Medication use, adherence and asthma control in ambulatory patients attending the chest clinic of a tertiary facility in southwestern Nigeria

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ABSTRACT

Background: Asthma is a chronic illness with rising prevalence and socio-economic burden in resource-poor countries. Better understanding of its management and periodic assessment of therapy adherence and asthma control is therefore essential.

Objectives: To evaluate treatment recommendations, medication adherence and asthma control among cohort of ambulatory asthmatic patients.

Methods: A cross-sectional questionnaire-guided interview among asthma patients attending chest clinic of University College Hospital, Ibadan, southwestern Nigeria, between March and May 2015, and a review of patients' medical records for asthma-specific clinical parameters. Socio-demographic information, allergen and anti-asthmatic therapies were explored. Morisky Adherence Predictor Scale and Royal College of Physicians Three Questions were used to evaluate adherence and asthma control, respectively. Data were summarised using descriptive statistics. Chi-square and Mann-Whitney U test were used for categorical and ranked variables, respectively at $p<0.05$.

Results: Majority, 59 (67.8%) were using fixed-dose combination of inhaled corticosteroids and long-acting β2 agonist plus add-on inhaled short-acting bronchodilator. Twenty-four percent were adjudged adherent. Intentional non-adherence was most common, 55 (64.0%). Forgetfulness (40; 46.0%) was the most common unintentional non-adherence. Forty (46.0%) had good asthma control compared to 86(98.9%) who perceived their asthma to be well-controlled. Summarily, dust (55; 54.4%) was the most commonly cited allergen.

Conclusions: Medication adherence and asthma control among studied population were suboptimal. Frequent use of add-on inhaled short-acting bronchodilator with controller medication partly suggest continuing experience of in-between acute exacerbations by patients. Thus, a need for caregivers to

consistently ensure therapy adherence at every patient-provider encounter, so as to guarantee improved asthma control.

Key words: Medication adherence, medication-use, asthma control, asthma patients

L'utilisation des médicaments, l'observance et le contrôle de l'asthme chez les patients ambulatoires fréquentant la clinique thoracique d'un établissement tertiaire du sud-ouest du Nigeria

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RESUME
Contexte: L'asthme est une maladie chronique avec une prévalence croissante et un fardeau socioéconomique dans les pays pauvres en ressources. Une meilleure compréhension de sa gestion et une évaluation périodique de l'adhésion thérapeutique et du contrôle de l'asthme est donc essentielle.

Objectifs: Évaluer les recommandations de traitement, l'adhésion aux médicaments et le contrôle de l'asthme chez une cohorte de patients ambulatoires asthmatiques.

Méthodes: Une interview par questionnaire transversal guidé entre les patients atteints d'asthme fréquentant la clinique thoracique du Centre hospitalier d'Ibadan (University College Hospital, Ibadan), dans le sud-ouest du Nigéria, entre mars et mai 2015, et une revue des dossiers médicaux des patients pour des paramètres cliniques spécifiques à l'asthme. Des informations socio-démographiques, des allergènes et des thérapies antiasthmatiques ont été explorées. Le Morisky Adherence Predictor Scale et Royal College of Physicians three questions (L'échelle prédicteur d'adhérence de Morisky et les trois questions du Royal College of Physicians) ont été utilisées pour évaluer respectivement l'observance et le contrôle de l'asthme. Les données ont été résumées à l'aide de la statistique descriptive. Le Chi-carré et le test U de Mann-Whitney ont été utilisés pour les variables catégoriques et classées, respectivement à $p<0,05$.

Résultats: La majorité, 59 (67,8%) utilisaient une combinaison à dose fixe de corticostéroïdes inhalés et un agoniste ß2 à action prolongée plus un supplément de bronchodilatateur à action brève inhalé. Vingt-quatre pour cent ont été jugés adhérents. La non-adhésion intentionnelle était la plus fréquente, 55 (64,0%). L'oubli (40 ; 46,0%) était la non-adhésion involontaire la plus fréquente. Quarante (46,0%) ont eu

un bon contrôle de l'asthme par rapport à 86 (98,9%) qui ont perçu que leur asthme était bien contrôlé. En résumé, la poussière (55, 54,4%) était l'allergène le plus souvent cité.

