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Chronic obstructive pulmonary disease and associated healthcare resource consumption in the Middle East and North Africa: The BREATHE study

Mehmet Polatli [a], Ali Ben Kheder [b], Siraj Wali [c], Arshad Javed [d], Adel Khattab [e], Bassam Mahboub [f], Ghali Iraqi [g], Chakib Nejjari [h], Samya Taright [i], Marie-Louise Koniski [j], Nauman Rashid [k], Abdelkader El Hasnaoui [k, *A], on behalf of the BREATHE Study Group[B]

[a] *Adnan Menderes University, Aydin, Turkey*
[b] *Abderrahmane Mami Hospital, Tunis, Tunisia*
[c] *King Abdulaziz University, Jeddah, Saudi Arabia*
[d] *Lady Reading Hospital, Peshawar, Pakistan*
[e] *Ain Shams University, Cairo, Egypt*
[f] *University of Sharjah, Sharjah, UAE*
[g] *Moulay Youssef Hospital, Rabat, Morocco*
[h] *Faculty of Medicine of Fez, Fez, Morocco*
[i] *Bab-El-Oued Hospital, Algiers, Algeria*
[j] *Lebanese American University, Beirut, Lebanon*
[k] *GlaxoSmithKline, Dubai, UAE*

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Summary
Data on COPD-related healthcare resources use are rarely documented in developing countries. This article presents data on COPD-related healthcare resource consumption in the Middle East, North Africa and Pakistan and addresses the association of this variable with illness severity. A large survey of COPD was conducted in eleven countries of the region, namely Algeria, Egypt, Jordan, Lebanon, Morocco, Pakistan, Saudi-Arabia, Syria, Tunisia, Turkey and United Arab Emirates, using a standardised methodology. A total of 62,086 subjects were screened. This identified 2,187 subjects fulfilling the "epidemiological"

* Corresponding author. Dr Abdelkader El Hasnaoui, GlaxoSmithKline, PO Box 50199, Dubai, United Arab Emirates. Tel.: +971 4409 6305; fax: +971 4332 3071. *E-mail address:* abdelkader.a.el-hasnaoui@gsk.com (A. El Hasnaoui).

[A] All academic authors contributed equally to the work presented.

[B] BREATHE Steering Committee members (*in alphabetical order of names*): Ashraf **Alzaabi**, Zayed Military Hospital, Abu Dhabi, UAE; Majed **Beji**, University of Tunis El Manar, Faculty of Medicine of Tunis, La Rabta Hospital, Tunis, Tunisia; Ali **Ben Kheder**, Abderrahmane Mami Hospital, Tunis, Tunisia; Majdy **Idrees**, Riyadh Military Hospital, Riyadh, Saudi Arabia; Ghali **Iraqi**, Moulay Youssef Hospital, Rabat, Morocco; Arshad **Javed**, Lady Reading Hospital, Peshawar, Pakistan; Javaid Ahmed **Khan**, Aga Khan University Hospital, Karachi, Pakistan; Adel **Khattab**, Ain Shams University, Cairo, Egypt; Marie-Louise **Koniski**, Lebanese American University, Beirut, Lebanon; Bassam **Mahboub**, University of Sharjah, Sharjah, UAE; Salim **Nafti**, Mustapha Bacha Hospital, Algiers, Algeria; Nathir M. **Obeidat**, University of Jordan, Amman, Jordan; Mehmet **Polatli**, Adnan Menderes University, Aydin, Turkey; Abdullah **Sayiner**, Ege University, Izmir, Turkey; Naem **Shahrour**, Alasaad University Hospital, Damascus, Syria; Mohamed Awad **Tageldin**, Ain Shams University, Cairo, Egypt; Samya **Taright**, Bab-El-Oued Hospital, Algiers, Algeria; Esra **Uzaslan**, Uludag University Medical Faculty, Bursa, Turkey; Siraj **Wali**, King Abdulaziz University, Jeddah, Saudi Arabia.

BREATHE core team members: Abdelkader **El Hasnaoui**, GlaxoSmithKline, Dubai, UAE; Nauman **Rashid**, GlaxoSmithKline, Dubai, UAE; Aïcha **Lahlou**, MS Health, Rabat, Morocco; Adam **Doble**, Foxymed, Paris, France, Hocine **Salhi**, Foxymed, Paris, France and Chakib **Nejjari** Faculty of Medicine of Fez, Fez, Morocco.

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definition of COPD. A detailed questionnaire was administered to document data on COPD-related healthcare consumption. Symptom severity was assessed using the COPD Assessment Test (CAT). 1,392 subjects were analysable. Physician consultations were the most frequently used healthcare resource, ranging from 43,118 [95% CI: 755–85,548] consultations in UAE to 4,276,800 [95% CI: 2,320,164–6,230,763] in Pakistan, followed by emergency room visits, ranging from 15,917 [95% CI: 0–34,807] visits in UAE to 683,697 [95% CI: 496,993–869,737] in Turkey and hospitalisations, ranging from 15,563 [95% CI: 7,911–23,215] in UAE to 476,674 [95% CI: 301,258–652,090] in Turkey. The use of each resource increased proportionally with the GOLD 2011 severity groups and was significantly ($p < 0.0001$) higher in subjects with more symptoms compared to those with lower symptoms and in subjects with exacerbations to those without exacerbations. The occurrence of exacerbations and the CAT score were independently associated with use of each healthcare resource. In conclusion, the BREATHE study revealed that physician consultation is the most frequently COPD-related healthcare resource used in the region. It showed that the deterioration of COPD symptoms and the frequency of exacerbations raised healthcare resource consumption.

