Prevalence of chronic obstructive pulmonary disease in Saudi Arabia

Siraj O. Wali, FRCPC, FCCP, Majdy M. Idrees, FRCPC, FCCP, Omer S. Alamoudi, FRCP, FCCP, Ahmed M. Aboulfarag, MD, Abdelrahman D. Salem, MD, MRCP, Ahmed A. Aljohaney, MD, FRCPC, Mohamed H. Soliman, MD, Muntasir M. Abdelaziz, FRCP, PhD.

ABSTRACT

الأهداف: لتقييم مدى انتشار مرض الانسداد الرئوي المزمن الوبائي في المملكة العربية السعودية.

الطريقة: أجري هذا المسح المستعرض المرتكز على السكان لمرض الانسداد الرئوي المزمن خلال الفترة ما بين يونيو 2010م وديسمبر 2011م. لقد تم الاتصال ب 56،000 رقم تم اختيارهم عشوائياً وذلك ليتم تحديد 10،001 فرد مؤهل للمشاركة. وقد وافق 9،779 فرد على المشاركة. وكل من كانت ردوده على استبيان الفرز إيجابية انتقل للأجابة على أسئلة أكثر تركيزاً حول مرض الانسداد الرئوي المزمن .

النتائج: بلغت نسبة المدخنين الحاليين أو السابقين 27.9%. أما عن معدلات التدخين المرتبطة بالجنس المصنفة طبقاً للعمر فقد بلغت 38.7% في الرجال و 7.4% في النساء. ولقد عانى من مرض الانسداد الرئوي المزمن حسب التعريف الوبائي 249 شخص. وأما بالنسبة للمعدل المصنف طبقاً للعمر والجنس لدى السعوديين فقد بلغ 2.4%. وبشكل عام فقد كان المرض أكثر انتشاراً لدى الرجال 3.5% مقارنة بالنساء 1.0%.

الخاتمة: الانتشار الوبائي لمرض الانسداد الرئوي المزمن لعموم سكان المملكة هو 2.4% والتي كانت أقل من نسبة الدول الصناعية.

Objectives: To assess the prevalence of epidemiologically defined chronic obstructive pulmonary disease (COPD) in Saudi Arabia.

Methods: This cross-sectional, observational, population-based survey of COPD was conducted between June 2010 and December 2011 across the country of Saudi Arabia. A total of 56,000 randomly selected telephone numbers were called, which identified 10,001 eligible subjects; of whom 9,779 agreed to participate. A screening questionnaire included 6 questions related to cigarette consumption and water-pipe use was administered to each participant. Subjects with positive screening results were invited to provide input for a detailed COPD questionnaire.

Results: The adjusted proportion of subjects who reported a current, or past smoking history was 27.9%. Gender-specific smoking rates adjusted by age were 38.7% (95% confidence interval [CI]: 37.5-39.9%) in men, and 7.4% (95% CI: 6.5-8.3%) in women. The epidemiological definition of symptomatic COPD was met by a total of 249 subjects. The age and gender-adjusted prevalence of COPD was 2.4% (95% CI: 2.1-2.7%). Overall, COPD was more frequently documented ($p<0.0001$) in men (3.5% [95% CI: 3-4%]) than in women (1% [95% CI: 0.7-1.3%]).

Conclusion: The prevalence of epidemiologically defined COPD in the general population of Saudi Arabia is 2.4%, which is lower than that reported in industrialized countries.

Saudi Med J 2014; Vol. 35 (7): 684-690

From the Department of Medicine (Wali, Alamoudi, Salem, Aljohaney), King Abdulaziz University Hospital, GlaxoSmithKline (Abulfarag, Sulaiman), Emerging Markets & Asia Pacific, Jeddah, and the Department of Medicine (Idrees), Prince Sultan Military Medical City, Riyadh, Kingdom of Saudi Arabia, and the Department of Respiratory Medicine (Abdelaziz), Tameside Hospital, Ashton Under Lyne, England, United Kingdom.

Received 29th January 2014. Accepted 13th May 2014.