Conclusions: L'observance des médicaments et le contrôle de l'asthme chez la population étudiée étaient sous-optimales. L'utilisation fréquente d'un supplément de bronchodilatateur à action prolongée par inhalation avec un médicament contrôleur suggère en partie une expérience continue d'exacerbations aiguës par les patients. Ainsi, le besoin pour les soignants d'assurer systématiquement l'adhésion thérapeutique à chaque rencontre patient-fournisseur, afin de garantir un meilleur contrôle de l'asthme.

Mots-clés: Adhérence aux médicaments, Prise de médicaments, Contrôle de l'asthme, patients asthmatiques

INTRODUCTION

Asthma is a common chronic illness that affects nearly 300 million people and causes more than 250,000 deaths annually.[1,2] It affects children and adults of all ages and its prevalence is increasing particularly in resource-limited countries.[1,3] Over 80% of asthma deaths occur in low and medium income countries.[3,4] In Nigeria, recent reports from different parts of the country have shown a prevalence of adolescent and adult's asthma in excess of 10% and the rising trend in the incidence of asthma[4-8] has been attributed to environmental factors such as urbanisation, industrialisation and adoption of western lifestyle.[9] Non-adherence to prescribed treatment continues to be a frequent problem among asthma patients with medication adherence rates consistently low in practice.[10,11] The consequences of non-adherence with prescribed therapies may be dependent upon the pattern of nonadherence and pharmacological characteristics of medication.[12,13] Studies have reported a number of factors associated with non-adherence to asthma therapy including medication-related factors such as difficulties with inhaler devices, complex regimen, side effect, and costs of medication among others.[12-15] The most obvious form of non-adherence is chronic under-use[16], and chronic under treatment of asthma may lead to poor control of symptoms and greater reliance on *pro re nata* (PRN) treatments for the relief of acute asthma symptoms. [16,17]

The National Asthma Education and Prevention Program Expert Panel Report 3[18] and the Global Initiative for Asthma Guidelines[1,19] identify achieving and maintaining asthma control as goals of therapy and this entails the achievement of symptom-free control and to minimize future risks measured by the absence of asthma exacerbations, the prevention of accelerated decline in lung function over time, and no side effects from medications.[18,20] Despite the recent advances in asthma management, the current level of asthma control worldwide falls far short of the goals for longterm management in international guidelines.[10,11,21] The Asthma Insights and Reality in Europe study reported persistence of day time symptoms of up to 48% among asthmatics under treatment.[22] Surveys from other parts of the world reveal a similar picture of suboptimal control.[23,24] Local studies are in agreement with the world-wide picture with more than two-thirds of patients having sub-optimal control in some survey.[25,26] The rising prevalence and burden of asthma especially in resource-poor countries create the need for better understanding of asthma management, and thus periodic assessment and monitoring of the level of adherence and asthma control so as to determine whether therapy should be maintained or adjusted.[27-29] However, accurate assessment of asthma control is difficult due to the complexity of asthma as well as limitations in the traditional methods of assessment such as lung function tests, physician assessment and

patient's self-assessment.[11,20,27] Relying solely on the role of lung function tests is insufficient to reflect the status of asthma control since patient with asthma may have normal spirometry between exacerbations.[25,29] Also, objective monitoring measure such as use of peak flow meter to determine the peak expiratory flow rates should have been better but availability and inconvenience of use may hinder its frequent use in clinical practice.[29,30] Thus, asthma continues to represent a significant disease burden with surveys consistently showing unacceptably poor control mostly associated with poor adherence to medical regimen.[11,25,26,29] Though, studies might have been carried out to assess asthma management in different settings, evidencebased research focusing on medication use, treatment adherence and asthma control among asthma patients in Nigeria and other resource-limited countries is scarce.

This study therefore aimed at evaluating and relating treatment recommendations, medication adherence and asthma control among ambulatory asthmatic patients attending chest clinic of a tertiary healthcare facility in southwestern Nigeria, using validated selfreport assessment tools. The Royal College of Physicians Three Questions[31] recommended by the British Asthma Guideline was used for quick review of asthma control,[32] while 5-item modified Morisky Adherence Predictor Scale[33] was used to assess therapy adherence among patients.

