Asthma control and asthma treatment adherence in primary care: results from the prospective, multicentre, non-interventional, observational cohort ASCOPE study in Malaysia

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ABSTRACT

Introduction: As the first point of contact for those presenting with asthma symptoms, primary healthcare plays a crucial role in asthma management. This is a nationwide study of assessment of asthma symptom control and adherence to asthma medication among outpatients in public health clinics in Malaysia.

Methods: This is a prospective, observational multicentre study (ASCOPE; NCT03804632). Data on asthma control, assessment of control symptoms, and adherence to treatment were collected from medical records and interviews of patients. The level of asthma control was assessed using the Global Initiative for Asthma (GINA) Assessment of Symptom Control. Adherence of patient to medication for asthma was assessed through interview of patients using four questions adapted from the Malaysian Medication Adherence Scale.

Results: Among the 1011 patients recruited, 416 (41%) had well controlled asthma, 388 (38%) were partly controlled, and 207 (21%) had uncontrolled asthma. Majority (81%) had mild asthma and all patients were on asthma medication. Most patients did not have spirometry data (97%) but underwent peak flow rate measurements (98%). Poor adherence occurred at all levels of asthma control but was worst among those with uncontrolled asthma. This was statistically significant across all four questions on adherence ($p<0.05$). For example, more patients with uncontrolled asthma forgot doses (56%) or stopped treatment (39%) than those with well-controlled asthma (44% and 27% respectively).

Conclusions: Among Malaysian primary care patients with asthma, less than 50% had well-controlled asthma, and low adherence to treatment was common. More effort is needed to improve asthma control among patients in Malaysia, including those with mild asthma.

KEY WORDS:

Asthma, Malaysia, outpatient health service, primary healthcare, disease control, medication adherence

INTRODUCTION

Asthma is a common chronic disease that imposes a significant burden on patients, their families and the community.[1] The World Health Organization (WHO) estimated about 383,000 asthma-related deaths in 2015.[2] In Malaysia, the National Health and Morbidity Survey 2011 reported a 6.3% prevalence of asthma.[3] A survey conducted among urban centres in Asia-Pacific countries showed that asthma and other respiratory diseases caused reduction in the work productivity and quality of life of patients.[4]

The main goal in the management asthma is to achieve overall asthma control which includes the control of symptoms and reducing risk of adverse outcomes in the future.[5] Identifying poor control is therefore an important criteria in improving asthma.[6] In Malaysia, the Global Initiative for Asthma (GINA) global report on the management of asthma is widely recognised by healthcare providers, and medications such as inhaled corticosteroids (ICS) and long-acting β2-agonists (LABA) are generally available for effective management of asthma. Nevertheless, the control of asthma is still a critical challenge. An audit of the control of asthma at the Greentown health clinic, for example, a primary public healthcare facility in city of Ipoh, Malaysia showed that only 39.2% of patients who were prescribed maintenance for asthma therapy had controlled asthma; of the remainder, 34.3% had partly-controlled asthma and 26.5% had uncontrolled asthma.[7] A survey conducted among urban centres in Asia-Pacific countries which included Malaysia showed that many patients felt that asthma control means managing exacerbations instead of control of symptoms and preventive care.[8]

In Malaysia, primary care centres play an integral role in the management of asthma. However, there is limited data available on the level of asthma control in these centres. Only a few Malaysian studies specifically assessed the level of asthma control, but these studies were done at single centres. Given the varied demographics of the population across Malaysia, it becomes necessary to conduct more studies at different parts of the country to assess the perceived level of asthma control in the Malaysian population. A multicentre

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study involving various public health clinics across Malaysia would therefore provide more information on the gaps in treatment and control of asthma.

This study is a nationwide assessment of asthma symptoms control and adherence to asthma medication among outpatients seen and treated by healthcare providers at public health clinics in Malaysia.