Address correspondence and reprint request to: Dr. Siraj O. Wali, Associate Professor of Medicine, Department of Medicine, College of Medicine, King Abdulaziz University Hospital, Jeddah 21589, PO Box 80215, Kingdom of Saudi Arabia. Tel. +966 (12) 6408258. Fax. +966 (12) 6408315. E-mail: sowali@kau.edu.sa

In Saudi Arabia, limited data are available regarding the epidemiology of chronic obstructive pulmonary disease (COPD). However, it is believed that cases of COPD are under-diagnosed, but later detected at an advanced stage.[1] Lack of laws governing smoking in public places contributes to air pollution and exposure to second-hand smoke, hence, an expected high prevalence of COPD.[2,3] The Breathing REtraining for Asthma-Trial of Home Exercises (BREATHE) study was conducted to assess the epidemiology of COPD in a large population of residents in the Middle East and North Africa (MENA) region.[4] The standardized methodology used in this study was similar to that used in the Confronting COPD surveys previously conducted in North America and Europe.[5] Estimating the prevalence of COPD symptoms in the MENA region was the primary objective of the BREATHE study.[4] The current report focuses on data obtained from residents in Saudi Arabia. Our main objective is to estimate the prevalence of the epidemiologically defined COPD in Saudi Arabia; determining risk factors and describing the COPD population are the secondary objectives. .

Methods. This was a cross-sectional, observational, population-based survey of COPD conducted between June 2010 and December 2011 across the country of Saudi Arabia. Systematic screening of a national population sample in order to identify a group of individuals likely to have COPD was carried out using telephone interviews.[4] Patients' approval of being a part of this research was sought and obtained, and their information was kept confidential. A random stratified sampling method generated a group of at least 10,000 adult subjects. An assisted random-digit dialing procedure generated and called telephone numbers by blocs. In the initial evaluation of the proportion of usable numbers, a bloc of 5,000 random phone numbers was generated and called. This continued until a minimum of 10,000 subjects agreed to take part in the survey. Each telephone number on the list was consecutively dialed, and in order to improve the chance of reaching a subject, numbers were dialed up to 15 times (on different days and at different times) until contact was established. Based on the 15 attempts, subjects were categorized as: interview, formal refusal, or an invalid number (out of service, professional number or fax, not reachable). Telephone number eligibility was assessed, for example, work telephone numbers are non-eligible. Subjects with eligible telephone numbers were characterized according to age, gender, and region (**Figure 1**). To evaluate the efficacy of the telephone random-dialing method in recruiting subjects along with the acceptability of the questionnaires, a pilot feasibility study was conducted before starting the main survey. During the screening phase, male or female subjects aged ≥40 years, and who were willing to take part were enrolled in the study. Those who were excluded included subjects not residing in the country, foreign origin residents who have been in the country for <6 months at the time they were contacted, and those with a comorbid mental illness. Eligible subjects were given identical information regarding the study without specifically mentioning COPD as to avoid possible bias. The total number, gender, and ages of subjects recruited for this study are shown in **Figure 1**. To ensure that the sample of recruited patients was representative of the entire Saudi population, cross-stratification was performed to ensure representativeness by age and gender, and margin stratification was performed to ensure representativeness by region (**Table 1**). As a first step, a screening questionnaire using the Computer Assisted Personal Interviewing (CAPI) method, or an equivalent was administered.[4] The screening questionnaire was composed of 6 questions to determine the presence of respiratory symptoms that met the definition of chronic bronchitis or breathlessness (symptom criterion), one question regarding the existence of a diagnosis of COPD, chronic bronchitis or emphysema (diagnosis criterion), and 6 questions in order to collect information on smoking habits, type, and frequency of tobacco used (smoking criterion). Only those who fulfilled the screening criteria were invited to complete a more detailed COPD questionnaire, which consisted of 18 questions regarding demographics, smoking habits, and respiratory symptoms. Although the diagnosis of COPD in this study was made using a specific questionnaire, the authors appreciate that according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) Guidelines[6] the diagnosis of COPD depends on the presence of airflow limitation based on the value of forced exploratory volume in one-second (FEV_1) and its ratio to forced vital capacity (FVC).[6] However, the questionnaire used in this study contains questions present in the COPD assessment test (CAT),[7]

Disclosure. Authors have reported no significant conflicts of interest exist with any companies/organizations whose products or services may be discussed in this article. The work was funded by GlaxoSmithKline.