Ethical approval
Ethical clearance and approval for the study protocol was obtained from the joint University of Ibadan/University College Hospital (UI/UCH) Health Research and Ethics Committee with approval number UI/EC/15/0345.

METHODS Study site
This study was carried out at Medical Out-Patient clinic of the University College Hospital (UCH), Ibadan. UCH is a 900-bed federal teaching hospital in Nigeria and affiliated with University of Ibadan, located in southwestern Nigeria. The hospital has different specialties including a respiratory disease unit involved in treating chest-related diseases.

Study design/study population

This study was a cross-sectional questionnaire-guided interview among cohorts of asthma patients attending the chest out-patient clinic of the Hospital within twelve consecutive weeks from March to May, 2015. A review of patients' medical records was subsequently carried out to retrieve d asthma-specific clinical parameters. Inclusion/exclusion criteria

Patients enrolled into the study had primary diagnosis of asthma and were 18 years and above. Also, eligible patients must have been on prescribed anti-asthmatic therapies for more than three months prior to the time of the study. Patients who were booked for in-patient admission on the clinic day and those who decline participation were excluded.

Sample size determination

Based on available data, an average of between 32 and 40 asthma patients regularly attend the chest clinic per month. The representative sample size was calculated to be 95 based on the estimated sample population of regular asthma attendee at the chest clinic for the 12week study period, at 95% confidence interval and 5% margin of errors, using Raosoft[R] sample size calculator [34], and allowing for a 10% non-response rate.

Patients' sampling and recruitment procedure

Eligible patients were purposively selected from the list of asthma patients who attend the weekly out-patient chest clinic. Selected patients were approached for participation while they were waiting for the physicianled asthma review clinic and consultation. The study protocol and informed consent form were translated into local language (Yoruba), especially for respondents who did not understand English. The purpose and objectives of the study were explained verbally to individual patient after which voluntary informed consent was individually obtained to signify intention to participate in the study. Elderly patients were assisted by caregivers who accompanied them to the hospital while clarifications were made when necessary by the principal investigator. Patients were informed that participation is voluntary and were assured of anonymity and confidentiality of responses. Translation and back-translation of information in the study instrument was done to ensure response consistency. Only consented patients at every clinic day were enrolled and administered the questionnaire which took about 20 minutes to complete. A total of 100 copies of questionnaire were administered to consented participants within the study period.

Data collection

The interviewer-administered questionnaire consisted of open-ended, closed-ended dichotomous response options and 4-point Likert scale questions. The questionnaire consisted of six sections. Section A requested for socio-demographic information and duration of asthma diagnosis, section B contained questions that explore opinions on history of allergy including specific allergen, as well as commonly experienced asthma symptoms and triggers at onset of diagnosis. Section C comprised questions to evaluate anti-asthmatic therapies used by patients. Section D explored responses to 5-item modified Morisky Adherence Predictor Scale (MMAPS)[33] to assess medication adherence status of patients. In this study, a "YES" response to item-statement on the scale was assigned a score of "one" and "NO" response was assigned a score of "zero". Adherence was defined as "NO" response to all the 5-item questions on the MMAPS. Binary variables using categorization of a total score of < 1 (adherent) and a total score of ≥ 1 (nonadherent) were subsequently developed from patients' scores on the scale. Section E consisted of questions with a 4-point Likert scale response options to explore respondents' opinion on reasons for treatment nonadherence. Section F comprised the Royal College of Physicians Three Questions (RCP3Qs)[31] for quick review of asthma control. A "YES" response to the itemstatement in RCP3Qs was assigned a score of "one" and "NO" response was assigned a score of "zero". Good asthma control was defined as "NO" response to all the 3-item questions on the RCP3Qs. Binary variables using categorization of a total score of < 1 for "good control" and a total score of ≥ 1 for "poor control" were subsequently developed.