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a chronic illness requiring long-term management. It has a major impact on healthcare expenditure and can impose a substantial economic burden on patients and healthcare service providers.[1] In addition, COPD has a major negative impact on the daily lives of patients, as it impairs individual well-being, functional status and work production.[1]

It is important to collect standardised information on the healthcare resources used and to identify which factors are most involved in driving consumption with respect to the local specificities of each country or region of the world. From this perspective, many studies performed in developed countries have shown that physician consultations and hospitalisations constitute the principal outlay in terms of healthcare resources in the management of COPD.[2–4] In addition, disease exacerbations in COPD make a major contribution to resource consumption and related cost.[5] In the USA, the National Heart, Lung, and Blood Institute (NHLBI) estimated the total costs attributable to COPD to over $38 billion in 2005, with a direct cost of $22 billion.[6] The direct costs per patient ranged from $2,700 to $5,900 annually.[6] It has also been reported that the use of healthcare resources by patients with COPD in the USA is higher than that of patients with other chronic diseases presenting similar demographic and morbidity features.[2] The SCOPE study, performed in France in 2001, revealed that the total medical cost of COPD was €3.5 billion with a direct cost per patient of €1,800.[7] In this study, the main cost drivers identified were hospitalisations (35%) and medications (31%) whereas physician visits contributed only 4% of the total direct cost.[7]

Information on the use of COPD-related healthcare resources in developing countries is limited, despite the important impact that COPD may have on patients, on healthcare systems and on the economies of these countries. To our knowledge, no studies describing COPD-related healthcare resources have been published in the Middle East and North Africa (MENA) region.

We have recently performed a large epidemiological survey of patients presenting COPD-related symptoms in the general populations of eleven countries in the MENA region using a standardised methodology, the BREATHE study.[8] This survey interviewed over 60,000 individuals aged $\geqslant$40 years and identified 2,187 subjects fulfilling an epidemiological definition of COPD. These subjects were invited to answer a detailed questionnaire collecting information on risk factors, disease history, clinical symptoms, impact on daily life, disease management and healthcare resource consumption. This article presents the data on resource utilisation and addresses the association of this variable with the severity of the illness. Since costing conventions for healthcare expenditure and the structure of healthcare provision differ widely between participating countries, no attempt has been made in the present analysis to quantify resource use in monetary terms, although this may be addressed in future publications at the individual country level.

Methods

This was a cross-sectional observational survey of COPD conducted in a random sample of the general population of eleven countries: (Algeria, Egypt, Jordan, Lebanon, Morocco, Pakistan, Saudi Arabia, Syria, Tunisia, Turkey and UAE) between June 2010 and December 2011. The methodology used in the study is presented in detail in another article in this supplement.[8] The present article presents the data collected on COPD-related healthcare consumption.

Study sample

A general population sample of 10,000 subjects in each country or zone was generated from random telephone numbers. A structured interview was proposed to all eligible subjects by telephone. Subjects not domiciled in the country or zone or those of foreign origin resident in the country for less than six months at the time of the study were excluded, as were those who had comorbid mental illness.

All subjects (males or females) aged $\geqslant$ 40 years, who agreed to participate in the study and who reported respiratory symptoms fulfilling the epidemiological definition of COPD were eligible for the analysis. As described previously in this supplement,[8] this definition required two criteria to be fulfilled. The first criterion was EITHER a

diagnosis of COPD, emphysema or chronic bronchitis OR the presence of coughing with phlegm or sputum (productive cough), breathlessness or symptoms consistent with chronic bronchitis. The second criterion was a lifetime smoking exposure of $\geqslant$10 pack·years.

Data collection

When initial telephone contact had been made, the interviewer explained to the interviewee the goal of the study and the next steps. Subjects who agreed to participate in the study completed a first screening questionnaire which collected data on demographics, respiratory symptoms and smoking habits.[8–10]

Subjects fulfilling the epidemiological definition of COPD were considered to have COPD and were invited to undergo a second, more detailed telephone questionnaire on the disease (detailed COPD subject questionnaire). This second questionnaire consisted of 77 questions collecting information on risk factors, comorbidities, disease history, clinical symptoms, impact on daily life and disease management. They were also invited to complete an additional COPD-related healthcare consumption questionnaire which documented data on healthcare consumption of COPD subjects together with the associated cost. However, only data from the detailed COPD questionnaire are presented in this article, since the number of responders to the specific cost questionnaire was low compared to the response rate for the detailed COPD questionnaire and since no monetary valuation was required for the present analysis at the regional level.

In the detailed COPD questionnaire, information was collected on diagnosis (whether diagnosed with COPD and if so at what age), consultations (how often, type of physician seen, other health professionals), hospitalisations (how many times and how many nights), emergency room visits (how many visits), lung function testing (spirometry and peak flow meter – whether tested and how often), paraclinical tests, use of oxygen therapy (yes/no and frequency) and medication use (checklist of specific respiratory medicines, use of over-the-counter medications, antibiotic use for respiratory infections).

Determination of resource consumption by country

Total healthcare resource consumption attributable to COPD was determined by extrapolation of the rates of use documented in the BREATHE study to the total population of each country aged forty years or more. The demographic data for the total population were obtained from the most recent national censuses in each country.[11–22] Data on the age-adjusted prevalence of COPD according to the epidemiological definition used in the BREATHE study correspond to those reported elsewhere in this supplement.[10] Data on the absolute number and the proportion of COPD patients who were hospitalised or admitted to an emergency room due to their respiratory condition have been reported in the article dedicated to disease management elsewhere in this supplement.[23] These source data used to extrapolate national healthcare resource consumption are summarised in Table 1.