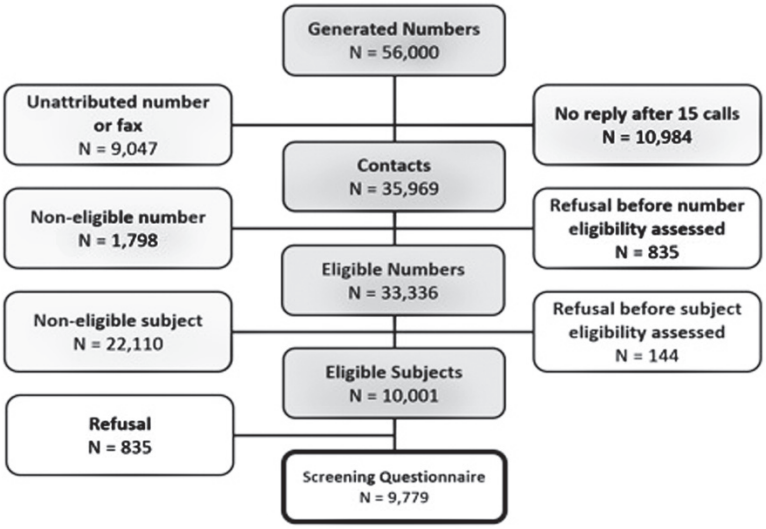

Figure 1 - Subjects included for determination of response rate in a study on chronic obstructive pulmonary disease in Saudi Arabia.

Table 1 - Demographics of the study population compared with the expected data from eligible subjects in a study conducted on chronic obstructive pulmonary disease in Saudi Arabia.

Variables	Screened	Expected
Number	9,779	10,000
Gender, n (%)		
Women	3,392 (34.7)	4,463 (44.6)
Men	6,387 (65.3)	5,537 (55.4)
Age, n (%)		
40-49	5,909 (60.4)	5,461 (54.6)
50-59	2,677 (27.4)	2,400 (24.0)
≥60	1,193 (12.2)	2,139 (21.4)

which has been recommended in the GOLD Guidelines to be used as a measure of health status in COPD.[6]

The objective was to identify a group of eligible subjects, who fulfilled the epidemiological case definition of COPD. Accordingly, the subjects were categorized into 4 populations (**Table 2**): the "COPD"; "Possible COPD"; "Non-COPD"; and the "Potential COPD" populations.[4] Subjects included in the "COPD" population were considered as having positive screening results and invited to provide input for a more detailed questionnaire. This detailed COPD patient questionnaire consisted of 77 questions on risk factors of COPD, disease history, clinical symptoms, effect on daily-life, and management. The screening procedures and detailed COPD patient questionnaires used in this study were developed using the validated questionnaires provided in the Confronting COPD study.[5] Methods of translation, back-translation, medical review, and linguistic validation were used to ensure trans-cultural validation of the questionnaires. Out of the final 234 "COPD" subjects who were included in this study, 216 completed the detailed COPD questionnaire, with a response rate of 92.3%.

Statistical analysis. Data are presented as proportions and mean values with standard deviations (SD), or median values with interquartile ranges (IQR). Confidence intervals (95% CI) were calculated for binomial data. The x^2 test and the Mantel Haenszel test were used, as appropriate, to estimate associations between categorical variables for trends. Two-sided tests were always used, and a p value of 0.05 was considered significant. Bonferroni's correction was applied for multiple testing procedures, when appropriate. All statistical analyses were performed using the Statistical Package for Social Sciences version 17 software (SPSS Inc, Chicago, IL, USA).