Pre-test and validation of data collection instrument

Questionnaire for this study was pre-tested among five asthma attendee who were booked for in-patient admission while content validity was assessed by two scholars from academia. Feedback from validity assessment and pre-test led to some modifications to remove ambiguity and ensure clarity. Data analysis Data were sorted, coded, and entered into Predictive Analytics Software version 18.0 for management and analysis. Descriptive statistics including frequency, 50th

percentile or median value, as well as mean ± standard deviation were used to summarise data. Chi-square was used to evaluate associations between relevant patients' characteristics and status of medication adherence and asthma control. Opinions in ranked variables were evaluated using Mann-Whitney U test at $p < 0.05$.

RESULTS

Available data from the medical record unit of the hospital indicated that the three priority diseases in chest clinic include pulmonary tuberculosis with the highest proportion of patients (25 to 30) attending the clinic per week, asthma attendee between 8 and 10, while chronic obstructive pulmonary disease usually has 5 to 10 patients per week (every Wednesday). Out of 100 copies of questionnaire administered within the study period, 87 (87.0%) were completely filled and analyzed. The mean age was 54.1 ± 20.8 years.

Fortytwo (48.3%) were within the age range of 61-81 years, 24 (27.6%) were of ages >18-39 years, 19 (21.8%) between 40 and 60 years, while 2 (2.3%) were 80 years and above. Male participants were 44 (50.6%) and 43 (49.4%) were female. Fifty-six (64.4%) were literate and 31 (35.6%) were illiterates. Thirty-two (37.2%) were retirees, 23 (26.7%) were traders, 20 (23.3%) were students, 6 (7.0%) were civil servants and 5 (5.8%) were artisans. Duration of asthma diagnosis showed that 8 (9.2%) were diagnosed since childhood, 50 (57.5%) between 1 and 10 years, 22 (25.3%) for 11 to 20 years and 7 (8.0%) were diagnosed for more than 20 years. Thirty (34.5%) had family history of asthma including mother (9; 30.0%), father (4; 13.3%), siblings (7; 23.3%), grandparents (8; 26.7%) and grandson (2; 6.7%), while 57 (65.5%) reported no family history of asthma. Shortness of breath (74; 54.8%) was the most common symptom reported by participants at onset of asthma diagnosis. Seventy-five (86.2%) had history of

Table 1: Summary of common symptoms, allergens and asthma triggers at onset of diagnosis among participants

Variables	Frequency	Percentage (%)
Symptom experienced at onset of asthma (n = 135)		
Shortness of breath	74	54.8
Wheezing	37	27.4
Cough	24	17.8
History of allergy (n = 87)		
Yes	75	86.2
No	12	13.8
Summary of specific allergen (n =101)		
Dust	55	54.4
Cold air	31	30.7
Any disturbing smell	9	8.9
Smoke	3	3.0
Perfume	2	2.0
Alcohol	1	1.0
Triggering sign/symptoms before asthma attack (n = 109)		
Breathlessness	74	67.9
Cough	28	25.7
Wheezing	7	6.4
Experience with exposure to specific allergen (n = 87)	**SA & A; n (%)**	**D & SD; n (%)**
I experience more asthma attacks during cold season/weather	43 (49.4)	44 (50.6)
I experience asthma attack when frightened or after a shock	12 (13.8)	75 (86.2)
I experience asthma attack after a smell of a particular food	12 (13.8)	75 (86.2)
I get asthma attack after physical exercise	37 (42.5)	50 (57.5)
I get asthma attack from excessive laughter	6 (6.9)	81 (93.1)

allergy with specific allergen mentioned in different combinations to include mostly dust (55; 54.4%) and cold weather (31; 30.7%). Summary of common symptoms, allergens and asthma triggers is shown in Table 1.

SA = strongly disagree, A = agree, D = disagree, SD = strongly disagree, n = number. Total respondents may be more than eighty-seven in some cases on account of multiple responses.

Details of drug and non-drug recommendations are shown in Table 2. Majority (59; 67.8%) were using fixeddose combination of inhaled corticosteroids (ICS) and long-acting β2 agonist (LABA) plus add-on inhaled short-acting β2 agonist (SABA). Avoidance of dust (85; 46.4%) and keeping good hygiene 74 (40.4%) were the most common non-drug recommendations for participants.