Determination of exacerbations, symptom severity and GOLD category

An exacerbation was taken to have occurred in the previous six months if the subject fulfilled any of the three following criteria:

- Criterion 1: In the last 6 months, have you been told by your physician that you have had worsening of your "Respiratory Condition"? –**YES**
- Criterion 2: In the last 6 months, have you been told by your physician that you have had acute bronchitis? –**YES**
- Criterion 3: In the last 6 months, what aspects of your "Respiratory Condition" have worsened? (cough during the daytime, cough during the night, phlegm, breathlessness or shortness of breath and fatigue, ability to perform regular activities) – **At least two symptoms cited**

Symptom severity was assessed using the COPD Assessment Test (CAT),[24,25] which consists of eight items assessing health status impairment in COPD. The final score for this test ranges from 0 to 40. All subjects fulfilling the epidemiological definition of COPD were also asked to complete the CAT.

Subjects were then classified into one of four groups depending on their CAT score and risk of exacerbations, according to the recommendations of the 2011 GOLD report[26] (Fig. 1). However, since the number of exacerbations was not documented, the GOLD classification was adapted according to the presence or absence of exacerbations over the previous six months.

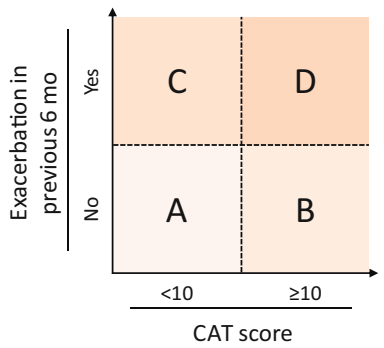

Figure 1. Classification of COPD subjects in this study according to their CAT score and exacerbation history (adapted from the 2011 GOLD report[26]). Group A: low risk, less symptoms: no exacerbations and CAT score <10; Group B: low risk, more symptoms: no exacerbations and CAT score $\geqslant$10; Group C: high risk, less symptoms: $\geqslant$1 exacerbation and CAT score <10; Group D: high risk, more symptoms: $\geqslant$1 exacerbation, and CAT score $\geqslant$10.

Statistical analysis

For national resource consumption, the total number of units of consumption was calculated together with their 95% confidence intervals (95% CI). Total healthcare consumption was compared between CAT score categories (<10 and $\geqslant$10) and exacerbation category (presence or

Table 1
Source data for the extrapolation of national healthcare resource consumption

	Algeria	Egypt	Jordan	Lebanon	Morocco	Pakistan	Saudi Arabia	Syria	Tunisia	Turkey	UAE
Total population[a]	34,080,030	75,097,000	5,103,639	3,759,134	29,891,708	165,000,000	23,980,834	17,920,844	9,910,872	73,722,988	4,106,427
Population ⩾ 40 yrs[a]	8,588,165	18,075,848	918,655	1,266,828	7,771,844	33,000,000	5,083,937	3,476,644	2,884,064	24,085,306	837,711
COPD prevalence[b]	3.7%	3.5%	5.4%	5.3%	2.2%	2.1%	2.4%	6.1%	3.7%	4.2%	1.9%
Physician consultation[c]	53.3%	48.8%	61.4%	64.9%	54.5%	90.0%	65.3%	51.8%	69.8%	66.9%	59.3%
Number of consultations[c] (Mean±SD)	1.80±1.10	4.38±4.07	2.03±1.63	3.31±2.82	3±3.57	6.86±5.43	3.69±3.71	2.86±3.41	3.33±6.26	3.14±3.02	4.57±4.86
Hospitalisation[c]	10.5%	20.3%	20.7%	28.8%	13.0%	33.3%	22.2%	21.9%	11.3%	19.3%	40.7%
Number of hospitalisations[c] (Mean±SD)	2.27±2.65	1.71±3.06	1.03±1.38	1.34±1.49	4.00±4.81	2.00±1.80	3.83±6.33	1.52±1.36	5.33±4.80	2.50±2.38	2.40±1.65
Mean number of nights hospitalised[c] (Mean±SD)	10.00±8.26	3.47±5.39	4.66±7.53	6.31±11.02	9.89±11.11	5.5±6.44	4.66±7.91	5.8±12.29	7.33±3.88	8.89±8.25	3.8±5.03
Emergency room visit[c]	10.5%	13.4%	15.7%	20.7%	3.9%	26.7%	29.6%	11.4%	3.8%	21.3%	22.2%
Number of visits[c] (Mean±SD)	3.55±2.66	3±2.98	5.27±12.04	2.61±3.99	2.67±2.08	1.63±0.92	4.02±4.39	2.38±1.39	7.00±7.07	3.25±3.80	4.5±5.09

[a] Data from national population census data. [b] Data from Tageldin et al.[10] [c] Data from Idrees et al.[23]

absence in the previous six months) using the χ^2 test, and *per capita* consumption compared between GOLD severity groups using one-way analysis of variance (ANOVA). To assess the impact of exacerbations and symptom severity, these variables were categorised as presence or absence of exacerbations in the previous six months and CAT score of <10, 10–19, 20–29 or ⩾30. These variables were entered into a multivariate logistic regression analysis which was adjusted for gender and age by class (40–50 years, 50–60 years and ⩾60 years). Odds ratios together with their 95% CI were derived.