Results. *Smoking rates.* The adjusted proportion of subjects who reported current or past smoking was 27.9% (n=2,662; [95% CI: 27.0-28.8%]), regardless of the type of tobacco used (cigarettes and/or water-pipes). Most of the 2,138 cigarette smokers (93.3%; n=1,994) were men (**Table 3**). Gender-specific smoking rates adjusted by age were 38.7% (95% CI: 37.5-39.9%) in men, and 7.4% (95% CI: 6.5-8.3%) in women (**Figure 2**). No differences were found between age groups in gender-adjusted smoking rates: 31.2% (95% CI: 30.7-31.7%) in subjects aged 40-49 years; 32.6% (95% CI: 31.9-33.3%) in subjects aged 50-59 years; and 29.8% (95% CI: 29.0-30.5%) in subjects aged

Table 2 - Definitions used in a survey using the Computer Assisted Personal Interviewing (CAPI) method[4] in a study conducted on chronic obstructive pulmonary (COPD) disease in Saudi Arabia.

Variable	Definition
Definition of chronic bronchitis	The GOLD definition of chronic bronchitis was used in the study: "the presence of cough and sputum production for at least 3 months in each of 2 consecutive years," not necessarily associated with airflow limitation.[6]
Epidemiological definition of COPD	"COPD" cases were defined as eligible subjects fulfilling BOTH the following smoking and symptoms/diagnosis criteria:
Study populations	Four populations were characterized: "COPD" population: eligible subjects fulfilling the epidemiological definition of COPD (both smoking and symptoms/diagnosis criteria fulfilled). "Possible COPD" population: eligible subjects fulfilling either the smoking criterion or the symptoms/diagnosis criterion, but not both. "Non-COPD" population: eligible subjects fulfilling neither criterion. "Potential COPD" population: eligible subjects fulfilling at least one criterion. This group, thus includes both the "COPD" and the "Possible COPD" groups.

Table 3 - Age-adjusted smoking exposure in this study on chronic obstructive pulmonary disease in Saudi Arabia.

Variables	Women	Men
Total*	3,322	6,237
Cigarettes smokers	144	1,994
≥10 pack-years, n (%)	77 (53.5)	1,541 (77.3)
Pack-years (mean ± SD)	17.9 ± 22.0	25.4 ± 23.7
Water-pipes smokers	127	816
>5 years use, n (%)	111 (87.0)	622 (76.2)
*227 missing data		

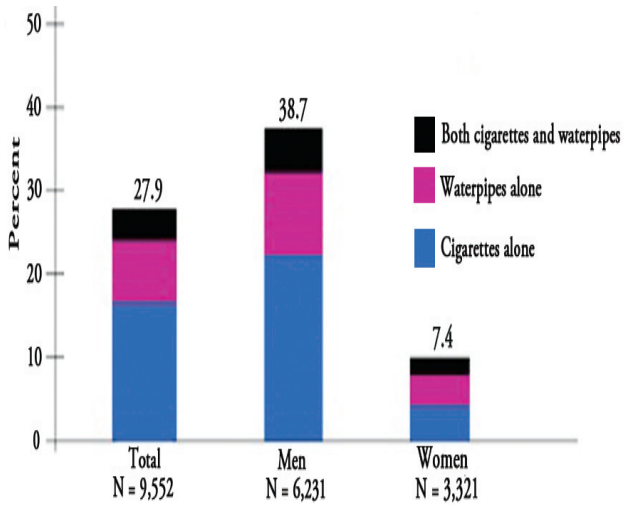

Figure 2 - Age-adjusted smoking rates in men and women in this study on chronic obstructive pulmonary disease in Saudi Arabia.

≥60 years. Cigarettes were the main source of tobacco consumption. Their use was reported by 79.6% of smokers in Saudi Arabia. While 34.9% of smokers reported using water-pipes, only 9.87% reported using water-pipes alone. Among water-pipe users (n=943), men were 6-fold more likely to report water-pipe use than women (816 men versus 127 women) (**Table 3**). The prevalence of water-pipes smoking adjusted to age is shown in **Figure 2**. More than 66% of water-pipe users reported long-term use (87% of women and 76.2% of men had used water-pipes ≥5 years).