Table 2: Pattern of anti-asthma medications and non-drug recommendations among participants

Medication	Frequency	Percentage
Monotherapy		
Salbutamol inhaler	12	13.8
Fixed-dose combination therapy alone		
Fluticasone + Salmeterol inhaler	3	3.4
Budesonide + Formeterol inhaler	9	10.3
Co-administered combination therapy		
Fluticasone + Salmeterol inhaler plus salbutamol inhaler	58	66.7
Budesonide + Formeterol plus salbutamol inhaler	1	1.1
Salbutamol inhaler and salbutamol tablet	2	2.3
Salbutamol inhaler plus prednisolone tablet	2	2.3
Therapeutic class/category of anti-asthma medication		
Inhaled short-acting β_2-agonist (reliever) alone	12	13.8
Inhaled corticosteroid (preventer) + long-acting β_2-agonist	12	13.8
Inhaled corticosteroid + long-acting β_2-agonist plus inhaled short-acting $\beta_2$agonist	59	67.8
Inhaled short-acting β_2-agonist plus oral short-acting β_2-agonist	2	2.3
Inhaled short-acting β_2-agonist plus oral corticosteroid	2	2.3
Summary of non-drug recommendations (n = 183)		
Avoidance of exposure to dust	85	46.4
Maintain good hygiene	74	40.4
Avoidance of exposure to cold weather	11	6.0
Always keep warm and desist from anger	11	6.0
Avoidance of alcohol	1	0.5
Avoidance of smoking	1	0.5

Modified Morisky Adherence Predictor Scale (MMAPS) showed that 19 (24.1%) had a total score < 1 indicating adherence, while 60 (75.9%) had a total score ≥ 1 suggesting non-adherence. Majority (55; 64.0%) showed intentional non-adherence by stopping their medications when they feel better. Forgetfulness (40; 46.0%) was the most common unintentional nonadherence; 37 (44.0%) had primary non-adherence behaviour by not filling prescription sometimes (Table 3).

Table 3: Summary of participants' response to 5-point modified Morisky Adherence Predictor Scale

	Response (score coding), N (%)	
Question	Yes (1)	No (0)
1.Do you ever forget to take your prescribed medicine?	40 (46.0)	47 (54.0)

2. Are you not been careful at times about taking your medicine?	30 (35.7)	54 (64.3)
3. Do you sometimes stop taking your medicine when you feel better?	55 (64.0)	31 (36.0)
4. Do you sometimes stop taking your medicine if they make you feel worse?	6 (7.0)	80 (93.0)
5. Are you sometimes unable to fill the prescribed medicine?	37 (44.0)	47 (56.0)
Distribution of scores (only for participants with complete response to the 5-item questions)	**Number (%)**	
0	19 (24.1)	
1	17 (21.5)	
2	13 (16.5)	
3	18 (22.8)	
4	12 (15.2)	
5	0 (0.0)	
Cut-off	**Number (%)**	**Category**
Total score < 1	19 (24.1)	Adherent
Total score ≥ 1	60 (75.9)	Non-adherent

Forty-two (48.3%) had previously discontinued their medication(s); of these, 23 (54.8%) had the medication(s) discontinued by physician, 14 (33.3%) were discontinued on account of unaffordable cost, 4 (9.5%) discontinued medication(s) because they feel better and one (2.4%) reported to discontinue medication due to complex dosage regimen. Adherence status was significantly influenced by previous engagement in medication discontinuation (Chi-square [X^2] = 6.68; p = 0.01) and having a family history of asthma (X^2 = 5.67; p = 0.02). Proportion of non-adherent patients (92.3%) was more among those who had family history of asthma compared to those who do not (67.9%). Socio-demographic characteristics did not significantly affect adherence status (p > 0.05). Twenty-one (24.1%) patients reported to previously use herbs for asthma management and of these, 9 (42.9%) used herbal remedies whose contents cannot be ascertained, four (19.0%) reported tobacco leaves, one (4.8%) mentioned a prepared herbal concoction from a popular herbal medicine dealer in southwestern part of the country, while one (4.8%) mentioned Aloe Vera. The remainder 6 (28.6%) could not mention any specific herb they had previously used.