Results

Study sample

A total of 1,392 subjects were interviewed, corresponding to 63.6% of the COPD population (n = 2,187). No relevant differences in terms of age, gender and COPD symptoms (productive cough, breathlessness or symptoms consistent with chronic bronchitis) were found when comparing the COPD population who completed the detailed questionnaire with all 2,187 subjects who fulfilled the epidemiological definition of COPD. The demographic features of these interviewees are presented by country in Table 2. Consistent with the demographics of the COPD population, the number of men was higher than the number of women (sex ratio 3.1) and the number of subjects aged ⩾60 years was lower than the two other age groups. Half of the study population reported that they considered themselves to be in good, very good or excellent health (696/1388; 50.1%), although around one half reported at least one comorbidity (688/1392; 49.4%). Furthermore, around two thirds of subjects were overweight (643/996; 64.5%).

Global healthcare resource consumption

The extent of use of healthcare resources reported by subjects in the COPD population in the BREATHE study extrapolated to the total number of people aged ⩾40 years in each participating country is presented in Table 3. Overall, physician consultations were the most frequently used healthcare resource consumption item in the MENA region, followed by emergency room visits and hospitalisations. The number of physician consultations for respiratory conditions used in the BREATHE study varied from 43,118 [95% CI: 755–85,548] in UAE to 4,276,800 [95% CI: 2,320,164–6,230,763] in Pakistan. The number of emergency room visits ranged from 15,917 [95% CI: 0–34,807] visits in UAE to 683,697 [95% CI: 496,993–869,737] in Turkey. The same tendency was observed for hospitalisations, which varied from 15,563 [95% CI: 7,911–23,215] in UAE to 476,674 [95% CI: 301,258–652,090] in Turkey.

Symptoms, exacerbations and resource consumption

Healthcare resource consumption was evaluated according to CAT score and to the presence or absence of exacerbations in the previous year (Table 4). Overall, the use of healthcare resources was significantly higher when

Table 2
Demographics of the study population in each participating country

	Algeria		Egypt		Jordan		Lebanon		Morocco		Pakistan		Saudi Arabia		Syria		Tunisia		Turkey		UAE		Total	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Age group	**105**		**172**		**140**		**111**		**77**		**30**		**216**		**114**		**53**		**347**		**27**		**1392**	
40–49 years	26	(24.8%)	68	(39.5%)	64	(45.7%)	34	(30.6%)	36	(46.8%)	8	(26.7%)	116	(53.7%)	48	(42.1%)	19	(35.8%)	101	(29.1%)	15	(55.6%)	535	(38.4%)
50–59 years	42	(40.0%)	61	(35.5%)	36	(25.7%)	38	(34.2%)	22	(28.6%)	10	(33.3%)	68	(31.5%)	44	(38.6%)	17	(32.1%)	139	(40.1%)	10	(37.0%)	487	(35.0%)
⩾ 60 years	37	(35.2%)	43	(25.0%)	40	(28.6%)	39	(35.1%)	19	(24.7%)	12	(40.0%)	32	(14.8%)	22	(19.3%)	17	(32.1%)	107	(30.8%)	2	(7.4%)	370	(26.6%)
Gender	**105**		**172**		**140**		**111**		**77**		**30**		**216**		**114**		**53**		**347**		**27**		**1392**	
Male	101	(96.2%)	149	(86.6%)	117	(83.6%)	55	(49.5%)	72	(93.5%)	25	(83.3%)	185	(85.6%)	81	(71.1%)	50	(94.3%)	192	(55.3%)	25	(92.6%)	1052	(75.6%)
Female	4	(3.8%)	23	(13.4%)	23	(16.4%)	56	(50.5%)	5	(6.5%)	5	(16.7%)	31	(14.4%)	33	(28.9%)	3	(5.7%)	155	(44.7%)	2	(7.4%)	340	(24.4%)
General health status	**102**		**172**		**140**		**216**		**111**		**77**		**30**		**114**		**52**		**347**		**27**		**1388**	
Excellent	0	(0%)	9	(5.2%)	11	(7.9%)	29	(13.4%)	10	(9.0%)	1	(1.3%)	2	(6.7%)	8	(7.0%)	1	(1.9%)	2	(0.6%)	5	(18.5%)	**78**	(5.6%)
Very good to good	50	(49.0%)	66	(38.4%)	81	(57.9%)	137	(63.4%)	44	(39.6%)	42	(54.5%)	9	(30.0%)	47	(41.2%)	34	(65.4%)	100	(28.8%)	8	(29.6%)	**618**	(44.5%)
Fair	44	(43.1%)	76	(44.2%)	36	(25.7%)	31	(14.4%)	40	(36.0%)	26	(33.8%)	10	(33.3%)	42	(36.8%)	14	(26.9%)	40	(11.5%)	12	(44.4%)	**371**	(26.7%)
Poor to very poor	8	(7.8%)	21	(12.2%)	12	(8.6%)	19	(8.8%)	17	(15.3%)	8	(10.4%)	9	(30.0%)	17	(14.9%)	3	(5.8%)	205	(59.1%)	2	(7.4%)	**321**	(23.1%)
Body Mass Index (BMI; kg/m^2)	**75**		**102**		**122**		**143**		**81**		**75**		**29**		**80**		**50**		**223**		**16**		**996**	
Underweight: <18.5	3	(4.0%)	3	(2.9%)	3	(2.5%)	1	(0.7%)	2	(2.5%)	1	(1.3%)	4	(13.8%)	0	(0%)	3	(6.0%)	4	(1.8%)	0	(0.0%)	24	(2.4%)
Normal range: 18.5–<25.0	35	(46.7%)	32	(31.4%)	35	(28.7%)	34	(23.8%)	27	(33.3%)	42	(56.0%)	15	(51.7%)	30	(37.5%)	18	(36.0%)	59	(26.5%)	2	(12.5%)	329	(33.0%)
Overweight: 25.0–<30.0	23	(30.7%)	31	(30.4%)	40	(32.8%)	55	(38.5%)	29	(35.8%)	22	(29.3%)	5	(17.2%)	26	(32.5%)	18	(36.0%)	93	(41.7%)	6	(37.5%)	348	(34.9%)
Obese: ⩾30	14	(18.7%)	36	(35.3%)	44	(36.1%)	53	(37.1%)	23	(28.4%)	10	(13.3%)	5	(17.2%)	24	(30.0%)	11	(22.0%)	67	(30.0%)	8	(50.0%)	295	(29.6%)
Comorbidities	**105**		**172**		**140**		**111**		**77**		**30**		**216**		**114**		**53**		**347**		**27**		**1392**	
Yes	45	(42.9%)	99	(57.6%)	90	(64.3%)	70	(63.1%)	43	(55.8%)	8	(26.7%)	132	(61.1%)	59	(51.8%)	30	(56.6%)	98	(28.2%)	14	(51.9%)	688	(49.4%)