MATERIALS AND METHODS

This was a prospective non-interventional observational cohort study (ASCOPE; NCT03804632) involving outpatients seen and treated by healthcare providers at 14 public health clinics. Malaysians of ages 18 years and older, who were diagnosed with asthma by a physician and seen at public health clinics (*Klinik Kesihatan*) from September 2017 to December 2017, were included. These were either confirmed asthma patients who came to the clinic for a follow-up visit for asthma or any other medical reasons or those who were newly diagnosed with asthma during the period of study. Patients with clinical features suggesting emphysema, chronic bronchitis or other chronic lung disease, and pregnant patients, were excluded. These were determined through clinical examination during the visits and medical records of patients.

This study was approved by the Medical Research and Ethics Committee, Ministry of Health Malaysia. All subjects participating in the study provided voluntary, informed consent to data collection and use, based upon a clear understanding of the purpose of the data collection. The study was performed in accordance with the current version of the Declaration of Helsinki (52nd WMA General Assembly, Edinburgh, Scotland, October 2000), and in agreement with the International Conference on Harmonisation guidelines on Good Clinical Practice.

Information on age, gender, ethnicity, other demographic details, medical history, baseline asthma details (such as diagnosis, spirometric data, symptoms, exacerbations, peak flow rate, hospital visits, and laboratory results) and likely causes of asthma (such as history of smoking, allergens, and occupational exposures), comorbidities, type of inhalers used and pharmacotherapy were obtained from medical records of patients. In the study, asthma exacerbations referred to hospitalisation due to asthma, administration of systemic steroid due to asthma, use of antibiotics due to asthma (although antibiotics are not recommended for asthma exacerbations, it is prescribed when lung infection is present),[1] emergency consultation due to asthma, or unscheduled consultation due to severe worsening of symptoms asthma.

The level of asthma control was assessed by interviewing patients. The measure used was the Global Initiative for Asthma Level of Asthma Symptom Control (symptom control tool). Per GINA report, level of asthma symptom control was categorised as well-controlled, partly controlled, or uncontrolled.[1] Well-controlled was defined as the absence of the four symptoms of asthma in the past four weeks, partly controlled was defined as the presence of one or two of the symptoms in the past four weeks, and uncontrolled was defined as the presence of at least three of the symptoms in the past four weeks.[1]

Data on symptom control assessment (spirometric data, peak flow rate) were obtained from medical records of patients and based on forced expiratory volume in one second (FEV1), FEV1/forced vital capacity, and peak expiratory flow rate measurements from the last three visits.

Details on previous and current treatment of asthma were obtained from medical records of patients. Data on medication only included the drug class (ICS, short-acting β2-agonist (SABA), ICS/LABA) and not the name of the drug. The efficacy and safety of these drugs were not assessed.

Adherence of patients to medication for asthma was assessed through patient interview using four questions adapted from the Malaysian Medication Adherence Scale,[9,10] namely on whether during the previous one month, had they ever forgotten to take their medications, reduced their medications, stopped their medications, and had difficulty in taking medications. Adherence to treatment was determined for individual items; for example, a patient who answered 'yes' to one of the questions would be considered as a poor adherent for the particular item.

Inhaler techniques were assessed for each patient by the attending physician or principal investigator. An error in any of the common inhaler techniques will be considered as poor inhaler technique. Examples of such errors were not shaking an aerosol inhaler device before use, poor coordination of the inhaler device, not breathing out before inhaling, and incorrect positioning of inhaler device.[11]

Data analysis was conducted with STATA version 13.0. Categorical data were presented as frequencies and percentages. Continuous data were expressed as mean±SD.

RESULTS

Demographic and other baseline characteristics

In all 1011 patients from 14 clinics were included in the study. The clinics contributed between 11 and 135 patients. Six clinics recruited more than 100 patients each, three clinics recruited between 50 and 100 patients each, and five clinics recruited fewer than 50 patients. The study patients were aged between 18 and 85 years (mean: 46.9 (SD 14.7) years) (Table I). Half of the patients were Malays (54%), followed by 25% Indians, 13% Chinese and 8% other races. About two-thirds of the patients had full-time employment (71%).

Majority of the patients were non-smokers (82%) (Table I). Almost three-quarters of the patients (72%) had comorbidities such as dyslipidaemia, hypertension, diabetes mellitus, obesity, rhinitis/nasal polyposis, and food allergy (Table V).

About 72% of patients came to the health clinic for a routine asthma follow-up while the rest (28%) were newly diagnosed asthma patients, or those with asthma who came in for an emergency asthma treatment or other medical reasons (Table I).

Table I: Baseline demographic and medical history for patients according to GINA assessment of asthma control

Characteristic	All patients N=1011	Well-controlled N=416	Partly- controlled N=388	Uncontrolled N=207	p-value
Mean age (SD), years	46.9 (14.7)	48.5 (14.6)	47.3 (14.5)	42.9 (14.6)	
Gender, No. (%)					0.155[q]
Male	282 (28)	103 (25)	114 (29)	65 (31)	
Female	729 (72)	313 (75)	274 (71)	142 (69)	
Race, No. (%)					
Malays	547 (54)	204 (49)	231 (60)	112 (54)	0.012[a]
Chinese	133 (13)	69 (17)	45 (11)	19 (9)	
Indians	252 (25)	111 (26)	80 (21)	61 (30)	
Others	79 (8)	32 (8)	32 (8)	15 (7)	
Mean body mass index (SD), kg/m^2	27.8 (6.3)	27.6 (6.3)	28.0 (6.4)	27.7 (6.1)	
Type of visit, No. (%)					<0.001[a]
Routine follow up	731 (72)	320 (77)	286 (74)	125 (60)	
Others	280 (28)	96 (23)	102 (26)	82 (40)	
Smoking status, No. (%)					0.037[a]
Current smokers	82 (8)	22 (5)	35 (9)	25 (12)	
Former smokers	97 (10)	42 (10)	33 (9)	22 (11)	
Non-smokers	832 (82)	352 (85)	320 (82)	160 (77)	
Alcohol consumption, No. (%)					0.411[b]
Current	57 (5)	25 (6)	17 (4)	15 (7)	
Former	71 (7)	23 (6)	30 (8)	18 (9)	
Never	876 (87)	366 (88)	338 (87)	172 (83)	
Not available	7 (1)	2 (0)	3 (1)	2 (1)	
Employment status, No. (%)					0.235[a]
Full time	718 (71)	298 (72)	275 (71)	145 (70)	
Part-time	61 (6)	22 (5)	20 (5)	19 (9)	
Retired	103 (10)	42 (10)	44 (11)	17 (8)	
Unemployed	104 (11)	47 (11)	39 (10)	18 (9)	
Retrenched	2 (0)	0 (0)	2 (1)	0 (0)	
Student	23 (2)	7 (2)	8 (2)	8 (4)	
Education level, No. (%)					0.508[a]
Primary/Secondary school	726 (72)	292 (70)	288 (74)	146 (70)	
Diploma	127 (13)	52 (13)	42 (11)	33 (16)	
Degree	86 (8)	37 (9)	33 (9)	16 (8)	
Other	72 (7)	35 (8)	25 (6)	12 (6)	

GINA, Global Initiative for Asthma; SD, standard deviation
a: Chi Square Test; b: Fisher Exact Test

Table II: Baseline information on asthma stage, symptoms, and adverse outcomes for patients according to GINA assessment of asthma control

Baseline characteristics	All patients N=1011	Well controlled N=416	Partly controlled N=388	Uncontrolled N=207	p-value
Current stage of asthma at time of visit as per GINA report, No. (%)					<0.001[a]
Mild, intermittent	557 (55)	359 (86)	171 (44)	27 (13)	
Mild, persistent	267 (26)	50 (12)	147 (38)	70 (34)	
Moderate, persistent	177 (18)	7 (2)	70 (18)	100 (48)	
Severe, persistent	10 (1)	0 (0)	0 (0)	10 (5)	
Any symptoms reported in the last four weeks, No. (%)	727 (72)	168 (40)	354 (91)	205 (99)	<0.001[a]
Cough	544 (54)	119 (29)	255 (66)	170 (82)	<0.001[a]
Wheezing	334 (33)	49 (12)	162 (42)	123 (59)	<0.001[a]
Trouble breathing	385 (38)	59 (14)	172 (44)	154 (74)	<0.001[a]
Chest tightness	224 (22)	33 (8)	99 (26)	92 (44)	<0.001[a]
Other	2 (0)	1 (0)	0 (0)	1 (0)	0.515[b]
Mean no. of exacerbations in the past one year (SD)	4.4 (11.8)	2.3 (5.3)	4.8 (14.0)	7.6 (15.3)	0.0001[c]
Mean no. of visits to the emergency room in the past one year (SD)	1.7 (4.5)	0.9 (1.8)	1.5 (2.6)	3.9 (8.5)	0.0001[c]
Mean no. of asthma-related hospitalisations in the past one year (SD)	0.1 (0.4)	0.1 (0.4)	0.1 (0.3)	0.2 (0.7)	0.6730[c]

GINA, Global Initiative for Asthma; SD, standard deviation
a: Chi Square Test; b: Fisher Exact Test; c: Kruskal-Wallis Test

Table III: Baseline information on treatment for patients according to GINA assessment of asthma control

Baseline characteristics, No (%)	All patients N = 1011	Well controlled N=416	Partly controlled N=388	Uncontrolled N=207	p-value
Treatment category					
Frequent OCS (5 days or more course within 3 months)	46 (5)	6 (1)	14 (4)	26 (13)	<0.001[a]
Long term high-dose and/or potent ICS (more than a year)	71 (7)	16 (4)	37 (10)	18 (9)	0.004[a]
Not prescribed ICS	101 (10)	36 (9)	42 (11)	23 (11)	0.493[a]
Incorrect inhaler technique, No. (%)	219 (22)	60 (14)	94 (24)	65 (31)	<0.001[a]
P450 inhibitors e.g. ritonavir, ketocon zole, itraconazole, No. (%)	1 (0)	0 (0)	0 (0)	1 (0)	0.205[b]
Current asthma treatment					
SABA, No. (%)	968 (96)	405 (97)	362 (93)	201 (97)	0.010[a]
Inhaled corticosteroids, No. (%)	663 (66)	266 (64)	259 (67)	138 (67)	0.657[a]
ICS/LABA*, No. (%)	229 (23)	64 (15)	104 (27)	61 (29)	<0.001[a]
Oral corticosteroids, No. (%)	46 (5)	8 (2)	12 (3)	26 (13)	<0.001[a]
Leukotriene receptor antagonist, No. (%)	39 (4)	6 (1)	20 (5)	13 (6)	0.003[a]
Antibiotics, No. (%)	9 (1)	2 (0)	6 (2)	1 (0)	0.282[b]
Other, No. (%)	71 (7)	21 (5)	29 (7)	21 (10)	0.058[a]

GINA, Global Initiative for Asthma; ICS, inhaled corticosteroid; LABA, long-acting 2-agonist; OCS, oral corticosteroids; PEFR, peak expiratory flow rate; SABA, short-acting β2-agonist; SD, standard deviation

*ICS/LABA ascurrent asthma treatment was separate from inhaled corticosteroids group
a: Chi Square Test; b: Fisher Exact Test

Table IV: Treatment adherence within the last four weeks according to GINA assessment of asthma control

Treatment adherence	All patients N=1011	Well-controlled N=416	Partly- controlled N=388	Uncontrolled N=207	p-value
Forgetting to take medication at any time, No. (%)	423 (49)	148 (44)	175 (52)	100 (56)	0.013[a]
Took less medication at any time, No. (%)	363 (42)	122 (36)	143 (42)	98 (55)	<0.001[a]
Stopping medications when feeling better, No. (%)	273 (32)	93 (27)	110 (33)	70 (39)	0.020[a]
Difficulty in taking medications, No. (%)	58 (7)	10 (3)	30 (9)	18 (10)	0.001[a]

GINA, Global Initiative for Asthma
a: Chi Square Test

Table V: Supplemental data in patients according to GINA assessment of asthma control

Comorbidity	All patients N=1011	Well-controlled N=416	Partly- controlled N=388	Uncontrolled N=207	p-value
Any comorbid condition, No. (%)	730 (72)	313 (75)	288 (74)	129 (62)	0.002a
Diabetes mellitus, No. (%)	160 (16)	76 (18)	59 (15)	25 (12)	0.125a
Dyslipidaemia, No. (%)	336 (33)	158 (38)	120 (31)	58 (28)	0.021a
Hypertension, No. (%)	331 (33)	155 (37)	123 (32)	53 (26)	0.012a
Gastroesophageal reflux, No. (%)	13 (1)	2 (0)	7 (2)	4 (2)	0.163a
Food allergy, No. (%)	118 (12)	37 (9)	57 (15)	24 (12)	0.038a
Cardiac disorder, No. (%)	22 (2)	8 (2)	9 (2)	5 (2)	0.897a
Rhinitis/nasal polyposis, No. (%)	168 (17)	56 (13)	76 (20)	36 (17)	0.062a
Obesity, No. (%)	196 (19)	74 (18)	76 (20)	46 (22)	0.416a
Spirometric data					
Spirometric measurements in the last three visits, No. (%)	26 (3)	12 (3)	7 (2)	7 (3)	0.446a
FEV1, L	26	12	7	7	0.2031b
Mean (SD)	3.8 (8.9)	6.1 (13.1)	1.7 (0.6)	2.0 (0.6)	
FEV1/FVC	26	12	7	7	0.0029c
Mean (SD)	83.4 (15.9)	94.0 (10.1)	73.4 (19.2)	75.3 (8.6)	
Peak flow rate					
Peak flow rate measurements in the last three visits, No. (%)	988 (98)	407 (98)	381 (98)	200 (97)	0.461a
PEFR	988	407	381	200	0.0001b
Mean (SD)	74.1 (19.0)	76.4 (17.7)	74.6 (20.2)	68.2 (18.3)	
History category					
High SABA user (>1 x 200-dose canister/month), No. (%)	55 (5)	2 (0)	19 (5)	34 (16)	<0.001a
Major psychological or socioeconomic problems, No. (%)	74 (7)	14 (3)	35 (9)	25 (12)	<0.001a
Ever intubated or in intensive care unit for asthma, No. (%)	31 (3)	10 (2)	13 (3)	8 (4)	0.559a
≥ 1 severe exacerbation in last 12 months (indicated for hospitalisation), No. (%)	73 (7)	21 (5)	21 (5)	31 (15)	<0.001a
Pregnancy induced asthma, No. (%)	121 (12)	35 (8)	60 (15)	26 (13)	0.008a
Exposure category					
Smoking, No. (%)	184 (18)	52 (13)	88 (23)	44 (21)	<0.001a
Allergens exposure if sensitised, No. (%)	499 (49)	173 (42)	214 (55)	112 (54)	<0.001a
Noxious chemicals, No. (%)	124 (12)	39 (9)	56 (14)	29 (14)	0.064a
Occupational exposure, No. (%)	111 (11)	31 (7)	40 (10)	40 (19)	<0.001a
Laboratory category					
Low FEV1, especially if >60% predicted, No. (%)					0.057d
No	61 (6)	23 (6)	20 (5)	18 (9)	
Yes	11 (1)	1 (0)	6 (2)	4 (2)	
Not available	939 (93)	392 (94)	362 (93)	185 (89)	
Sputum or blood eosinophilia, No. (%)					0.479d
No	37 (4)	14 (3)	14 (4)	9 (4)	
Yes	1 (0)	0 (0)	0 (0)	1 (0)	
Not available	973 (96)	402 (97)	374 (96)	197 (95)	
Chronic mucus hypersecretion, No. (%)					0.736a
No	169 (17)	73 (18)	60 (15)	36 (17)	
Yes	24 (2)	8 (2)	9 (2)	7 (3)	
Not available	818 (81)	335 (81)	319 (82)	164 (79)	

a: Chi Square Test; b: Kruskal-Wallis Test; c: ANOVA; d: Fisher Exact Test;
GINA, Global Initiative for Asthma; FVC, forced vital capacity; FEV1, forced expiratory volume in one second; PEFR, Peak Expiratory Flow Rate

Majority of the patients used pressurised metered-dose inhalers. Other inhalers used were dry powder inhalers such as budesonide/formoterol Turbuhaler, salmeterol/fluticasone Accuhaler, and salbutamol Easyhaler.

Asthma control

Based on GINA guidelines on asthma control, 41% (n=416) of patients had well-controlled asthma, 38% (n=388) partly controlled asthma and 21% (n=207) uncontrolled asthma (Table II). At the time of their visit to the clinics, more than half of the patients (55%, n=557) had mild-intermittent asthma and 26% (n=267) had mild-persistent asthma (Table II).

Majority (72%) reported having no symptoms in the last four weeks (Table II). Among those who had symptoms, the top complaints were cough (54%), followed by breathing problems and wheezing at 38% and 33%, respectively. On average, each patient had experienced 4.4 (SD11.8) exacerbations in the previous year, with 1.7 (SD4.5) visits to the emergency room.

The majority of patients (97%) did not have spirometry data collected in their last three clinic visits (Table V). However, almost all underwent (98%) peak flow rate measurements in their last three visits.

Patient adherence to asthma medication

All patients were currently prescribed medication for asthma, including SABA (96%), ICS (66%), ICS/LABA (23%), oral corticosteroids (5%), and leukotriene receptor antagonists (4%) (Table III).

Based on the questions on adherence to controller medication, more patients in the partly controlled (56%) and uncontrolled (52%) groups had forgotten to take their medications in the previous one month than the well-controlled group (44%) (Table IV). Similarly, more patients in the uncontrolled and partly controlled group took less than the prescribed amount of medication and stopped taking their medications when they felt better than the well-controlled group.

Factors associated with poor asthma control

The uncontrolled group had higher incidences of exacerbations (mean of 7.6 ([SD 15.3]) and visits to the emergency room (mean of 3.9 ([SD 8.5]). Poor asthma control was highly associated with exposure to allergens (49%, $p<0.001$), smoking (184 (18%), $p<0.001$), and incorrect inhaler technique (219 (22%), $p<0.001$) (Table V). Other factors for the group with poor asthma control which were statistically significant include high SABA use (defined as more than one 200-dose canister per month), and frequent oral corticosteroid use (5 days or more course within 3 months).

DISCUSSION

As a nationwide assessment, this ASCOPE study had showed that patients with asthma across primary care centres in Malaysia largely consisted of those with mild asthma (mild-intermittent or mild-persistent) (81%). A survey conducted among urban centres in Asia-Pacific countries examining asthma control showed a similar composition of patientpopulation, with 73% having mild asthma.[12] This emphasises a scale of milder disease in the total Malaysian population with asthma. Additionally, a mean number of 4.4 exacerbations in the past year among all patients underscores the unmet need in asthma at the primary care level.

In this study, less than half (41%) of patients had well-controlled asthma. A study in Sweden, which sought to compare asthma control in primary care patients in 2001 and 2005 using the GINA report found that asthma control was achieved in 37% and 40% of patients, respectively – concluding that there was still insufficient control of asthma despite the availability of guidelines for treatment.[13] The similarity in the results of asthma control from Swedish study with Malaysia underscores the need for better control of asthma among patients in primary care.

Spirometry was rarely used (3% in this study), in line with previous reports.[14] A 2012 US survey revealed that only between 6.8% and 17% of physicians such as family/general medicine practitioners, internists, paediatricians and community health centre clinicians always performed spirometry.[14] Based on a 2011 UK qualitative study that reported that undergraduates and some junior doctors failed to mention spirometry as an aid to diagnosis, due to the lack of familiarity, shortage of access and lack of encouragement from seniors,[15] there is a strong need for explicit training on spirometry use in the diagnosis and management of lung disease.

Despite the various current medications prescribed to patients in this study, asthma was not well-controlled. Lack of adherence to controller medications and incorrect use of inhalers appear to inhibit good asthma control, and this was in line with previous studies.[16-18] Low adherence may be attributed to patients taking medication only when needed, tolerating the symptoms of their conditions, and not appreciating the benefits of regular controller medication.[17] Adherence could be improved with the use of technology devices that can remind patients to take their medication.[19,20] As physicians tend to overestimate the adherence and ability to use inhalers by patients,[21] educating patients on the correct use of inhalational devices can improve adherence/reduce errors and improve asthma.[18] Therefore, patient education and empowerment, as well as enhancement of physician-patient relationship may improve asthma control.[22] In addition, pharmacists can play a crucial role in improving outcomes by increasing the awareness about treatment and providing patients with self-management support.[23,24] Regarding the financial effect, the improvement of the outcomes asthma in the primary care setting may reduce the direct medical cost of treating acute asthma exacerbations and asthma-related hospitalisations in tertiary care centres. In addition to being the main provider of primary healthcare in Malaysia, the government greatly subsidises the direct medical cost of treating asthma in tertiary centres.[25]

The findings of our study were limited by incomplete patient records, potential bias due to different interpretation and understanding between patients and interviewer, and a universal subject selection rather than a randomised controlled

methodology. Additionally, it is worth noting that information on staging of asthma at the time of diagnosis was not available; hence, it is recognised as part of the limitations.

CONCLUSION

Overall, only 41% of patients across primary care centres in Malaysia had good control of asthma. Spirometry was grossly underutilised to diagnose and assess asthma patients in primary care. In addition, although patients were prescribed various medications, they were generally unable to achieve well-controlled asthma, suggesting the presence of other factors. The study suggests a link between low adherence to controller medications and poor health outcomes, with asthma control worsening as more patients reduced their medication in the past one month or stopped their medication upon feeling better. These results were obtained while recognising the limitations. Hence, more effort is needed to improve asthma control, including among those with mild symptoms, who make up a large proportion of patients with asthma attending primary care in Malaysia.

ACKNOWLEDGEMENTS

This study was supported by AstraZeneca. The authors thank MyXMO and their team of writers for project management and medical writing support, which was funded by AstraZeneca. The authors also thank all site investigators, from the respective government health clinics, for providing the necessary data to carry out this important study: (Klinik Kesihatan Telok Datok, Selangor; Klinik Kesihatan Kuang, Selangor; Klinik Kesihatan Bandar Baru Ayer Itam, Penang; Klinik Kesihatan Seremban, Negeri Sembilan; Klinik Kesihatan Lukut, Negeri Sembilan; Klinik Kesihatan Bandar Permaisuri, Terengganu; Klinik Kesihatan Hiliran, Terengganu; Klinik Kesihatan Pantai Remis, Perak; Klinik Kesihatan Asajaya, Sarawak; Klinik Kesihatan Luyang, Sabah; Klinik Kesihatan Putrajaya Presint 18, Putrajaya; Klinik Kesihatan Simpang Kuala, Kedah; Klinik Kesihatan Jalan Putra, Kedah; and Klinik Kesihatan Kuala Lumpur, Kuala Lumpur.

DISCLOSURE

Viknesh Naidu, Vieshal Raja Gopal and Anton Kumar Alexander are the employees of AstraZeneca (Malaysia) Sdn. Bhd., Selangor, Malaysia.

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