Eighty-six (98.9%) each perceived their asthma to be well-controlled and that the prescribed medicines are working. Quick review of asthma control using the Royal College of Physicians Three Questions (RCP3Qs)

showed that 40 (46.0%) had a total score of < 1 indicating good asthma control and 47 (54.0%) had score ≥ 1 suggesting poor asthma control (Table 4).

Table 4: Summary of participants' response to the royal college of physicians

Table 5: Association between relevant patients' characteristics and status of asthma

In the last month ,		
1.Have you had difficulty in sleeping because of your asthma symptoms, especially coughing	(10.3)	(89.7)
Have you had your usual asthma symptoms during the day (cough, wheeze or breathlessness)	(42.5)	(57.5)
Has your asthma interfered with your usual routine activities	(21.8)	(78.2)

Distribution of scores	Number (%)	
0	(46.0)	
1	(34.5)	
2	(16.1)	
3	(3.4)	
Cut-off	**Number (%)**	**Category of asthma control**
Total score < 1 (response is "NO" to all the 3-item)	(46.0)	Good control
Total score ≥1 (response is "YES" to any of the 3- item)	(54.0)	Poor control

There was no significant association between socio-demographic characteristics and status of asthma control (p>0.05). Twenty-three (26.4%) had previous history of hospitalisation, of which 17 (63.6%) had been hospitalised at least once, 4 (18.2%) twice and two (8.7%) were hospitalised thrice. Sixty-four (73.6%) had no previous history of hospitalization. Asthma control is significantly influenced by relevant patients' characteristics including history of allergy (p = 0.03) and history of hospitalization (p = 0.01). Details of association between status of asthma control and other patients' characteristics are shown in Table 5.

Question	Response (score coding),N (%)	
	Yes (1)	No (0)
control		

Variable	Asthma control		Chi-square	p – value
	Good control	Poor control		
Family history of asthma				
Yes	16 (53.3)	14 (46.7)		
No	24 (42.1)	33 (57.9)	0.998	0.32
History of asthma allergy				
Yes	38 (50.7)	37 (49.3)		
No	2 (18.7)	10 (83.3)	4.815	0.03*
Previous history of hospitalization				
Yes	5 (21.7)	18 (78.3)		
No	35 (54.7)	29 (45.3)	7.395	0.01*
Previous engagement in medication discontinuation (control/reliever)				

Yes	15 (35.7)	27 (64.3)		
No	25 (55.6)	20 (44.4)	3.44	0.06
Engagement in herbal medicine use				
Yes	6 (28.6)	15 (71.4)	3.376	
No	34 (51.5)	32 (48.5)	3.376	0.07
Classification on Morisky adherence predictor scale				
Adherent	10 (52.6)	9 (47.4)	0.703	0.40
Non-adherent	25 (41.9)	35 (58.3)		

Level of significance, p<0.05, *Statistically significance difference with Chi-square test

Outcome monitoring using spirometry was documented for 27 (31.0%) and of these 15 (55.6%) had ratio of Forced Expiratory Volume in one second and Forced Vital Capacity (FEV_1/FVC) value of 60 – 70% and 12 (44.4%) between 71 and 80%. Peak Expiratory Flow (PEF) rate was documented for only five (5.7%) patients, with values ranging between 100 and 200 Litres/minute.

A substantial proportion of participants agreed that daily or continuous use of medication (35; 40.2%) and forgetfulness (44; 50.6%) were the most common reasons for treatment non-adherence. A sizeable number also agreed that mode of approach of physician (18; 20.9%) and pharmacist (18; 20.9%) was a factor for treatment non-adherence. Details are shown in Table 6.

Table 6: Participants' reasons for treatment non-adherence and relationship with educational status

Reasons	Response, (%) SA & A	D & SD	50th percentile	Mann-Whitney U p –value
Concern about side effect(s)	9 (10.3)	78 (89.7)	1	0.64
Cost of prescribed medication unaffordable	29 (33.3)	58 (66.7)	2	0.43
Forgetfulness	44 (50.6)	43 (49.4)	3	0.51
Daily or continuous use of medication	35 (40.2)	52 (59.8)	2	0.97
Complex dosage regimen	9 (10.3)	78 (89.7)	1	0.92
Complicated technique of handling inhaler	8 (9.2)	79 (90.8)	1	0.81
Use of multiple medications to control symptoms	7 (8.0)	80 (92.0)	1	0.69
Interference of regimen with life-style	12 (13.8)	75 (86.2)	1	0.01*
Lack of understanding of reason for taking the medications	2 (2.3)	85 (97.7)	1	0.35
Physician mode of approach during treatment	18 (20.9)	68 (79.1)	2	0.58
Pharmacist mode of approach during medication delivery and counseling	18 (20.9)	68 (79.1)	2	0.42

SA = Strongly agree (4), A = Agree (3), D = Disagree (2), SD = Strongly disagree (1) *Significant difference with Mann-Whitney U test for educational status, Level of significance p < 0.05, N = number

DISCUSSION

Majority of participants were in the age range of 61 to 81 years compared to those considered to be of younger age. This may suggest that asthma patients at a younger age might perceive themselves as having stable control of asthma symptoms, and therefore tend to patronize the clinic less frequently for follow-up. The low patronage of clinic for follow-up by asthma patients is corroborated by other studies.[35,36,] Thus, the need to encourage patients at every provider-patient encounter to embrace follow-up clinic attendance even if they perceive their asthma as well-controlled, since asthma is a chronic disease that often require

consistent commitment to prescribed therapies and follow-up appointments.

More than two-third of the patients were using fixeddose combination of inhaled corticosteroid (ICS) and long-acting bronchodilator (LABA) plus add-on inhaled short-acting bronchodilator. The widespread use of an add-on inhaled short-acting bronchodilator among participants partly suggest increased experience of inbetween acute exacerbations and a likelihood of suboptimal asthma control. Studies have shown that patients who failed to take their asthma medications 100% of times as instructed reported frequent experience of symptoms and increased bronchodilator use.[37-39] Thus, there may be possibility of non-adherence to inhaled corticosteroid (ICS) among study participants, since ICS is indicated for prevention of frequent asthma attacks, and are currently the most effective anti-inflammatory medication for the treatment of persistent asthma.[1] Low adherence to inhaled steroids among asthma patients has been previously reported.[37,38] Postma et al (2011)[40] reported that ICS monotherapy effectively controlled daily symptoms in their asthma patients. However, combination therapy using ICS and LABA in a single inhaler device confers complementary and synergistic effect in the management of asthma.[19,40,41] In addition to improving patient's compliance and reducing ~~es~~ complexity of treatment, concomitant administration of ICS with LABA especially as a fixed-dose regimen has been reported to alleviate the safety concerns about LABA.[42, 43, 44] A recent meta-analysis has shown that when LABA is administered concomitantly with ICS, mortality is drastically reduced.[45] Nevertheless, the efficacy of inhaled medications is largely dependent on the proper use of such devices, and poor inhaler use has been found to be significantly associated with poor asthma control.[46]

Only one-quarter of patients have optimal medication adherence, with nearly one-half who demonstrated primary non-adherence by not filling prescription initially. More than three-quarter had intentional nonadherence. Poor adherence to medical regimen and advice may possibly explain the failure of asthma control resulting in substantial economic loss and increased healthcare system burdens.[10,11,16,47] Poor adherence to fixed-dose combination of ICS and LABA might have prompted the need for frequent use of an add-on inhaled SABA for quick relief of symptoms among study participants. Thus, a need for systematic,

proven methods to assess and address medication nonadherence among asthma patients[10] so as to ensure achievement of the overall goal of asthma treatment which entails symptom-free control and to minimize future risks.[18-20]

It is worthy of note that a high proportion of adherent patients have good asthma control compared to their non-adherence counterparts, while non-adherence is more prevalent among participants who had previously discontinued their medication. Most patients agreed that forgetfulness was the most common reason for medication non-adherence, while provider-related factor, especially the mode of approach of physician and pharmacist during consultations and medication dispensing, respectively, was also cited as a contributory reason for non-adherence. The Expert Panel Report Guidelines for the diagnosis and management of asthma[18,21] emphasized that healthcare provider-patient relationship has a more powerful influence on adherence than almost any other factor.[48, 49] Patients are more adherent to their regimen when their provider has answered all the patient's questions and communicated clearly and positively.[49]

Assessment of asthma control using the Royal College of Physicians Three Questions (RCP3Qs) showed that less than one-half had good asthma control. Outcome monitoring parameters documented in patients' medical records also corroborates the poor control as many participants had FEV_1/FVC value ≤ 0.8 (80%), while most patients had PEF rate less than 200 Litres/minutes. This is consistent with previous studies reporting unacceptably low asthma control among patients despite recent advances in its management.[10,11,21, 23-26] Several factors may be adduced to suboptimal asthma control including poor adherence to therapies.[10,11] Of note was the fact that there was inconsistency between patient's perception of their asthma control and objective assessment using the RCP3Qs. This seems to be in agreement with data from previous studies.[22,24,50] A substantial proportion of patients who perceived their asthma to be well-controlled were eventually discovered to fall in the category of poor control. The discrepancy therefore suggest the need for healthcare provider to always double-check patients' asthma control status by embracing the use of simple recognisable and validated tools including the RCP3Qs or the asthma control test (ACT) for quick asthma review.[31, 32] The use of RCP3Qs for quick

assessment of asthma control may prompt the need for therapy and adherence re-evaluation, thereby achieving

appropriate ~~ly~~ target care.[51] In this study, poor asthma control was significantly higher among participants who had previous hospitalization. This is consistent with other studies that have demonstrated an association between emergency room visit and poor control.[23, 24] Most patients agreed that they usually experienced more frequent attacks during cold weather. One-third had family history of asthma mostly mother, while more than two-thirdshad history of allergy, with dust and cold allergen constituting the highest proportions. High level of continued exposure to potential trigger is associated with frequent disease exacerbation and poor control.[52, 53] Environmental allergens and irritants are known to produce a cascade of immune-mediated events leading to airway inflammation which is a characteristic symptom of asthma.[54] In this study, avoidance of exposure to dust and consistent maintenance of good hygiene were the most common non-drug recommendations for patients. This becomes necessary, since asthma exacerbation may be caused by a variety of triggers, thus, its avoidance may improve the control of asthma and reduce medication needs.[36, 52] One-quarter of participants (24.1%) had used herbal concoctions at different times in the past, and a substantial number took concoctions whose content cannot be ascertained. Studies have consistently shown that many patients with chronic illness including asthma use herbal remedies to treat their condition[55,56] and utilisation of herbs is increasingly widespread.[57] While the use of herbal concoction may be beneficial, a potential concern is that herbs may be used in place of prescribed inhaled corticosteroids [5, 56], therefore posing ~~a~~ negative consequences on the overall goal of ensuring optimal asthma control.

This study is however limited by smaller sample size and assessments using self-reported tools which may have some inherent limitations. Patients may either underreport poor adherence or underestimate asthma symptoms, while both patients and caregiver may overestimate asthma control or adherence status.[58,59] However, since these tools are validated tools with questions posed in a non-judgmental and nonthreatening approach, It may make patient to feel comfortable in giving a truthful response to the itemquestions in the tools.[60,61] Also sample size determination was based on regular asthma attendee within the study period, thus might still be a representative sample size from the study site, Nonetheless, future research may need to consider larger sample size and use of combined approaches for assessing adherence and asthma control, so as to ensure far-reaching conclusions.

CONCLUSION

Medication adherence and asthma control among the studied population were suboptimal. Frequent use of add-on inhaled short-acting bronchodilator with fixeddose combination of inhaled steroids and long-acting bronchodilator, partly suggest continuing experience of in-between acute exacerbations by patients. Thus, a need for caregivers to consistently ensure therapy adherence at every patient-provider encounter, so as to guarantee improved asthma control.

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