comparing subjects with more symptoms (score CAT $\geqslant$10) to those with lower symptoms ($p < 0.0001$) and when comparing subjects with exacerbations to those without exacerbations ($p < 0.0001$).

Subjects were classified into four severity groups based on their CAT score and on the presence of exacerbations, following the GOLD 2011 severity classification, (Fig. 2). Healthcare expenditure increased proportionally with the GOLD severity group, with subjects with a CAT score $\geqslant$10 and experiencing exacerbations (Group D) having the highest expenditure. This was particularly striking for hospitalisations and emergency visits, which were six times more frequent in this group than in subjects with a CAT score <10 and who did not experience exacerbations (Group A). For all three types of expenditure, the association between GOLD group and resource consumption was highly statistically significant ($p < 0.001$; ANOVA).

Factors associated with healthcare resources

CAT score and exacerbations, together with age and gender, were entered into a multivariate logistic regression analysis of resource consumption; the results are presented in Fig. 3. The occurrence of exacerbations was significantly associated with physician consultations, emergency room visits and hospitalisations, with odds ratios ranging from 1.77 to 2.97 with respect to the reference group with no exacerbations. With respect to the CAT score, an overall trend was observed for increased likelihood of healthcare consumption for all three healthcare variables. This association reached statistical significance for hospitalisations and emergency room visits when the CAT score was higher than 20. No independent associations with resource utilisation were observed for age or gender, with the exception of male gender which appeared to be independently associated with a lower risk of hospitalisation (OR: 0.62 [95% CI: 0.46–0.93]. Moreover, a trend for increased hospitalisation with age was also observed, but this was not statistically significant.

The presence of comorbidities was also a factor associated with increased use of healthcare resources. Subjects with comorbidities were more likely to be hospitalised or make an emergency visit than subjects without comorbidities, and marginally more likely to consult a physician (Table 5). This was the case both for subjects with cardiovascular comorbidities and for those with diabetes.

Discussion

This study assessed the healthcare resources related to COPD used in eleven countries in the MENA region in the last year. The study evaluated subjects fulfilling the epidemiological definition of COPD. Healthcare resources consumed in each participating country, as well as the potential factors that influence this consumption, have been described. The results of the BREATHE study revealed that physician consultations were the principal healthcare resources used in the MENA region, followed by emergency room visits and hospitalisations. The healthcare consumption increased with GOLD severity grade, particularly for hospitalisations and emergency visits. Although costs were not evaluated in this analysis, it may be anticipated that hospitalisations, which were relatively frequent and have a high unit cost, may contribute the largest segment of cost.

The BREATHE study found that a total of 9,386,540 physician consultations, 1,696,433 emergency room visits and 1,613,079 hospitalisations are attributable to COPD in the participating countries of the MENA region. This hierarchy of resource use has also been reported in several other studies. For example, a study performed in the USA in 2000 reported that COPD was the cause of eight million physician consultations, over two million emergency room visits and near one million hospitalisations per year.[27] The same hierarchy was also found in an analysis of the burden of COPD in the Netherlands using data from the *Confronting COPD* international survey.[28] Overall, the analysis of healthcare resources found in that survey, which was conducted in seven countries in North America and Europe in 2000, revealed that physician consultations were also the most frequently used resource followed by hospitalisations and emergency room visits.[29] Nonetheless, in studies where resource utilisation has been valued, hospital inpatient care, which has the highest unit cost, is responsible for the highest expenditure outlay related to COPD.[29–31]

In developing countries, data on healthcare resource use attributable to COPD are sparse, making any direct comparison with the findings of the BREATHE study very difficult. The majority of available data on COPD-related healthcare resource consumption in these countries relate to frequency of use. For example, in an international study including Turkey and analysing the burden of COPD,[30] the reported rates of healthcare resource use in subjects with a physician-assigned diagnosis of COPD in Turkey were ~61% for specialist consultations, ~47% for primary care physician consultations, ~22% for emergency visits and ~15% for hospitalisation. These rates are in the same order of magnitude as those reported in the BREATHE study.

Even taking into account the different population sizes of participating countries, the BREATHE study showed that healthcare resource consumption differed between countries of the MENA region. This difference might be explained by local specificities regarding the healthcare system and the heterogeneous distribution of healthcare resources within countries. For example, the healthcare insurance system is different between countries (principally public sector in Algeria and Pakistan, principally private in UAE and Lebanon). One aspect of this is physical access to care facilities, which may differ between small urbanised countries with a high population density, such as Lebanon, and countries with large rural areas where hospitals may be far away and difficult to reach. This is a particular issue for diseases such as COPD in which mobility is affected. Another issue is the extent of reimbursement for physician consultation and treatments, which varies markedly between participating countries. Such differences may influence the decision to consult a physician or agree to hospitalisation particularly if the unit cost is considered expensive or if the reimbursement rate is low. A recent analysis of COPD-associated healthcare resource in the

Table 3
Details of resource consumption related to COPD in the participating countries. [a]

	Algeria	Egypt	Jordan	Lebanon	Morocco	Pakistan	Saudi Arabia	Syria	Tunisia	Turkey	UAE
Total population	34,080,030	75,097,000	5,103,639	3,759,134	29,891,708	165,000,000	23,980,834	17,920,844	9,910,872	73,722,988	4,106,427
Population aged ⩾40 years	8,588,165	18,075,848	918,655	1,266,828	7,771,844	33,000,000	5,083,937	3,476,644	2,884,064	24,085,306	837,711
Number of COPD subjects	313,997	632,655	49,607	67,142	172,088	693,000	122,014	212,075	105,834	987,498	15,917
[95% CI]	[266,233–369,291]	[560,351–704,958]	[43,176–56,037]	[58,274–76,009]	[139,893–209,839]	[528,000–858,000]	[106,762–137,266]	[184,262–239,888]	[80,753–129,782]	[915,241–1,059,753]	[11,727–20,105]
Number of patients consulting a physician for their respiratory condition	167,465	308,971	30,473	43,551	93,866	623,700	79,648	109,758	73,884	660,229	9,432
[95% CI]	[137,530–197,504]	[261,919–356,184]	[26,490–34,477]	[37,599–49,483]	[74,686–113,061]	[549,549–697,851]	[71,866–87,362]	[90,344–129,153]	[60,854–86,995]	[611,260–709,023]	[6,478–12,383]
Number of consultations	301,437	1,353,079	61,728	144,170	281,599	4,276,800	293,606	313,595	246,279	2,071,129	43,118
Number of patients hospitalised for their respiratory condition	32,895	128,738	10,276	19,356	22,349	231,000	27,114	46,508	11,981	190,670	6,485
[95% CI]	[14,443–51,181]	[90,469–167,020]	[6,945–13,592]	[13,696–25,043]	[9,464–35,278]	[114,345–347,886]	[20,376–33,920]	[30,326–62,562]	[2,963–21,060]	[150,099–232,061]	[3,533–9,438]
Number of hospitalisations	74,761	219,612	10,630	26,010	89,396	462,000	103,842	70,692	63,899	476,674	15,563
Number of nights hospitalised	328,949	446,796	47,836	122,186	221,008	1,270,500	126,341	269,745	87,862	1,695,597	24,641
Number of patients who visit an emergency room	32,895	84,599	7,795	13,912	6,705	184,800	36,152	24,184	3,994	210,590	3,537
[95% CI]	[14,443–51,181]	[52,510–117,041]	[4,811–10,764]	[8,862–19,001]	[4,111–10,688]	[74,844–294,525]	[28,673–43,559]	[11,876–36,476]	[1,481–9,419]	[167,874–252,799]	[1,034–6,032]
Number of emergency visits	116,627	253,798	41,103	36,293	17,879	300,300	145,193	57,670	27,956	683,697	15,917

[a] The data were calculated by extrapolation of the proportion of subjects fulfilling the epidemiological definition of COPD and the proportion of these subjects using the different healthcare resources documented in the BREATHE study to the overall population of individuals over forty years of age in each country. For example, the calculation of the number of physician consultations in Algeria was performed as follows: in a first step, the total number of COPD subjects in this country was obtained by multiplying the prevalence of COPD found in our study (3.7%) by the total population of ⩾40 years (8,588,165) based on the latest census (2008). In a second step, the number of subjects consulting a physician was calculated by multiplying the number of COPD subjects in Algeria determined in the previous step (313,997) by the proportion of COPD subjects consulting a physician as documented in the study (53.3%). Finally, the number of physician consultations was obtained by multiplying the number of COPD subjects consulting (167,465) by the mean number of consultations found in this study (1.8).

Table 4
Distribution of use of healthcare resources according to CAT scores and exacerbations

	CAT score				Exacerbations			
	<10	⩾10	Total	*p*-value	No	Yes	Total	*p*-value
Physician consultation	233	781	1,014		731	661	1392	
At least one in previous year	128 (54.9%)	542 (63.6%)	670 (66.1%)	<0.0001	343 (46.9%)	509(77.0%)	852 (61.2%)	<0.0001
[95% CI]	[48.5–61.3%]	[60.2–66.9%]	[63.2–69.0%]		[43.3–50.5%]	[73.8–80.2%]	[58.6–63.8%]	
Type of physician consulted	132	554	686		351	516	867	
General practitioner	36 (27.3%)	119 (21.5%)	155 (22.6%)	NS	71 (20.2%)	113 (21.9%)	184 (21.2%)	NS
[95% CI]	[19.7–34.9%]	[18.1–24.9%]	[19.5–25.7%]		[16.0–324.4%]	[18.3–25.5%]	[18.5–23.9%]	
Pulmonologist	49 (37.1%)	258 (46.6%)	307 (44.8%)		162 (46.2%)	235 (45.5%)	397 (45.8%)	
[95% CI]	[28.9–45.4%]	[42.4–50.7%]	[41.0–48.5%]		[41.0–51.4%]	[41.2–49.8%]	[42.5–49.1%]	
Other speciality	47 (35.6%)	177 (31.9%)	224 (32.7%)		118 (333.6%)	168 (32.6%)	286 (33.0%)	
[95% CI]	[27.4–43.8%]	[28.1–35.8%]	[29.1–36.2%]		[28.7–38.5%]	[28.6–36.6%]	[29.9–36.1%]	
Mean number of consultations	3.11±2.77	3.22±3.47	3.20±3.37	NS	2.74±3.22	3.53±3.63	3.39±3.57	NS
Hospitalisations	233	781	1,041		731	661	1392	
At least one in previous year	26 (11.2%)	178 (22.8%)	204 (20.1%)	0.0001	111 (15.2%)	173 (26.2%)	284 (20.4%)	<0.0001
[95% CI]	[7.1–15.2%]	[19.8–25.7%]	[17.7–22.6%]		[12.6–17.8%]	[22.8–29.6%]	[18.3–22.5%]	
Mean number of hospitalisations	0.74±0.96	2.72±4.36	2.46±4.13	0.0319	1.74±1.99	2.64±4.30	2.32±3.66	NS
Emergency room visits	233	781	1,014		731	661	1392	
At least one in previous year	15 (6.4%)	156 (20.0%)	171 (16.9%)	<0.0001	103 (14.1%)	146 (22.1%)	249 (17.9%)	<0.0001
[95% CI]	[3.3–9.6%]	[17.2–22.8%]	[14.6–19.2%]		[11.6–16.6%]	[18.9–25.3%]	[15.9–19.9%]	
Mean number of visits	1.87±1.46	3.96±6.02	3.78±5.79	NS	3.32±6.10	3.64±4.20	3.51±5.07	NS

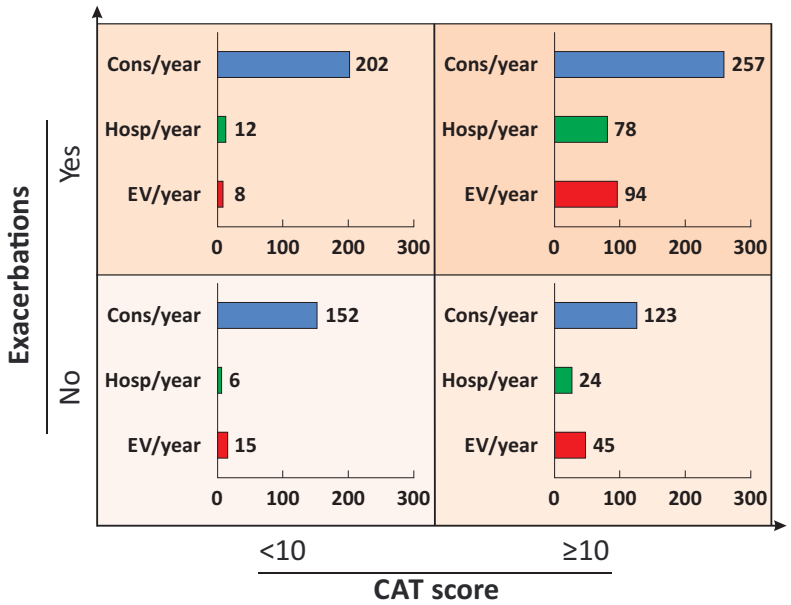

Figure 2. Healthcare distribution according to GOLD severity group. Data are presented as *per capita* consumption ×100. Cons/year, number of physician consultations per year; Hosp/year, number of hospitalisations per year; EV/year, number of emergency room visits per year.

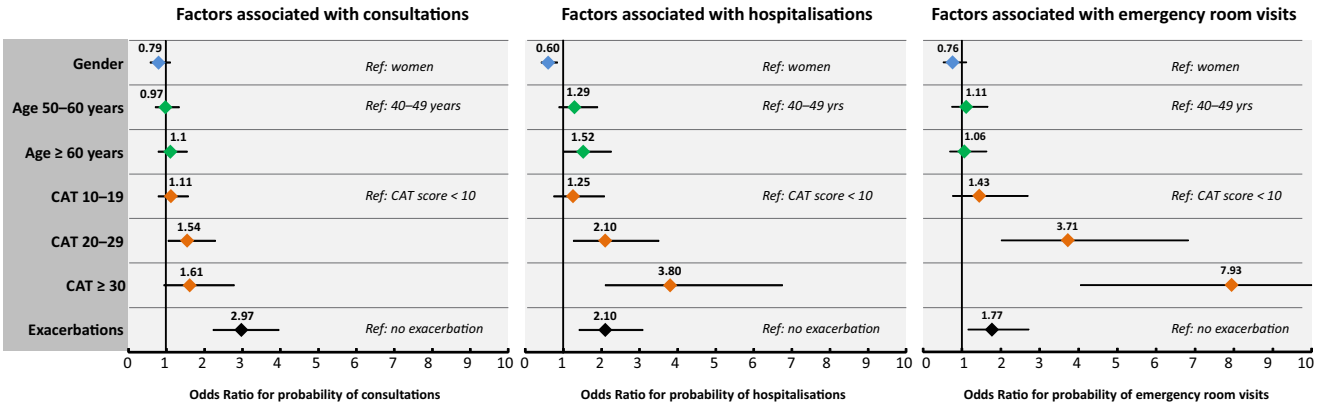

Figure 3. Variables associated with healthcare resources used identified by multiple logistic regression analysis. Data are presented as Forest diagrams showing odds ratios with their 95% confidence intervals.

Table 5
Distribution of use of healthcare resources according to comorbidities

	No comorbidities	Any comorbidity	p	Diabetes	Cardiovascular comorbidity
	N = 704	N = 688		N = 250	N = 344
Physician consultation	413 (58.7%)	439 (63.8%)	0.049	160 (64.0%)	218 (63.4%)
Number of consultations	3.67±4.03	3.15±3.12	0.218	2.98±2.80	3.05±3.00
Hospitalisation	100 (14.2%)	184 (26.7%)	<0.0001	66 (26.4%)	87 (25.3%)
Number of hospitalisations	2.03±2.57	2.45±4.07	0.401	2.54±5.57	2.01±3.90
Mean number of nights hospitalised	5.07±7.75	6.15±9.05	0.370	7.33±11.83	7.08±11.21
Emergency room visits	107 (15.2%)	142 (20.6%)	<0.008	56 (22.4%)	66 (19.2%)
Number of visits	3.05±6.20	3.85±4.02	0.219	3.60±4.00	3.92±4.42

USA revealed that COPD subjects were more likely to consider that the cost related to COPD was an obstacle to medical care than subjects without COPD (34.0% versus 17.0% respectively).[32] In addition, these disparities might be influenced by the number of physicians in each country and by the healthcare sector (specialist or generalist, hospital or community) in which COPD is generally managed. The difference in healthcare resource consumption between countries in the BREATHE study might also be explained by differences in disease severity or in the nature of the presenting symptoms, as described elsewhere in this supplement.[10] In this respect, a recent study performed in Turkey in 497 stable COPD patients suggested that reducing breathlessness was more of an incentive to seeking treatment than was controlling productive cough.[33]

It has been reported in the literature that COPD drives more healthcare consumption than many other chronic diseases. For example, in the United Kingdom, it was reported that the number of physician consultations for respiratory diseases is over three times as high as that for diseases of the circulatory or digestive system. In addition, COPD accounted for around five times as many hospital admissions as asthma, which has a higher prevalence than COPD in the UK.[4]

Not surprisingly, the BREATHE study showed that, in the MENA region, exacerbations of COPD were the major driver of physician consultations, emergency room visits and hospitalisations. This result was consistent with many other studies performed in North America and Europe.[34,35] In addition, the BREATHE study indicated that symptom severity as measured by the CAT also contributed to resource consumption, again consistent with previous studies.[7,30] This illustrates the importance of management strategies for COPD that address both reduction of the risk of exacerbations and the reduction of symptom severity. Effective treatments for achieving both these goals exist, as recommended in the most recent (2011) GOLD recommendations.[26] However, as observed in the BREATHE study,[23] most individuals reporting COPD symptoms in the MENA region are not receiving this standard of care. It is an important message for health system decision-makers that investments to ensure optimal management of COPD may generate important long-term cost savings to the health system through reduction in the need for hospitalisation and emergency room visits. The data collected in the BREATHE study may be of use for healthcare policy makers in setting priorities with respect to cost minimisation programmes, prevention programmes and access to care.

Another factor found to be associated with healthcare resource utilisation was the presence of comorbidities. This finding is consistent with a number of other studies.[36–38] The impact that such comorbidities may have on morbidity and mortality associated with COPD is being increasingly recognised as part of the overall burden of disease and an important driver of cost of the disease.[38] We also found that male gender appeared to be independently associated with a lower risk of hospitalisation. This may be related to loss of income due to the absence of social security and the man usually being the only breadwinner in the household.

Given the growing proportion of individuals in participating countries who smoke and the increase in life expectancy, the use of healthcare resources and its associated costs are likely to increase in the next decades. In this context, effective public health strategies together with cost minimisation programmes are needed to ensure timely diagnosis of COPD and adequate treatment over the long term in order to reduce the number of hospitalisations and emergency visits due to disease exacerbations, which are the principal drivers of cost in the management of COPD.

This study presents certain limitations. One of these relates to the source of the data which was from patient self-report. This may introduce a source of anamnestic error and also some inaccuracy due to the lack of physician ascertainment. Data on direct or indirect costs related to each healthcare resource used were not exploited in this analysis, since costing conventions are extremely diverse between countries in the region and not always standardised within individual countries. For this reason, we have no overall information on the global economic cost of COPD in the MENA region. Nonetheless, for certain individual countries, it should be possible to attribute costs and thus define the potential impact of COPD on the economy of each country. Such national analyses will be performed and published at a later stage. A further consequence of the method of data collection is the definition of exacerbations used in the study. We have tried to construct an operational definition of exacerbations based on subject's experience, with no information available directly from the physician, and using a language appropriate for the general population. The proportion of patients with exacerbations identified using this definition is within the range of that reported in other studies in which exacerbations were ascertained by the physician.[34,39] In addition, subjects with exacerbations used more healthcare resources than those without, supporting the face validity of the definition. Nonetheless, we cannot rule out some over-estimation of COPD exacerbations due to subjects potentially reporting worsening of respiratory symptoms caused by comorbidities. Our definition has not been previously validated, and it would be useful to compare the performance of this definition against physician-ascertained exacerbations in a future study.

In conclusion, the BREATHE study identified two factors which drive healthcare resource consumption in the MENA region, namely the severity of COPD symptoms (assessed with the CAT questionnaire) and the frequency of exacerbations. Given the importance of these factors, and as recommended by the recent GOLD guidelines, it seemed to be important to assess each of them as a part of an individualised approach in order to optimise the management of COPD and thus reduce the level of use of healthcare resources in the MENA region.

Conflict of interest statement

MP, ABK, SW, AJ, AK, BM, GI, ST and M-LK have received honoraria from GlaxoSmithKline Laboratories for their contribution to the BREATHE study. CN advised on the data management and statistical analysis of the results of the BREATHE study on behalf of GlaxoSmithKline Laboratories. NR and AEH are employees of GlaxoSmithKline Laboratories, which funded the BREATHE study and market a number of treatments for COPD.

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