Prevalence of COPD-related respiratory symptoms. Self-reported productive cough and breathlessness were the respiratory symptoms assessed during the screening phase of this study. A total of 1,301 subjects reported at least one of these symptoms. The prevalence of these respiratory symptoms, adjusted to age and gender was 14.3% [95% CI: 13.6-15%] of the general population (**Figure 3**). The most frequently reported sole symptom was breathlessness (approximately 70% of all reports). The COPD-related respiratory symptoms were more frequently reported (p<0.0001) by women (17.2% [95% CI: 15.9-18.5%]) than by men (11.2% [95% CI: 10, 4-12%]) (**Figure 3**).

Prevalence of chronic bronchitis. Subjects were considered to have chronic bronchitis when the reported respiratory symptoms fulfilled the GOLD definition of chronic bronchitis.[6] A total of 2.8% of subjects in this study population fulfilled this definition.

Prevalence of COPD. The epidemiological definition of symptomatic COPD was met by a total of 249 subjects, giving rise to an age and gender-adjusted COPD prevalence in the general population of 2.4% (95% CI: 2.1-2.7%) (**Figure 4**). Overall, COPD was more frequently documented (p<0.0001) in men (3.5% [95% CI: 3-4%]) than in women (1% [95% CI: 0.7-1.3%]) (**Figure 4**).

Diagnosis and duration of symptoms. Only 39.4% of the COPD defined population reported a previous diagnosis of COPD, and 43.3±12.1 years was the mean age at diagnosis (**Table 4**).

Association between respiratory disease and smoking. The association between cumulative cigarette exposure and symptoms was evaluated. Cigarette smokers had a higher frequency of all 3 evaluated

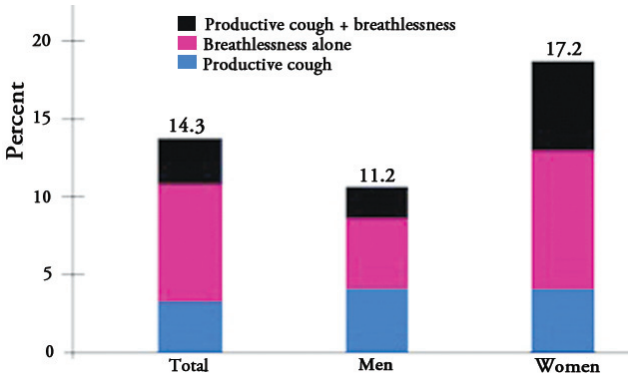

Figure 3 - Age-adjusted prevalence of respiratory symptoms in this study on chronic obstructive pulmonary disease in Saudi Arabia.

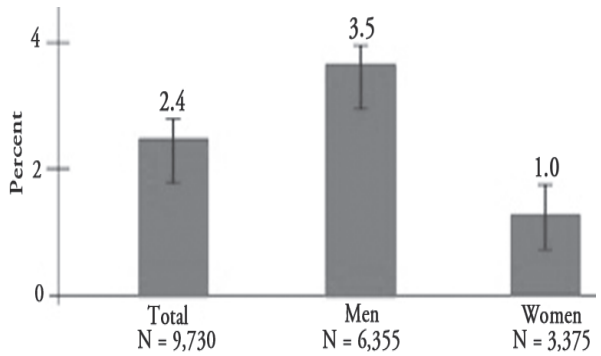

Figure 4 - Gender-specific chronic obstructive pulmonary disease distribution in the general population of Saudi Arabia

Table 4 - Diagnosis and duration of chronic obstructive pulmonary disease (COPD) symptoms in Saudi Arabia.

