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An assessment of adherence to asthma medication guidelines: findings from a tertiary care center in the state of Penang, Malaysia

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Background/aim: Multiple asthma guidelines have been developed to reduce asthma mortality, morbidity, and cost associated with asthma worldwide. In Malaysia, within this context, it is relatively unknown to what extent doctors adhere to the asthma guidelines. This study aimed to assess guideline adherence and calculate the cost of adhered and nonadhered prescriptions by medical doctors in a public tertiary health care facility.

Materials and methods: A cross-sectional study was carried out at Hospital Pulau Pinang, Malaysia. One hundred and eighty patients, a total of 30 patients per doctor, were enrolled to assess guideline adherence. The patients were followed for a second visit to assess their lung function. The costs of adhered and nonadhered prescriptions were calculated.

Results: One hundred and forty-three patients (79%) received guideline (Global Initiative for Asthma 2011)-adhering pharmacotherapy. In the majority of patients (n = 133, 73.9%) asthma control was classified as partially controlled. There was no significant association observed between patient asthma control and patient demographics; however, there was a significant difference ($P < 0.001$) between lung function values from the first and second visits. The cost of adhered prescription was higher (70.1 Malaysian ringgit) than that of nonadhered prescription (13.74 Malaysian ringgit).

Conclusion: Fair levels of guideline adherence were observed. Emphasis should be placed on identifying appropriate cost-effective medication regimens based on patient asthma control and constant feedback from patients.

Key words: Guideline adherence, cost-effectiveness, patient asthma control

1. Introduction

Asthma is a chronic respiratory disorder that is expected to affect 400 million people by 2025 (1). The increase in asthma prevalence not only affects asthma morbidity and mortality, but also affects asthma burden. The cost associated with asthma is estimated as one of the highest among chronic diseases (2). In Europe, asthma cases have doubled in the last decade. The cost associated with asthma was approximately $21.65 billion per year (3), the majority of which was related to productivity losses (55%), outpatient care (22%), and inpatient care (3%); the cost associated with antiasthma drugs was 20% (3). The mortality rate of asthma is 0.25 million deaths per year (1).

Asthma morbidity and mortality are largely preventable through appropriate medical services and patient education (4). To reduce asthma morbidity, mortality, and cost, multiple asthma guidelines have been developed for diagnosis, treatment, and management of the disorder. These guidelines are utilized by healthcare systems to provide a standardized approach for the treatment and management of asthma. Previous studies indicated that adherence to these guidelines is associated with a relative decrease in the risk of asthma-related hospitalization and emergency visits (5,6).

An epidemiological survey suggested that asthma is a substantial problem in the Asia-Pacific region. The control of asthma has been shown to fall short of the goals set forth by clinical practice guidelines. The annual direct cost per patient in Malaysia was estimated at $108 (7), with the prevalence of 1.8 million people, and the duration of days lost to asthma was 4.2 days per episode for adults and 2.4 days per episode for children. Asthma represents a significant socioeconomic burden for Malaysia (8).

The purpose of this paper is to evaluate guideline adherence by doctors and to determine the cost of adhered and nonadhered prescriptions.

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2. Materials and methods

A fundamental requirement for determining adherence to guidelines is an analysis of prescriptions given by doctors. This study aimed to prospectively record prescription patterns of 6 doctors from the respiratory clinic at Hospital Pulau Pinang. Thirty patients were selected per doctor participating in the study, for a total sample of 180 asthmatic patients (6 × 30 = 180). All established asthmatic patients were included in the current study, excluding pregnant women. Patients were followed-up with after 4 months and their lung function was recorded in order to compare and observe the difference in lung function from the first visit.

A data collection instrument was used to record patient demographic and clinical data. Hypertension, diabetes, and chronic obstructive pulmonary disease (COPD) were the 3 main recorded comorbidities. A thorough review of patient data was conducted to note multiple patient characteristics and to categorize patients' asthma control (controlled, partially controlled, and uncontrolled) based on the Global Initiative for Asthma (GINA) guidelines of 2011. Once patients were categorized, the doctor's treatment of the patient's asthma control and contraindicated medications were noted to indicate compliance with the GINA guidelines. Each prescription then was termed as "adhered" or "nonadhered".

All prescribed medications were recorded and their price was confirmed with the hospital pharmacy. The total cost of adhered and nonadhered prescriptions was calculated and compared.

2.1. Data analysis

Data were analyzed using SPSS 20.0 (IBM Corp., Armonk, NY, USA). Categorical data were illustrated as numbers and percentages, while continuous data were represented as mean ± standard deviation. Chi-square and Fisher exact tests were used to detect significance between variables. A paired sample t-test was used to identify any significant changes in lung function values from the first visit and the second visit. A P-value of 0.05 or below was considered statistically significant.

2.2. Ethical approval

The study was approved by the Ministry of Health and Medical Research Ethics Committee (MREC) of Malaysia, NMRR-12-1266-14166.

3. Results

3.1. Patient demographic and clinical data

Out of the total of 180 patients recruited for the study, 118 (65.6%) patients were female and 62 (34.4%) were male. Most of patients (n = 118, 65.6%) were aged 46 years and above. The sample was ethnically diverse and consisted of Malay (n = 93, 51.7%), Chinese (n = 47, 26.1%), and Indian (n = 40, 22.2%) ethnicities. Forty-three patients (23.9%) were smokers. Nocturnal awakening was reported in 49 patients (27.3%), and 6 patients (3.3%) reported nocturnal awakening thrice or more per week. Daytime asthma symptoms (twice per week) were reported by 21 patients (11.7%), whereas 38 patients (21.1%) required reliever medications twice or more per week. COPD was the most common comorbidity (n = 37, 20.6%), followed by diabetes 34 (18.9%) and hypertension (n = 30, 16.7%) (Table 1).

Table 1. Patient demographics and clinical characteristics.

Variables	No. (%)
Sex	
Male	62 (34.4)
Female	118 (65.6)
Age group	
Less than 25 years	11 (6.1)
25–35 years	26 (14.4)
36–45 years	25 (13.8)
46 years and above	118 (65.6)
Ethnicity	
Malay	93 (51.7)
Chinese	47 (26.1)
Indian	40 (22.2)
Smoking	
Yes	43 (23.9)
No	137 (76.1)
Nocturnal awakening	
None	125 (69.4)
Some	49 (27.3)
Thrice or more/week	6 (3.3)
Daytime symptoms	
None	156 (86.7)
Twice/week	21 (11.7)
Thrice or more/week	3 (1.7)
Reliever medication	
None	142 (78.9)
Twice or more/week	38 (21.1)
Comorbidities	
Hypertension	30 (16.7)
Diabetes	34 (18.9)
COPD	37 (20.6)
Single comorbidity	40 (22.2)
Two comorbidities	23 (12.8)
Three comorbidities	5 (2.8)

3.2. Categorizing patient asthma control

Patient asthma control was categorized based on patient clinical data and lung function values. Out of 180 patients, 14 (7.8%) patients' asthma control was categorized as controlled, 133 (73.9%) patients' asthma control was categorized as partially controlled, and 33 (18.3%) patients' asthma control was categorized as uncontrolled (Table 2).

3.3. Doctor guideline adherence and patient characteristics

The majority of patients (n = 143, 79%) received pharmacotherapy by respiratory department doctors in compliance with the GINA guidelines of 2011. Most male (74.1%) and female (82.2%) patients received guideline-adhering treatment. The majority of patients with diabetes (76.4%) as a comorbidity received guideline-adhering pharmacotherapy, followed by COPD (72.9%) and hypertension (66.6%). Statistically there was no significant association between patient characteristics and doctor guideline adherence grade (Table 3).

3.4. Patient lung function

Lung function tests were performed for all enrolled patients and were repeated on the second visit. During the first visit, most patients' (n = 154, 85.1%) lung function (FEV1) was recorded as <80%, whereas 25 (13.8%) patients' lung function was recorded as >80%; none of patients' lung function was reported as <40%. During patient follow-up, 41 (22.8%) patients reported their lung function as >80%, whereas the majority of patients (n = 117, 65%) had lung function values of <80% (Table 4).

3.5. Treatment cost of adhered and nonadhered prescriptions

All medicines prescribed were noted and the cost of each prescription was calculated. The total cost of 143 (79%) adhered prescriptions was 10,024.88 Malaysian ringgit (RM); the average cost per adhered prescription was RM 70.1. The total cost of 37 nonadhered prescriptions was RM 508.74; the average cost per nonadhered prescription was RM 13.74 (Table 6).

Table 2. Patient asthma control.

Asthma control	No. (%)
Controlled	14 (7.8)
Partially controlled	133 (73.9)
Uncontrolled	33 (18.3)

Table 3. Patient characteristics and guideline adherence.

Variable	Adhered No. (%)	Nonadhered No. (%)	P-value
Overall	143 (79)	37 (21)	
Sex			
Male	46 (74.1)	16 (25.9)	0.24*
Female	97 (82.2)	21 (17.8)	
Ethnicity			
Malay	76 (81.7)	17 (18.3)	0.061**
Chinese	32 (68)	15 (32)	
Indian	35 (87.5)	5 (12.5)	
Age group			
Less than 25 years	7 (63.6)	4 (36.4)	0.43**
25–35 years	22 (84.6)	4 (15.4)	
36–45 years	21 (84)	4 (16)	
46 and older	93 (78.8)	25 (21.2)	
Comorbidity			
Hypertension	20 (66.6)	10 (33.4)	0.08*
Diabetes	26 (76.4)	8 (23.6)	0.64*
COPD	27 (72.9)	10 (16.1)	0.36*

*Fisher exact test, **chi-square test.

Table 4. Lung function of patients' on first and second visits.

Patient lung function	No. (%)
First visit	
>80%	25 (13.8)
<80%	154 (85.1)
<60%	1 (0.6%)
<40%	-
Second visit	
>80%	41 (22.8)
<80%	117 (65)
<60%	22 (12.2)
<40%	-

The mean scores of lung function after the first (1.24) and second (1.59) visits indicate a difference in spirometry values. Statistically, the paired sample t-test indicates that there is a significant difference ($P < 0.001$) in lung function values after the second visit (Table 5).

Table 5. Spirometry values after first and second visits.

Variables	Mean	Std. deviation	t	Sig. (2-tailed)
First visit	1.24	0.51	–14.7	<0.001
Second visit	1.59	0.52		

Table 6. The cost of adhered and nonadhered prescriptions.

Variables	Doctor prescription	Total cost (RM)	Average cost/prescription (RM)
Adhered prescription	143	10,024.88	70.1
Nonadhered prescription	37	508.744	13.74

4. Discussion

Our findings indicate that the majority of patients (79%) received guideline-adhering therapy. This is contrary to previous studies that indicated poor adherence to guidelines (9–12). The essence of clinical practice guidelines is to provide a standardized approach in treatment and management of disease, and importantly to improve patients' conditions. Despite the majority of patients being given guideline-adhering treatment, most patients' asthma control was still categorized as partially controlled. However, appropriate treatment is one of the many factors that are involved in managing asthma patients.

Spirometry has long been used as a marker of airway obstruction and is endorsed by various asthma guidelines (13). A decline in FEV1 is associated with a risk of nonreversible airway obstruction (14). However, unlike the previous guidelines that insisted on spirometry as a frontline indicator of patients' asthma status, GINA 2011 recommends evaluation of patient clinical symptoms together with spirometric values as an indicator of patient asthma control. Spirometric evaluation of patients indicated a statistical difference in the FEV1 values between the first and second visits; this improvement cannot solely represent our patient sample's improvement overall. Hence, attention to patients' clinical symptoms is equally important in managing asthma.

Past studies indicated cost-effectiveness by guideline adherence (15). In the current study, most of the prescriptions were adhered to (79%) and a variety of asthma medications along with controller medication were prescribed. The average cost of adhered prescriptions (RM 70.1) was higher when compared to nonadhered prescriptions (RM 13.74). Although the mainstays of asthma medications are corticosteroids and B agonists, the guideline provides a stepwise approach to managing

asthma patients based on patient asthma control. Since Malaysia is a multiethnic country with 3 coexisting main ethnicities, establishing a suitable cost-effective medication for the general population is challenging. However, clinical trials and further research can help identify an appropriate cost-effective medication in a multiethnic population.

The relationship between total deposition fraction (TDF) and particle size has long been established as one in which TDF increases with the decrease in particle size (16). Moreover, combination therapy in a single dose is widely used and provides better results than conventional multiple dose therapy (17). In the current study, budesonide/formoterol and fluticasone/salmeterol combination single-dose therapies were prescribed to 91 (50.5%) patients. Although combination therapy of a single dose with smaller particle size produces superior results, together both medications make up a major (82.7%) portion of total adhered prescription expenditures. It is critical to pay attention and monitor the patient for constant feedback to identify the most suitable and cost-effective medication combination. To ensure cost-effectiveness, single-dose combination therapy should be used with more selective decision-making.

A balance between guideline-adhering medication and cost-effectiveness should be maintained. Efforts are needed to identify appropriate cost-effective medications in a multiethnic population. In the current study, patient follow-up was done once. Multiple follow-ups with patients and a larger patient sample size could have provided us with more information. Nevertheless, the current study highlights a fine barrier between cost-effective medication and guideline adherence that doctors need to keep in mind during their clinical practice.

In conclusion, although a fair level of guideline adherence was observed, the cost of guideline-adhering prescriptions was higher than that of nonadhered prescriptions. The asthma guideline recommends a variety of medication combinations. Doctors need to identify appropriate cost-effective medication regimens based on patient asthma control and constant feedback from patients.

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