.7
Patient stopped asthma medication due to cost	Yes	80	60.6
	No	52	39.4
Patient always demonstrates correct use of inhaler	No	62	47.0
	Yes	70	53.0
Patient has history of allergies	No	13	9.8
	Yes	119	90.2
Patient often avoids triggers/allergens	Always	36	27.3
	Not at all	23	17.4
	Sometimes	73	55.3
Patient engages in cigarette smoking	Current smoker	13	9.8
	Ex-smoker	22	16.7
	Never smoked	97	73.5

**Source:** Mama Lucy Kibaki Hospital (2019)

From the findings as reported in Table 2, it is evident that 51.5% (68) of the patients take asthma medication on a regular basis while 48.5% do not take medication on a regular basis. Majority of the patients as shown by 71.2% (94) forget to take asthma medicines while 28.8% (38) do not forget to take asthma medicines. The findings also show that 66.7% (88) of the patients stopped (at one point) using controllers without doctors’ advice, 33.3% (44) have never stopped controllers without doctors’ advice. Majority of the patients as shown by 60.6% (80) stopped asthma medication due to cost while 39.4% (52) have never stopped asthma medication due to cost. It is also evident that 53.0% (70) always demonstrated the correct use of inhalers, 47.0% (62) did not demonstrate the correct use of inhalers. The findings also demonstrated that 90.2% (119) asthma patients attending the clinic had a history of allergies while 9.8% (13) did not have a history of allergies. From the study, 55.3% (73) of the patients avoid triggers or allergens sometimes, 27.3% (36) always avoid triggers/allergens and 17.4% (23) did not avoid triggers at all. Lastly, the findings demonstrated that 73.5% (97) of the patients had never smoked before, 16.7% (22) were ex-smokers and 9.8% (13) were currently smoking. The overall level of patients’ adherence to asthma control

measures were determined by grouping the patients who observed positive practices towards asthma management. It was established that 59% (58) had good adherence to

asthma control practices and 41 % (40) had poor adherence (see Figure 1).



**Fig. 1:** Overall Level of Adherence to Asthma Control Measures.  
**Source:** Researcher (2019)

**Knowledge, Attitude and Perceptions towards Asthma**

The study assessed the data from the questionnaire responses on patients’ knowledge, attitude and perceptions towards asthma. The findings on knowledge revealed that majority of the patients as shown by 74.2% (98) attend asthma management education seminars; 25.8% (34) did not attend. Also, 59.1% (78) of the patients have asthma action plans while 40.9% (54) did not have. The findings also demonstrated that 56.1% (74) of the patients are not knowledgeable on asthma treatment; 43.9% (58) were knowledgeable on asthma treatment. However, the findings demonstrated that 97.0% (128) of the patients were knowledgeable on asthma first aid process in the event of attacks; 3.0% (4) were not knowledgeable. According to the findings, 62.9% (83) of the asthma patients were knowledgeable on the frequency of medication as per the symptoms while 37.1% (49) were not knowledgeable on medication frequency. On the knowledge of asthma triggers, 91.7% (121) of the patients were knowledgeable on the triggers such as dust, smoking, fur from animals, emission from engines among others while 8.3% (11) were not knowledgeable on asthma triggers (see Table 3).

**Table 3:** Knowledge on Asthma Control Measures.

Knowledge Indicator		Frequency	Percentage
Patients attend education seminars towards asthma management	Yes	98	74.2
	No	34	25.8
Patients have asthma action plan?	Yes	78	59.1
	No	54	40.9
Patients are knowledgeable on asthma treatment	Yes	58	43.9
	No	74	56.1
Patients are knowledgeable on asthma first aid in the event of an attack	Yes	128	97.0
	No	4	3.0
Patients are knowledgeable on the frequency of medication depending on symptoms	Yes	83	62.9
	No	49	37.1
Patients are knowledgeable on asthma triggers	Yes	121	91.7
	No	11	8.3

**Source:** Field Data (2019)

The responses on attitudes and perceptions demonstrated that 53.8% (71) of the patients perceived that when asthmatic attacks stop, then they still have asthma; however 46.2% (61) perceive that when asthmatic attacks stop, then they do not have asthma. The findings also show that 67.4% (89) of the patients disagree that one cannot have asthma as an adult if they did not have as children; 32.6% (43) agree that adults cannot have asthma if they did not have it as children. Majority of the respondents as shown by a response of 64.4% (85) are of the opinion that inhalers are not addictive while 35.6% (47) believe that inhalers are addictive. Additionally, 53.8% (71) of the patients believe that tablets are better than inhalers while 46.2% (61) are do not believe that tablets are better than inhalers. The findings also show that 83.3% (110) of the patients do not worry when others know that they have asthma and 16.7% (22) worry when others know that they have asthma (see Table 4).

**Table 4:** Attitude and Perception on Asthma.

Statement Question		Frequency	Percentage
When asthmatic attack stops you do not have asthma?	Yes	61	46.2
	No	71	53.8
You cannot have asthma as an adult without having it as a child	Yes	43	32.6
	No	89	67.4
Inhalers are addictive	Yes	47	35.6
	No	85	64.4
Tablets are better than inhalers	Yes	71	53.8
	No	61	46.2
Do you worry when others know you have asthma?	Yes	22	16.7
	No	110	83.3

**Source:** Field Data (2019)

**Patient Based Factors Determining Adherence of Adult Patients to Asthma Control Measures**

Chi-square test was used to ascertain the patient-based factors that had a significant association with adherence to asthma control measures using CHI square test. The study established that attitude (p-value<0.000), knowledge (p-value<0.000), education (p-value<0.000), proper use of

inhaler ( $p$ -value<0.000) and cigarette smoking ( $p$ -value=0.002) had a significant association with adherence

to asthma control measures (see Table 5).

**Table 5:** Client factors that Influence Adherence to Asthma Control Measures.

Variable		Good adherence	Poor adherence	Chi-Square value	p-value
Attitude	Positive	69	26	27.706	0.000*
	Negative	9	28		
Knowledge	Adequate	58	16	25.917	0.000*
	Inadequate	20	38		
Gender	Female	50	27	3.314	0.069
	Male	27	28		
Level of education	College	30	10	24.954	0.000*
	Primary	8	24		
	Secondary	22	15		
	University	19	4		
Demonstrates proper use of inhaler	yes	57	13	28.882	0.000*
	No	22	40		
Cigarette Smoking	Current smoker	4	10	12.438	0.002*
	Ex-smoker	8	13		
	Never smoked	66	31		
Marital Status	Married	50	35	0.009	0.995
	Separated	12	8		
	Single	16	11		

\*significant at 5% level of significance

Source: Researcher (2019)

## Discussion

Adherence to treatment is considered the major factor influencing the control of asthma. In the present study, there was unsatisfactory adherence to treatment as most of respondents were on reliever inhalers or tablets. The use of medicines when symptoms were perceived also indicated low adherence. Close to half of the respondents were taking reliever inhalers for asthma medication. Slightly less than two fifths of the patients were taking ICS and reliever inhalers, close to one tenths were taking tablets to control symptoms. This is an indication of inadequate knowledge on treatment for asthma which could have been the likely cause of poor adherence. These findings are similar to Alzahrani *et al.*, (2015) in their study whereby majority of participants used reliever inhalers to treat asthma.

The study found that close to one third of the patients were not taking medications on regular basis. This was based on that the medications are necessary only when the symptoms are perceived. An approximate one tenth of the respondents stated that inhalers were expensive to purchase and due to the unavailability in public hospitals, they were required to purchase the medicines. According to (Sastre *et al.*, 2016) most patients take their medications if symptoms are present. Unavailability of controller inhalers in the public hospitals and improper prescriptions contribute to these non-adherences.

More than half of the patients stopped using asthma controllers without consulting health care providers and slightly less than a half stopped using controllers due high cost. This was likely to be associated with unavailability of asthma controller inhalers in the primary care centers and other public hospitals. These findings are similar to Adele (2015), whereby the researcher found that asthmatic patients stated cost as a common barrier to using the right treatment to control asthma.

Close to a half of the patients demonstrated the correct use of inhalers that they were using. The results of this study concur with Sulaiman and Panicker (2017) and Onyedum *et al.*, (2014) who found majority of the patients having

improper inhaler techniques. The most likely factors attributed to the improper inhaler device use technique could be due to clinicians/nurses/pharmacists being busy attending to large number of patients therefore unable to demonstrate and have return demonstration by their clients. Inability of asthmatic patients to interpret the instructions from the inhaler leaflets also contributes to the inappropriate inhaler technique.

Majority of respondents who reported allergies such as dust, cold, pollen and smoke opined them as triggers to asthma symptoms. The report is similar to Ozdoganoglu & Songu (2012) reporting that allergens increase asthma exacerbations. Similarly, in china Zhang *et al.*, (2014) found cold or very hot weather to exacerbate asthma symptoms. The study revealed that majority (three quarters) had never smoked and this could be due to being allergic to smoke. Among the smokers and ex-smokers majority had uncontrolled asthma with spirometry reading below 80%. Smoking has been reported to affect the lung parenchyma due to accelerated loss of lung function as it was supported by Thomson & spears (2011).

From the Chi-square test results, the study established that attitude, knowledge, education, proper use of inhaler and cigarette smoking significantly influenced adherence to asthma control measures. The findings align with Hamdan *et al.*, (2013) who found that education influenced proper/improper use of inhaler devices and regular clinic follow-up and thus adherence to asthma control measures. According to Nguyen *et al.*, (2011), face to face education was also demonstrated to improve asthma medication adherence with improved symptom management by the patients. The findings also agreed with Madsen *et al.* (2016) who demonstrated that asthma patients' knowledge and perception led to better understanding of asthma symptoms, medication and thus influenced adherence to asthma control measures.

## Conclusion and Recommendations

The study revealed that adherence to asthma control measures was not satisfactory. The Chi-square test also

revealed that patient-based factors such as attitude, knowledge, education, proper use of inhaler and cigarette smoking significantly influenced adherence to asthma control measures. With knowledge gaps existing among the patients and this this being a significant factor in adherence to asthma control measures, the study recommends that government and non-government factors initiate education and awareness campaigns on asthma medication and other management measures. This will help in creating awareness and thus hasten adherence to asthma control measures.

## References

- Allegra, L., Cremonesi, G., Girbino, G., Ingrassia, E., Marsico, S., Nicolini, G., ... & PRISMA (PRospective Study on asthMA control) Study Group. (2012). Real-life prospective study on asthma control in Italy: cross-sectional phase results. *Respiratory medicine*, *106*(2), 205-214.
- Al-Zahrani, J. M., Ahmad, A., Abdullah, A. H., Khan, A. M., Al-Bader, B., Baharoon, S., ... & Hamdan, A. J. (2015). Factors associated with poor asthma control in the outpatient clinic setting. *Annals of Thoracic Medicine*, *10*(2), 100.
- Antó, J. M., Sunyer, J., Basagana, X., Garcia-Esteban, R., Cerveri, I., De Marco, R., ... & Kuenzli, N. (2010). Risk factors of new-onset asthma in adults: a population-based international cohort study. *Allergy*, *65*(8), 1021-1030.
- Azzi, E., Srour, P., Armour, C., Rand, C., & Bosnic-Anticevich, S. (2017). Practice makes perfect: self-reported adherence a positive marker of inhaler technique maintenance. *NPJ primary care respiratory medicine*, *27*(1), 1-6.
- Bender, B. G. (2016). Promoting adherence and effective self-management in patients with asthma. In *Pediatric Allergy: Principles and Practice* (pp. 354-359). Elsevier.
- Dale, T. (2010). *Selected sociodemographic and drug adherence factors associated with uncontrolled asthma at chest clinic, Kenyatta National Hospital* (Doctoral dissertation, University of Nairobi).
- Desalu, O. O., Fawibe, A. E., & Salami, A. K. (2012). Assessment of the level of asthma control among adult patients in two tertiary care centers in Nigeria. *Journal of Asthma*, *49*(7), 765-772.
- El Sony, A. I., Chiang, C. Y., Malik, E., Hassanain, S. A., Hussien, H., Khamis, A. H., ... & Enarson, D. A. (2013). Standard case management of asthma in Sudan: a pilot project. *Public Health Action*, *3*(3), 247-252.
- Forte, G. C., Barni, G. C., & Dalcin, P. D. T. R. (2016). Relationship between self-related adherence to asthma and asthma control in adult patients. *JSM allergy and asthma. San Diego. Vol. 1, n. 1* (2016), *1005*, 5 p.
- Gamble, J., Stevenson, M., McClean, E., & Heaney, L. G. (2009). The prevalence of nonadherence in difficult asthma. *American journal of respiratory and critical care medicine*, *180*(9), 817-822.
- Hamdan, A. J., Ahmed, A., Abdullah, A. H., Khan, M., Baharoon, S., Salih, S. B., ... & Al-Muhsen, S. (2013). Improper inhaler technique is associated with poor asthma control and frequent emergency department visits. *Allergy, asthma & clinical immunology*, *9*(1), 8.
- Kang, M. G., Kim, J. Y., Jung, J. W., Song, W. J., Cho, S. H., Min, K. U., & Kang, H. R. (2013). Lost to follow-up in asthmatics does not mean treatment failure: causes and clinical outcomes of non-adherence to outpatient treatment in adult asthma. *Allergy, asthma & immunology research*, *5*(6), 357-364.
- Kaptein, A. A., Klok, T., Moss-Morris, R., & Brand, P. L. (2010). Illness perceptions: impact on self-management and control in asthma. *Current opinion in allergy and clinical immunology*, *10*(3), 194-199.
- Marsden, E. J., Somwe, S. W., Chabala, C., Soriano, J. B., Vallès, C. P., & Anchochea, J. (2016). Knowledge and perceptions of asthma in Zambia: a cross-sectional survey. *BMC pulmonary medicine*, *16*(1), 33.
- Merghani, T. H., Zaki, A. M., Ahmed, A. M., & Toum, I. M. (2012). Knowledge, attitude and behaviour of asthmatic patients regarding asthma in urban areas in Khartoum State, Sudan. *Khartoum Medical Journal*, *4*(1).
- Ngahane, B. H. M., Pefura-Yone, E. W., Mama, M., Tengang, B., Nganda, M. M., Wandji, A., ... & Kuaban, C. (2016). Evaluation of factors affecting adherence to asthma controller therapy in chest clinics in a sub-Saharan African setting: a cross-sectional study. *African health sciences*, *16*(1), 194-200.
- Nguyen, K., Zahran, H., Iqbal, S., Peng, J., & Boulay, E. (2011). Factors associated with asthma control among adults in five New England states, 2006–2007. *Journal of Asthma*, *48*(6), 581-588.
- Nunes, C., Pereira, A. M., & Morais-Almeida, M. Asthma costs and social impact. *Asthma Res Pract.* 2017; 3: 1.
- Ozdoganoglu, T., & Songu, M. (2012). The burden of allergic rhinitis and asthma. *Therapeutic advances in respiratory disease*, *6*(1), 11-23.
- Polosa, R., & Thomson, N. C. (2013). Smoking and asthma: dangerous liaisons. *European respiratory journal*, *41*(3), 716-726.
- Rifaat, N., Abdel-Hady, E., & Hasan, A. A. (2013). The golden factor in adherence to inhaled corticosteroid in asthma patients. *Egyptian journal of chest diseases and tuberculosis*, *62*(3), 371-376.
- Sastre, J., Fabbri, L. M., Price, D., Wahn, H. U., Bousquet, J., Fish, J. E., ... & Sears, M. R. (2016). Insights, attitudes, and perceptions about asthma and its treatment: a multinational survey of patients from Europe and Canada. *World Allergy Organization Journal*, *9*, 13.
- Shamkuwar, C. A., Kumari, N., Meshram, S. H., Dakhale, G. N., & Motghare, V. M. (2016). Evaluation of Knowledge, attitude and medication adherence among asthmatics outpatients in tertiary care teaching hospital-a questionnaire based study. *Journal of Young Pharmacists*, *8*(1), 39.
- Smits, D., Brigis, G., Pavare, J., Maurina, B., & Barengo, N. C. (2017). Factors related to good asthma control using different medical adherence scales in Latvian asthma patients: an observational study. *NPJ Primary Care Respiratory Medicine*, *27*(1), 1-7.
- Souza-Machado, A., Santos, P. M., & Cruz, Á. A. (2010). Adherence to treatment in severe asthma: predicting factors in a program for asthma control in Brazil. *World Allergy Organization Journal*, *3*(3), 48-52.

26. Sulaiman, S. P., & Panicker, V. (2017). Attitudes of patients with asthma on inhaler use-A cross-sectional study from South Kerala. *J. Evid. Based Med. Healthc*, 4(26), 1505-1509.
27. Tan, N. C., Ngoh, S. H. A., Teo, S. S. H., Swah, T. S., Chen, Z., & Tai, B. C. (2012). Impact of cigarette smoking on symptoms and quality of life of adults with asthma managed in public primary care clinics in Singapore: a questionnaire study. *Primary Care Respiratory Journal*, 21(1), 90-93.
28. Thomson, N. C., & Spears, M. (2011). The role of cigarette smoking on persistent airflow obstruction in asthma. *Ann Respir Med*, 2, 47-54.