Variables	No.
Total no. of COPD patients*	216
Patients with known COPD diagnosis, n (%)	85 (39.4%)
Age at diagnosis (years), mean ± SD	43.3 ± 12.1
Age at first PCP (years), mean ± SD	38.8 ± 10.1
Age at first dyspnea (years), mean ± SD	40.9 ± 10.2

*33 missing data. PCP - persistent coughing with phlegm

symptoms (productive cough, chronic bronchitis, and breathlessness), in particular those who have smoked for >10 pack-years. The association between water-pipe use and symptoms was determined after adjusting for cigarette consumption as approximately 50% of water-pipe users also smoked cigarettes. Once more, all 3 symptoms showed a significant association. The association was most prominent for chronic bronchitis and flattest for breathlessness in regard to both cigarette smoking and water-pipe use.

Discussion. This study demonstrated that the adjusted proportion of subjects who reported a current or past smoking history was 27.9%. The estimated epidemiologically defined COPD rate was 2.4%, while the gender-specific COPD distribution among the population was found to be 3.5% in men and 1% in women.

In this study, smoking rates were evaluated throughout the Saudi region using a standardized methodology and screening a large sample of subjects (n=9,779). Both current and past smoking habits, as well as smoking vehicles (both cigarettes and water-pipes) were considered. Overall, tobacco use has been associated with many factors including social status, education, age, employment status, income level, marital status, psychological status, and religious beliefs.[8,9] The difference in smoking rates between men and women found in our study was well described in Saudi Arabia, as well as in other countries in the region.[9,10] This difference may be related to underreporting among females, which is probably attributed to the social stigma associated with smoking. Nevertheless, our findings are more in keeping with previously reported prevalence in the general population; the prevalence of smoking among Saudi males ranges from 13-38% with a median of 26.5%, while in Saudi females the range is 1-16% with a median of 9%.[11] However, smoking rates in women have rapidly increased in the Middle East region during the past years.[9] This is possibly due to the influence of social customs, media, and proactive marketing efforts.[10]

In our study, more than one-third of the smokers smoked both cigarette and water-pipe. This is probably due to the common misconception that water-pipe smoking is harmless.[12] In fact, water-pipe smoking may be more damaging since the level of plasma nicotine resulting from smoking one water-pipe was found to be 20% higher than the level of plasma nicotine resulting from smoking 21 cigarettes.[13] In other words, water-pipe smoking may carry greater risks to health, and current data refutes the delusion that smoking a water-pipe is harmless.[14] These findings strongly imply that tobacco control programs must address all the forms of tobacco consumption, not just smoking cigarettes.[12] The rates of water-pipe use alone described in our study appear lower than previously reported.[12,15,16] The age range used in our study, which excluded individuals <40 years of age, may have contributed to this difference, since water-pipe smoking is particularly prevalent among adolescents and young adults worldwide.[17,18] Similarly, the smoking rates found in this study only

apply to the population aged ≥40 years, and therefore cannot be generalized to all age categories because of the predominantly young Saudi population.

The prevalence of COPD was only 2.4% according to the epidemiological definition of COPD used, which is lower than the prevalence reported by local and international studies.[5,19,20] However, it is difficult to compare epidemiological data on the prevalence of COPD symptoms from different studies because of the considerable variation in the methodology and definition of COPD used in these studies. Recently, Al Ghobain et -al[20] reported that the prevalence of COPD among smokers >40 years of age and attending a primary healthcare clinic in Saudi Arabia was 14.2%. However, this study was focused on a specific population requesting health provider advice at primary health care clinics. In the Confronting COPD surveys conducted in North America and Europe, where a comparable methodology was used, the overall proportion of subjects in all countries with symptomatic COPD (approximately 6.5%) was higher than that reported in our study.[5]

Several factors may have contributed to this difference. First, COPD may be more prevalent in western countries possibly due to the contribution of other factors, such as air pollution.[20-23] Second, smoking, particularly in women, and respiratory symptoms may be under-reported in telephone interviews. In this respect, it is pertinent that while more women than men reported COPD-related symptoms in our study, inclusion of the smoking criterion in the epidemiological definition of COPD resulted in a 3-fold lower prevalence of COPD in women than in men. Third, productive cough may be considered by some as a 'normal' behavior in smokers, and hence contribute in underreporting symptoms. This was further evident by the fact that productive cough was less frequently reported than breathlessness. Finally, certain groups of subjects with COPD may not have been captured in our study. These include subjects with mild symptoms that were not considered worthy of reporting, those with COPD incorrectly diagnosed as asthma, and subjects with chronic airway obstruction who have been exposed to airborne risk factors other than smoking. Several reports from developing countries have demonstrated that indoor air pollution from biomass fuel is a significant COPD risk factor, especially for non-smoking rural women.[21-24] In addition, independent of the risk associated with concomitant cigarette smoking, water-pipe use maybe another discrete risk factor in the Saudi region due to the observed noteworthy connection concerning water-pipe use and the rate of respiratory symptoms. Furthermore, in 2009, a Lebanese survey indicated that the harmful effects of water-pipe smoking on health could be similar to those of cigarette smoking.[25] Therefore, since COPD related to cigarette smoking is what the epidemiological definition of COPD focused on, risk factors besides cigarette smoking should be considered by a future epidemiological definition of COPD.[26] This study has some limitations. First, the subjects may not recognize COPD symptoms, which undoubtedly lead to the underestimation of the prevalence of COPD. Moreover, COPD is not necessarily diagnosed until it is moderately advanced. Second, the high prevalence of tuberculosis in developing countries that may cause bronchiectasis and chronic irreversible airflow limitation may pose a problem regarding the case definition for COPD.[19,23] In addition, we also realize that the diagnosis of COPD is usually made on the basis of a lung function displaying an airflow limitation, which is not the case in this study. However, this criterion may be difficult to apply here and may be time consuming, considering the large number of the individuals included in the study.

In conclusion, this report demonstrated that the adjusted proportion of subjects who reported current or past smoking was 27.9%. The prevalence of epidemiologically defined COPD in the general population of Saudi Arabia is 2.4%, which is lower than that reported in industrialized countries.

Acknowledgment. *The authors gratefully acknowledge Ms. Walaa M. Abuzahra for editing, reviewing, and typing this manuscript.*

References

1. Chapman KR, Mannino DM, Soriano JB, Vermeire PA, Buist AS, Thun MJ, et al. Epidemiology and costs of chronic obstructive pulmonary disease. ***Eur Respir J*** 2006; 27: 188-207.
2. Baddoura R, Wehbeh-Chidiac C. Prevalence of tobacco use among the adult Lebanese population. ***East Mediterr Health J*** 2001; 7: 819-828.
3. Nejjari C, Benjelloun MC, Berraho M, El Rhazi K, Tachfouti N, Elfakir S, et al. Prevalence and demographic factors of smoking in Morocco. ***Int J Public Health*** 2009; 54: 447-451.
4. El Hasnaoui A, Rashid N, Lahlou A, Salhi H, Doble A, Nejjari C, et al. Chronic obstructive pulmonary disease in the adult population within the Middle East and North Africa region: rationale and design of the BREATHE study. ***Respir Med*** 2012; 106 (Suppl 2): S3-S15.
5. Rennard S, Decramer M, Calverley PM, Pride NB, Soriano JB, Vermeire PA, et al. Impact of COPD in North America and Europe in 2000: subjects' perspective of Confronting COPD International Survey. ***Eur Respir J*** 2002; 20: 799-805.
6. Global Initiative for Chronic Obstructive Lung Disease (GOLD). Global Strategy for the Diagnosis, Management and Prevention of COPD 2014. Available from URL: http://www.goldcopd.org/uploads/users/files/GOLD_Report2014_Feb07.pdf

7. Jones W, Harding G, Berry P, Wiklund I, Chen H, Kline Leidy N. Development and first validation of the COPD Assessment Test. ***Eur Respir J*** 2009; 34: 648-654.
8. Ghouri N, Atcha M, Sheikh A. Influence of Islam on smoking among Muslims. ***BMJ*** 2006; 332: 291-294.
9. Khattab A, Javed A, