



Contents lists available at ScienceDirect



The burden of adult asthma in a high GDP per capita country: the QASMA study

Wanis H. Ibrahim, MD^{*}; Noor N. Suleiman, MD[†]; Fathi El-Allus, MD[‡]; Jamal Suleiman, MD[‡]; Abdurrahmaan A. Elbuzidi, MD[‡]; Mylai D. Guerrero, MD[‡]; Aldwin N. Guerrero, MD[§]; Abdelrauof Akkari, MD[‡]; Hanfa Karim, MD[‡]; Samah A. Awouda, MD[‡]; and Salma Suliman, MD[†]

^{*} Department of Medicine, Pulmonary Section, Hamad General Hospital and Weill-Cornell Medical College, Doha, Qatar

[†] Department of Medicine, Hamad General Hospital, Doha, Qatar

[‡] Department of Public Health, Hamad Medical Corporation, Doha, Qatar

[§] Department of Emergency Medicine, Hamad General Hospital, Doha, Qatar

ARTICLE INFO

Article history:

Received for publication July 1, 2014.

Received in revised form August 18, 2014.

Accepted for publication August 20, 2014.

ABSTRACT

Background: Asthma is a major health problem worldwide. Suboptimal asthma care and poor asthma control are common even in developed countries. Qatar has the highest gross domestic product per capita in the world and high per capita health expenditure. No prior study has assessed the burden of adult asthma in this country.

Objectives: To assess asthma control, patients' level of education about asthma, and level of asthma care in a country with the highest gross domestic product per capita in the world.

Methods: A face-to-face, cross-sectional study of 520 adults with physician-diagnosed asthma conducted in various health care facilities in Qatar.

Results: Thirty-three percent, 41%, and 26% of patients had uncontrolled, controlled, and partly controlled asthma, respectively. Only 4.9% of patients had previously received a written asthma management plan, 3.5% had a flow meter at home, and 37.2% had a spirometry performed in the previous 5 years. In addition, 42.9% misunderstood the role of reliever and controller medications. Inhaler technique was incorrect in 47% of these patients. There was a significant association between the type of physician practice and level of asthma control, with worst control being at the general practice level. Moreover, 57.3% of patients had at least 1 asthma-related visit to the emergency department in 1 year and 18.7% had more than 3 visits.

Conclusion: The very high gross domestic product per capita in Qatar and the high health expenditure per capita do not seem to have led to better asthma care and control. A comprehensive national asthma service improvement program is much needed.

© 2014 American College of Allergy, Asthma & Immunology. Published by Elsevier Inc. All rights reserved.

Introduction

Asthma represents a major global health problem and is associated with significant morbidity. More than 300 million individuals are affected by asthma and asthma accounts for approximately 1 of every 250 deaths worldwide.^{1,2} Many of these deaths are preventable and are due to suboptimal long-term medical care and delay in obtaining help during the final attack. Furthermore, asthma was the 25th leading cause of disability-adjusted life years lost worldwide in 2001.¹ Although there are geographic differences in the prevalence of asthma, overall asthma prevalence seems to be increasing worldwide, particularly in communities that have adopted Western lifestyles or become

urbanized.¹ Factors such as increased allergic sensitizations; changing environmental influences, such as microorganisms, pollutants, indoor, and outdoor allergens; and diet could have played a role in this increase.³ Aside from the increase in asthma prevalence, there has been a sharp increase in asthma-related morbidity and economic burden worldwide. In Europe, for example, an alarming percentage of patients with asthma from the general population have reported productivity losses, leisure time forgone, or use of hospital services.⁴ Disappointingly, despite the availability of widely accepted international and national guidelines, asthma control remains largely suboptimal even in developed countries. Multiple factors related to health care systems and patient and environmental exposures have contributed to the poor asthma control in many countries worldwide. For example, in many areas of the world, individuals with asthma do not have access to basic asthma medications or medical care.¹ In a study evaluating the affordability of inhaled corticosteroids as a potential barrier to

Reprints: Wanis H. Ibrahim, MD, Department of Medicine, Hamad General Hospital and Weill-Cornell Medical College, Doha, Qatar; E-mail: wibrahim@hmc.org.qa.

Disclosure: Authors have nothing to disclose.

<http://dx.doi.org/10.1016/j.anai.2014.08.014>

1081-1206/© 2014 American College of Allergy, Asthma & Immunology. Published by Elsevier Inc. All rights reserved.

treatment of asthma in 8 developing countries, medications were consistently available in only 4 of these 8 countries. In all but 2 countries, the cost of 1 year of drugs for the treatment of a moderate, persistent case exceeded the monthly salary of a nurse in that country.⁵ Qatar is an oil- and gas-rich country with a population of 1,903,447 (1,405,164 male and 498,283 female residents).⁶ It has the highest gross domestic product (GDP) per capita in the world (2013 estimates)⁷ and is at the top of the list of per capita health expenditure in the Gulf Cooperation Council.⁸ The country is currently witnessing rapid development and comprehensive reforms in its health care system. The prevalence of asthma in the adult population in Qatar is unknown. A previous study has estimated a prevalence of 19.8% of asthma in school children in Qatar.⁹ The behavior of asthma, its level of control, patient awareness about asthma, health care usage, and level of care provided for patients with asthma have not been examined previously in this country. Qatar Asthma in Adult (QASMA) is the first study of the Qatari adult population with asthma exploring the burden and control of the disease.

Study Objectives

The main objectives of this study were to assess asthma control, patients' level of education about asthma, and level of asthma care in a country with the highest GDP per capita in the world. Secondary objectives were to link the level of asthma control to the type of physician practice and to assess the clinical characteristics of asthma in Qatar.

Methods

This was a cross-sectional study of 520 adults with physician-diagnosed asthma. The study was approved by the joint institutional review board of Hamad Medical Corporation and Weill Cornell Medical College (Doha, Qatar) and was conducted from May 2011 to March 2014. Inclusion criteria included all patients at least 15 years old at the time of interview with physician-diagnosed asthma who attended various health care facilities in Qatar for their asthma follow-up or care during the study period (the cutoff age of 15 years is considered the onset of adulthood in the Qatari health system). The study settings included outpatient clinics, primary health centers, inpatient settings, cardiac hospitals, emergency departments (EDs), and the private health care sector. Pregnant women with asthma were excluded because they were enrolled in another ongoing study and because of the effects of pregnancy on asthma. Ten of the 530 patients who were invited to participate declined because of their busy schedule, yielding a 98% participation rate.

Data Collection

After obtaining verbal consent, participants were interviewed face to face by one of the authors of this report for an average of 30 minutes using a written questionnaire. The questionnaire assessed 5 asthma-related items. The first item included details of asthma history, symptoms, triggering factors, associated medical conditions (that might worsen asthma control), family history, and smoking history. The second item included questions on the level of asthma control. The third item assessed the type of physician practice providing asthma care for the participant, peak expiratory flow rate (PEF), pulmonary function test (PFT) results, and allergy test results. The fourth item assessed the current asthma medications used by the patient. The fifth item assessed patient knowledge and education about asthma and asthma medications. Results of the last PFT and allergy tests were obtained from the electronic patient record system. If the PFT result was not available on the electronic system, a confirmation of when was the last PFT

was performed and the number of times it was performed was ascertained directly from the participant.

Assessment of Asthma Control

Asthma control was assessed based on the Global Initiative for Asthma (GINA) classification system for level of asthma control,¹⁰ which is comprised of daytime symptoms, nocturnal symptoms, need for reliever medications, limitation of activity, and lung function test (forced expiratory volume in 1 second or PEF). Asthma was classified as controlled if during the previous 4 weeks the patient had daytime symptoms no more than 2 times per week, no asthma-related limitation of activities, no nocturnal symptoms, use of reliever medication no more than 2 times per week, and a forced expiratory volume in 1 second or PEF greater than 80% of predicted or the patient's best record. If any 1 of these was not fulfilled, then the asthma would be classified as partly controlled, and if at least 3 features of partly controlled asthma were present, asthma was classified as uncontrolled. For patients who had no recent PFT result at the time of or before the interview, the remaining 4 clinical components of the GINA criteria were used to determine the level of asthma control.

Assessment of Inhaler Technique

Patients were requested to demonstrate their inhaler technique to the interviewer using their own inhalers. For metered-dose inhalers, the following 5 steps¹¹ were used to determine the correct use of inhaler: (1) removing cap and shaking the inhaler, (2) breathing out gently before using the inhaler, (3) putting the mouthpiece in the mouth, (4) pressing the canister down at start of inspiration and continuing to inhale slowly and deeply, and (5) performing a breath-hold for at least 10 seconds. For dry powder inhalers, patients were assessed for their performance of the following steps: (1) breathing out gently before using the inhaler, (2) placing the inhaler in the mouth and creating an adequate seal with the lips, (3) deep inhalation of the powder, and (4) removing the inhaler from the mouth and performing a breath-hold for 10 seconds. Incorrect use was defined as the failure to perform at least 1 of these steps.

Quality Assurance

To ensure consistency of the study methodology and limit bias, physicians who conducted the interviews received prior training sessions on asthma guidelines (GINA) and inhaler use. Only answers that a participant was sure of were recorded. Answers that the participants were not sure of were recorded as unknown.

Statistical Analysis

Qualitative and quantitative data were expressed as frequency with percentage and mean $\pm$ SD with median and range. Descriptive statistics were used to summarize demographic and all other clinical characteristics of the participants. Associations between at least 2 qualitative or categorical variables were assessed using χ^2 test. For small cell frequencies, χ^2 test with a continuity correction factor or the Fisher exact test was applied. Pictorial presentations of the key results were made using appropriate statistical graphs. A 2-sided *P* value less than .05 was considered statistically significant. All statistical analyses were performed using SPSS 19.0 (SPSS, Inc, Chicago, Illinois).

Results

Asthma and Characteristics of Study Population

Tables 1 and 2 list the characteristics of asthma in the participants. Approximately 58% and 42% of participants in this study were men and women, respectively. The most common age of onset

Table 1
Patient and disease characteristics

Sex (n = 518)	
Men	301 (58.1%)
Women	217 (41.9%)
Nationality (n = 520)	
Qatari	188 (36.2%)
Non-Qatari	332 (63.8%)
Asthma symptoms usually experienced by patient (n = 520)	
Breathlessness	438 (84.2%)
Wheezing	411 (79.0%)
Cough	435 (83.7%)
Sputum	177 (34.0%)
Age of onset of asthma (n = 473)	
<15 y	127 (26.8%)
15–40 y	236 (49.9%)
>40 y	110 (23.3%)
Relation of asthma symptoms to work (n = 520)	
No difference	338 (65.0%)
Worse at work	97 (18.7%)
Better at work	10 (1.9%)
Not sure	75 (14.4%)
Symptoms better or worse during weekends (n = 515)	
Better during weekends	79 (15.3%)
Worse during weekends	22 (4.3%)
No difference	385 (74.8%)
Not sure	29 (5.6%)
Symptoms better indoors or outdoors (n = 517)	
Symptoms worse indoors	66 (12.8%)
Symptoms worse outdoors	196 (37.9%)
No difference	255 (49.3%)
Diurnal variation of asthma symptoms (n = 520)	
No diurnal variation	232 (44.6%)
More during daytime	77 (14.8%)
More at night	211 (40.6%)
Seasonal variation of asthma symptoms (n = 518)	
No seasonal variation	199 (38.4%)
Worse in spring	10 (1.9%)
Worse in summer	48 (9.3%)
Worse in autumn	8 (1.5%)
Worse in winter	242 (46.7%)
Worse in summer and winter	8 (1.5%)
Worse in spring and winter	2 (0.4%)
Worse in spring and autumn	1 (0.2%)

of asthma in this adult population was 15 to 45 years. Approximately 19% of participants reported worsening of their asthma at work, 37.9% outdoors, and 40.6% at night. Asthma symptoms were noted to be worse in winter. Thirty-six percent of participants had at least 1 first-degree family member with asthma. Allergic rhinitis was the most commonly associated allergic disease (49.2% of participants). Respiratory tract infection followed by air pollution was the most commonly encountered triggering factor for asthma symptoms in participants.

Level of Asthma Control

Based on the GINA criteria of asthma level of control, the estimates of the proportion of participants whose asthma was uncontrolled, controlled, and partly controlled in this study were 33%, 41%, and 26%, respectively. In addition, 5.5% of participants reported that their asthma was steroid dependent (ie, unable to withdraw from oral steroids because of asthma worsening).

Asthma Care Practices in Participants

Table 3 presents asthma care practice in Qatar. Of the 520 participants included, 176 (33.9%), 168 (32.4%), 31 (6%), 29 (5.6%), and 46 (8.9%) were under the care of a respiratory specialist, a general practitioner, a private physician, an internal medicine resident, and an internal medicine specialist (fellow), respectively. Sixty-five participants (12.5%) were under the care of other specialists (cardiologist, ED physician, etc) and 4 patients (0.8%) were not

Table 2
Additional patient and disease characteristics

Family history of asthma and allergic diseases (n = 520)	
First-degree family member with asthma	187 (36.0%)
Second-degree family member with asthma	80 (15.4%)
Skin allergy in family	94 (18.1%)
Allergic rhinitis in family	96 (18.5%)
Other allergies in family	60 (11.5%)
Smoking history (no = 520)	
Current smoker	60 (11.5%)
Ex-smoker	57 (11.0%)
Associated allergic and other conditions that might worsen asthma control (no = 520)	
Allergic rhinitis	256 (49.2%)
Nasal polyps	46 (8.8%)
Symptomatic GERD	96 (18.5%)
Sinusitis	76 (14.6%)
Obesity	84 (16.2%)
Skin allergy	87 (16.7%)
Triggering factors for asthma symptoms (n = 520)	
Respiratory infections	384 (73.8%)
Air pollution	322 (61.9%)
House dust mite	195 (37.5%)
Perfumes	286 (55.0%)
Animals	91 (17.5%)
Cockroaches	27 (5.2%)
Pollens	55 (10.6%)
Molds	14 (2.7%)
Aspirin	11 (2.1%)
NSAID	15 (2.9%)
β Blockers	5 (1.0%)
Cigarette smoke	228 (43.8%)
Laughing or crying	142 (27.3%)
Exercise	169 (32.6%)
Dusty weather	30 (5.8%)
Level of asthma control based on GINA criteria (no = 516)	
Controlled	212 (41.1%)
Partially controlled	134 (26.0%)
Uncontrolled	170 (32.9%)

Abbreviations: GERD, gastroesophageal reflux disease; GINA, Global Initiative for Asthma; NSAID, nonsteroidal anti-inflammatory drug.

receiving any regular medical care. Only 4.9% of participants had previously received a written asthma management plan and 3.5% had a PEF meter at home. In addition, 37.2% of participants had a PFT performed in the previous 5 years (22% had a PFT performed in the previous year) and 17% had skin prick testing performed previously.

Patient Knowledge and Awareness about Asthma and Medication

Of the participants included, 42.9% did not know the difference between reliever and controller medications. Inhaler technique was incorrect in 47% of these participants.

Correlation between Different Variables and Level of Asthma Control

Table 4 presents the association between different variables and level of asthma control. In the present study, a strong association was found among a positive history of allergic rhinitis, a history of sinusitis, and poor asthma control ($P < .001$). There also was a statistically significant association between symptomatic gastroesophageal reflux disease (GERD) and poor asthma control ($P = .014$). Participants who reported skin allergy also had poor asthma control ($P = .003$). Although asthma control was generally suboptimal, it was worse at the general practice level ($P < .001$). Incorrect use of an inhaler was found to be strongly associated with poor asthma control and vice versa ($P = .009$). No statistically significant association between level of asthma control and patient sex was found.

Table 3
Asthma care practice in Qatar

Physician following patients with asthma (no = 519)	
Specialist in chest diseases	176 (33.9%)
General practitioner	168 (32.4%)
Private physician	31 (6.0%)
Internal medicine resident	29 (5.6%)
Internal medicine specialist (fellow)	46 (8.9%)
Others	65 (12.5%)
None	4 (0.8%)
Percentage of patients with asthma who have PEF meter at home (no = 520)	
Yes	18 (3.5%)
No	502 (96.5%)
Percentage of patients with asthma provided with written asthma management plan (n = 511)	
Provided	25 (4.9%)
Not provided	486 (95.1%)
Percentage of patients with asthma who had previous SPT (n = 520)	
Yes	87 (17%)
No	433 (83%)
Percentage of patients with asthma who had PFT in previous 5 y (n = 519)	
Yes	193 (37.2%)
No	326 (62.8%)
Asthma controller medications used by participants (n = 518)	
Seretide Diskus (GSK)	233 (45%)
Symbicort Turbohaler (AstraZeneca)	43 (8.3%)
Beclomethasone inhaler	45 (8.7%)
Montelukast	33 (6.4%)
Oral steroid	49/517 (9.5%)
Steroid dependent	28/513 (5.5%)

Abbreviations: PEF, peak expiratory flow rate; PFT, pulmonary function testing; SPT, skin prick testing.

Health Care Service Use and Work Absenteeism Related to Asthma

Table 5 presents the health care usage and work absenteeism related to asthma. Of participants included, 25.6% had work absenteeism in the previous 3 months; 57.3% of these participants had at least 1 visit to the ED in the previous year for asthma and 18.7% of these had more than 3 visits. Twenty-two participants had at least 1 medical ward admission in the previous year and 3.2% had at least 1 admission to the intensive care unit in the previous year.

Discussion

The most striking finding in this study is the suboptimal control of asthma in this country with the highest GDP per capita in the world. Although asthma control was generally poor at all levels of care, control was worse at the primary care level. Qatar is witnessing comprehensive reforms in its health care system aiming at achieving a world-class, patient-centered health care system by 2030. All governmental hospitals are of high standard and accredited by the Joint Commission International. Nevertheless, the newly initiated family physician program is not fully established. There are no dedicated asthma clinics in primary health centers. Furthermore, most of these centers do not have spirometry machines. An asthma education program remains underdeveloped even at tertiary care level. Inadequate asthma control seems to be a worldwide problem. Large population-based studies have clearly shown that an achievable level of control is not always reached. Even in developed nations, including Europe, Canada, and the United States, the GINA guideline goals are not currently being achieved. Chapman et al.¹² reported that most patients with asthma in Canada treated in general practice had uncontrolled asthma. In a very recent study on patients with asthma in Italy, the proportions of controlled, partly controlled, and uncontrolled asthma were 26.3%, 51.6%, and 22.1%, respectively.¹³ A large survey using the Asthma Control Test conducted in 5 European countries, including France, Germany, Italy, Spain, and the United Kingdom, showed

Table 4
Association between different variables and level of asthma control^a

Variable	Controlled	Partially controlled	Uncontrolled	P value
Age of onset of asthma				.541
<15 y	42 (23.3%)	34 (27.2%)	50 (30.5%)	
15–40 y	96 (53.3%)	64 (51.2%)	74 (45.1%)	
>40 y	42 (23.3%)	27 (21.6%)	40 (24.4%)	
Sex				.622
Men	122 (57.5%)	74 (55.2%)	102 (60.7%)	
Women	90 (42.5%)	60 (44.8%)	66 (39.3%)	
Allergic rhinitis				<.001
Yes	88 (41.5%)	61 (45.5%)	105 (61.8%)	
No	124 (58.5%)	73 (54.5%)	65 (38.2%)	
Nasal polyps				.88
Yes	12 (5.7%)	14 (10.4%)	20 (11.8%)	
No	200 (94.3%)	120 (89.6%)	150 (88.2%)	
GERD				.014
Yes	36 (17%)	17 (12.7%)	43 (25.3%)	
No	176 (83%)	117 (87.3%)	127 (74.7%)	
Sinusitis				<.001
Yes	18 (8.5%)	17 (12.7%)	41 (24.1%)	
No	194 (91.5%)	117 (87.3%)	129 (75.9%)	
Obesity				.219
Yes	27 (12.7%)	24 (17.9%)	32 (18.8%)	
No	185 (87.3%)	110 (82.1%)	138 (81.2%)	
Skin allergy				.003
Yes	25 (11.8%)	20 (14.9%)	42 (24.7%)	
No	187 (88.2%)	114 (85.1%)	128 (75.3%)	
Kind of physician practice caring for participant with asthma				<.001
Specialist in chest disease	70 (33%)	59 (44.4%)	46 (27.1%)	
General practitioner	51 (24.1%)	30 (22.6%)	84 (49.4%)	
Private physician	18 (8.5%)	5 (3.8%)	8 (4.7%)	
Internal medicine resident	21 (9.9%)	5 (3.8%)	3 (1.8%)	
Internal medicine specialist	18 (8.5%)	19 (14.3%)	9 (5.3%)	
Others	32 (15.1%)	13 (9.8%)	20 (11.8%)	
None	2 (0.9%)	2 (1.5%)	0 (0%)	
Technique of inhaler use				.009
Correct	120 (61.2%)	57 (46.7%)	74 (47.1%)	
Incorrect	76 (38.8%)	65 (53.3%)	83 (52.9%)	

Abbreviation: GERD, gastroesophageal reflux disease.

^aData are presented as count (percentage with asthma control).

that 50.4% of patients with asthma did not have well-controlled asthma.¹⁴ In the United States, a recent survey of 1,000 patients with asthma found that 79% of them had persistent asthma and should have been on controllers. Of the 51% on controllers, 86% were inadequately treated because their asthma was not well or very poorly controlled.¹⁵ Reports from Arabian Gulf countries also have described poor asthma control and a critical shortage in the care provided for patients with asthma.^{16–18} Suboptimal asthma care practice in Qatar is another major finding of this study. The present study found inadequate monitoring of patients' lung function using spirometry or a home PEF meter and inadequate testing. An important fact regarding spirometry service in Qatar is that it is not available in most primary care centers. Even in the main tertiary hospital caring for asthma, it is rarely performed on site owing to over-reliance on the PFT laboratory in that hospital. This study also showed a significant deficiency in patient education and patients' perception of asthma and asthma medications. Misunderstanding the role of reliever and controller medications in asthma management, incorrect use of an inhaler, and underuse of a written asthma management action plan were major findings in this study. There is strong evidence in the literature that education in asthma self-management, which involves self-monitoring by a PEF meter or symptoms, coupled with regular medical review and a written action plan improves health outcomes for adults with asthma and improves asthma control.¹⁹ All current asthma guidelines recommend that patients be educated about their condition, obtain regular medical reviews, monitor their condition at home

Table 5

Health care usage and work absenteeism related to asthma

Asthma-specific work/school absenteeism in previous 3 mo (no = 444)	
Work/school absenteeism in previous 3 mo	114 (25.6%)
Asthma-specific ED visits in previous 12 mo (no = 518)	
1 visit in previous year	105 (20.3%)
2 visits in previous year	54 (10.4%)
3 visits in previous year	41 (7.9%)
>3 visits in previous year	97 (18.7%)
Asthma-specific medical ward admissions in previous 12 mo (no = 516)	
1 admission in previous year	71 (13.8%)
2 admissions in previous year	24 (4.7%)
3 admissions in previous year	6 (1.2%)
>3 admissions in previous year	12 (2.3%)
Asthma-specific ICU admissions in previous 12 mo (no = 517)	
1 admission in previous year	14 (2.7%)
2 admissions in previous year	1 (0.19%)
3 admissions in previous year	1 (0.19%)
>3 admissions in previous year	1 (0.19%)
Placed on mechanical ventilator in previous year (n = 516)	
Yes	30 (5.8%)
No	486 (94.2%)

Abbreviations: ED, emergency department; ICU, intensive care unit.

with a PEF meter or symptoms, and use a written action plan.^{10,19} Similar problems with patient education regarding asthma have been observed in developed and developing countries. In Washington State and New York City in the United States, only 25% of patients with asthma had ever been provided with a written asthma action management plan and approximately half of them had never been taught how to use a PEF meter.²⁰ Another finding in the QASMA study is the substantial health care use by patients with asthma. The very large number of ED visits by patients with asthma in Qatar is very striking (57% of participants had at least 1 asthma-specific ED visit in the 12 months preceding the study). This figure seems much higher than what has been reported in other countries. In Montana in the United States, for example, 11.7% of adults with asthma reported visiting an ED for asthma within 1 year.²¹ In Europe, 25% of patients with asthma reported an unscheduled urgent care visit, 10% reported at least 1 ED visit, and 7% reported overnight hospitalization owing to asthma in a 1-year period.²² In other parts of the world, such as Latin America and Oman, the figure seems closer to that of Qatar.^{17,23} The most likely explanation for the many ED visits by patients with asthma in Qatar is the strong reliance on the ED service in general. The very large, well-equipped ED, the lack of a well-established family physician service, the long waiting list of scheduled outpatient clinics, and the rapidly increasing population could have resulted in the over-reliance on the ED service. Data from the ED registry of Hamad General Hospital (the main hospital providing tertiary asthma care) showed approximately 6,233 ED asthma-related adult visits in that hospital alone during a 12-month period (November 2012 to October 2013). This translates to an average of 17 ED visits for asthma in that hospital each day. Most of these cases were treated and released from the ED. Three hundred eighty-one (6.1%) and 14 (0.22%) resulted in hospitalization in a medical floor and an intensive care unit, respectively. The average total costs of ED visits, medical floor admissions (average length of stay 4.36 days), and intensive care unit admissions (average length of stay 6.12 days) by patients with asthma in Hamad General Hospital (in 1 year) are approximately US\$973,345.28, US\$1,944,254.89, and US\$260,162.18, respectively. Incorrect use of metered-dose inhaler devices is common in patients with asthma worldwide. Some studies from developed countries have confirmed that more than 60% of patients were unable to use their metered-dose inhaler correctly after being shown how on 3 occasions.²⁴ In practice, it is logical that inhalers are prescribed only after patients have received

training and demonstrated their ability to use the device. The association between incorrect inhaler technique and poor asthma control has been reported in multiple previous studies.^{25–27} In the present study, almost half of patients used their inhaler devices incorrectly. In agreement with previous studies, a strong association was found between poor asthma control and incorrect use of inhaler devices. Previous studies have implicated some respiratory viruses in the pathogenesis of asthma. Furthermore, seasonal variations in asthma symptoms are well known in the literature. Asthma mortality and hospital admissions are more common during the winter months (possibly explained by infections).^{28,29} In a large study of more than 2,500 young adults with asthma, a substantial proportion reported seasonal variation in their asthma attacks. Individuals who were not sensitized to grass reported more attacks in the winter months (most likely owing to the effects of respiratory infections).³⁰ In the QASMA study, most patients reported respiratory tract infections as the most common triggering factor for their asthma symptoms. In addition, winter was the season in which asthma symptoms worsened compared with other seasons of the year. Rhinitis is a major risk factor for asthma and often precedes it. Increasing evidence on the link between allergic rhinitis and asthma comes from epidemiologic, immunologic, and clinical studies. Epidemiologically, up to 40% of patients with allergic rhinitis also have asthma, and up to 80% of patients with asthma have nasal symptoms. Adults and children with asthma and concomitant allergic rhinitis have more asthma-related hospitalizations and physician visits and incur higher asthma drug costs than patients with asthma alone.^{31–35} In the present study, nearly half the patients with asthma also had received the diagnosis of allergic rhinitis by their physicians. Moreover, a strong association was found between the presence of allergic rhinitis and poor asthma control. Self-reported GERD has been reported in as many as 80% of patients with asthma, and GERD identified by a positive pH probe occurs at a rate of 38%. GERD might contribute to poorly controlled asthma and asthma exacerbations.^{36–38} In the present study, a prevalence of 18.5% of symptomatic GERD was found in participants with asthma. In addition, a statistically significant association was found between the presence of GERD symptoms and poor asthma control. In contrast to previous studies that showed an association between female sex and poor asthma control,^{13,39} the present study found no such association. Rather, female sex in this study showed a trend toward better asthma control, although this was statistically insignificant. A very recent study of 242 patients that directly assessed the effect of sex on asthma control showed a similar statistically nonsignificant association.⁴⁰ The QASMA study is the first comprehensive study to document the burden of asthma in an adult population of Qatar. A point of strength in this study is that interviews of patients with asthma were conducted face to face by physicians who already had good background knowledge of asthma and asthma guidelines. In this study, inhaler technique was observed directly by the interviewing physician. Furthermore, for information accuracy, interviewing physicians were not responsible for the asthma care of the participants. Another point of strength is that patients from various levels of health care facilities (eg, general practice and specialized care clinics) were recruited. This permitted a comparison between the kind of physician practice and the level of asthma control. Nevertheless, a major limitation of this study is that PFT was not performed regularly for the participants. For participants who did not have a recent PFT result (in the previous year), the remaining clinical symptoms of the GINA criteria were used for assessing the level of asthma control. It has been suggested that asthma control is likely to be overestimated if evaluated by symptoms alone.^{41–44} Nevertheless, subgroup analysis of the 115 participants (22%) with a PFT result in the previous year also showed suboptimal asthma control (27.8% with controlled asthma, 47% with partly controlled asthma, and 25.2% with

uncontrolled asthma). Furthermore, reliance on prior physician diagnosis of asthma in a country where PFT is underused and on patient recall could result in an impure asthma cohort and recall bias. Another limitation of this study is that the relation between socioeconomic factors and asthma control was not assessed. The authors are not sure how many participants could afford to buy asthma medications. The GINA has identified limited access to asthma medication as an important barrier to asthma control.¹ Although many drugs, including asthma medications, are offered to patients at lower prices in governmental health care facilities in Qatar, many expatriates with low income cannot afford to buy such medications. It should be noted that this is not a prevalence study and, therefore, the prevalence of asthma was not assessed.

The QASMA study showed that the very high GDP per capita does not seem to have led to better asthma care compared with other affluent countries. Asthma control in this rich country is currently far from being achieved, which has resulted in substantial use of health care resources by patients with asthma. A critical shortage in the level of patient education regarding asthma and its treatment is obvious. The results of this study have shed light on the urgent need for improving asthma care in Qatar. A national asthma service improvement program that considers patient education, objective assessment and monitoring of asthma control, and implementation of evidence-based guidelines for asthma management in the nation is needed. Furthermore, because better asthma control might be achieved by the improvement of physicians' knowledge about asthma, future research to assess the knowledge of physicians treating asthma in Qatar is worth doing.

Acknowledgments

The authors thank Dr Prem Chandra (Medical Research Center), Dr Tasleem Raza (Pulmonary Section, Hamad General Hospital), Dr Salem Abu-Salah and Mr Jibin Moinudheen (ED, Hamad General Hospital), Mr Mohamed A. Mohamed (Cost-Accounting Department, Hamad General Hospital), Mr Shams Eldin A. Khalifa and Dr Alanood Althani (Supreme Council of Health), and Dr Ibrahim Fawzi (Intensive Care Unit, Hamad General Hospital) for their valuable support.

References

- [1] Beasley R. The global burden of asthma report. Global Initiative for Asthma (GINA). <http://www.ginasthma.org>. Published 2004. Accessed April 30, 2014.
- [2] Masoli M, Fabian D, Holt S, Beasley R. Global Initiative for Asthma (GINA) Program. The global burden of asthma: executive summary of the GINA Dissemination Committee report. *Allergy*. 2004;59:469–478.
- [3] Braman S. The global burden of asthma. *Chest*. 2006;130(suppl):4s–12s.
- [4] Accordini S, Corsico A, Cerveri I, et al. The socio-economic burden of asthma is substantial in Europe. *Allergy*. 2008;63:116–124.
- [5] Ait-Khaled N, Auregan G, Bencharif N, et al. Affordability of treatment of asthma in some developing countries. *Int J Tuberc Lung Dis*. 2000;4:268–271.
- [6] Qatar Statistics Authority. Ministry of Development Planning and Statistics. Population Structure, January 31, 2013.
- [7] Central Intelligence Agency. *The World Fact Book*. 2013 estimate. <https://www.cia.gov/library/publications/the-world-factbook/geos/qa.html>. Accessed September 10, 2014.
- [8] World Health Organization. Global Health Observatory Data Repository. Qatar: statistics summary (2002–present). <http://apps.who.int/gho/data/node.country.country-QAT>.
- [9] Janahi I, Bener A, Bush A. Prevalence of asthma among Qatari schoolchildren: International Study of Asthma and Allergies in Childhood. *Qatar Pediatr Pulmonol*. 2006;41:80–86.
- [10] Global Initiative for Asthma (GINA). Global strategy for asthma management and prevention. <http://ginasthma.org>. Published 2012.
- [11] Global Initiative for Asthma (GINA). Patient guide. http://www.ginasthma.org/local/uploads/content/files/GINA_PatientGuide2007. Published 2007.
- [12] Chapman K, Boulet L, Franssen E. Suboptimal asthma control: prevalence, detection and consequences in general practice. *Eur Respir J*. 2008;31:320–325.
- [13] Cazzoletti L, Guido A, Albicini F, et al. The course of asthma in adults: a population-based nine-year follow up on asthma remission and control. *PLoS One*. 2014;9:e86956.
- [14] Demoly P, Paggiaro P, Plaza V, et al. Prevalence of asthma control among adults in France, Germany, Italy, Spain and the UK. *Eur Respir Rev*. 2009;18:105–112.
- [15] Colice GL, Ostrom NK, Geller DE, et al. The CHOICE survey: high rates of persistent and uncontrolled asthma in the United States. *Ann Allergy Asthma Immunol*. 2012;108:157–162.
- [16] Mahboub B, Santhakumar S, Soriano J, Pawankar R. Asthma insights and reality in the United Arab Emirates. *Ann Thorac Med*. 2010;5:217–221.
- [17] Al-Busaidi N, Soriano J. Asthma control in Oman. National results within the Asthma Insights and Reality in the Gulf and Near East (AIRGINE) study. *Squibb Qaboos Univ Med J*. 2011;1:45–51.
- [18] Al-Jahdali HH, Al-Hajjaj MS, Alanezi MO, Zeitoni MO, Al-Tasan TH. Asthma control assessment using asthma control test among patients attending 5 tertiary care hospitals in Saudi Arabia. *Saudi Med J*. 2008;29:714–717.
- [19] Gibson PG, Powell H, Wilson A, et al. Self-management education and regular practitioner review for adults with asthma. *Cochrane Database Syst Rev*. 2002;3:CD001117.
- [20] Centers for Disease Control and Prevention. Self data profile. <http://cdc.gov/asthma/stateprofiles/Asthma>. Published 2011. Accessed March, 29, 2014.
- [21] Asthma Control Program. Montana Asthma Surveillance Report October–December 2011. <http://dphhs.mt.gov/publichealth/asthma/documents/SurveillanceReportOct-Dec-2011>. Published 2011. Accessed March 29, 2014.
- [22] Rabe K, Vermeire P, Soriano J, Maier W. Clinical management of asthma in 1999: the Asthma Insights and Reality in Europe (AIRE) study. *Eur Respir J*. 2000;16:802–807.
- [23] Neffen H, Fritscher C, Schacht F, et al. Asthma control in Latin America: the Asthma Insights and Reality in Latin America (AIRLA) survey. *Rev Panam Salud Publica*. 2005;17:191–197.
- [24] Hardwell A, Barber V, Hargadon T, McKnight E, Holmes J, Levy ML. Technique training does not improve the ability of most patients to use pressurised metered-dose inhalers (pMDIs). *Prim Care Respir J*. 2011;20:92–96.
- [25] Giraud V, Roche N. Misuse of corticosteroid metered-dose inhaler is associated with decreased asthma stability. *Eur Respir J*. 2002;19:246–251.
- [26] Coelho A, Souza-Machado A, Leite M, et al. Use of inhaler devices and asthma control in severe asthma patients at a referral center in the city of Salvador. *Brazil J Bras Pneumol*. 2011;37:720–728.
- [27] Molimard M, Le Gros V. Impact of patient-related factors on asthma control. *J Asthma*. 2008;45:109–113.
- [28] Kurai D, Saraya T, Ishii H, Takizawa H. Virus-induced exacerbations in asthma and COPD. *Front Microbiol*. 2013;4:293.
- [29] Huynh B, Tual S, Turbelin C, et al. Short-term effects of airborne pollens on asthma attacks as seen by general practitioners in the Greater Paris area, 2003–2007. *Prim Care Respir J*. 2010;19:254–259.
- [30] Canova C, Heinrich J, Anto JM, et al. The influence of sensitization to pollens and moulds on seasonal variations in asthma attacks. *Eur Respir J*. 2013;42:935–945.
- [31] Pawankar R, Bunnag C, Chen Y, et al. Allergic Rhinitis and Its Impact on Asthma Update (ARIA 2008)—Western and Asian-Pacific perspective. *Asian Pac J Allergy Immunol*. 2009;27:237–243.
- [32] Price D, Zhang Q, Kocavar VS, Yin DD, Thomas M. Effect of a concomitant diagnosis of allergic rhinitis on asthma-related health care use by adults. *Clin Exp Allergy*. 2005;35:282–287.
- [33] Gaugris S, Sazonov-Kocavar V, Thomas M. Burden of con-comitant allergic rhinitis in adults with asthma. *J Asthma*. 2006;43:1–7.
- [34] Sole D, Camelo-Nunes IC, Wandalsen GF, Melo KC, Naspić CK. Is rhinitis alone or associated with atopic eczema a risk factor for severe asthma in children? *Pediatr Allergy Immunol*. 2005;16:121–125.
- [35] Kanani AS, Broder I, Greene JM, Tarlo SM. Correlation between nasal symptoms and asthma severity in patients with atopic and nonatopic asthma. *Ann Allergy Asthma Immunol*. 2005;94:341–347.
- [36] Mastrorade JG. Is there a relationship between GERD and asthma? *Gastroenterol Hepatol (N Y)*. 2012;8:401–403.
- [37] Braidó F. Failure in asthma control: reasons and consequences. *Scientifica (Cairo)*. 2013;2013:549252.
- [38] Cheung TK, Lam B, Lam KG, et al. Gastroesophageal reflux disease is associated with poor asthma control, quality of life, and psychological status in Chinese asthma patients. *Chest*. 2009;135:1181–1185.
- [39] de Marco R, Bugiani M, Cazzoletti L, et al. The control of asthma in Italy. A multicentre descriptive study on young adults with doctor diagnosed current asthma. *Allergy*. 2003;58:221–228.
- [40] Dursun AB, Kar Kurt O, Bayiz H, Ozkan E, Cakaloglu A, Karasoy D. Does gender affect asthma control in adult asthmatics? *Chron Respir Dis*. 2014;11:83–87.
- [41] Cowie RL, Underwood MF, Field SK. Asthma symptoms do not predict spirometry. *Can Respir J*. 2007;14:339–342.
- [42] Ait-Khaled N, Enarson D, Bencharif N, et al. Implementation of asthma guidelines in health centres of several developing countries. *Int J Tuberc Lung Dis*. 2006;10:104–109.
- [43] Ali H, Hend B, Salim N, et al. Control of Asthma Maghreb, results of the AIR-MAG study. *Respir Med*. 2009;103(Suppl 2):S12–S20.
- [44] Zemedkun K, Woldemichael K, Tefera G. Assessing control of asthma in Jush, Jimma, South West Ethiopia. *Ethiop J Health Sci*. 2014;24:49–58.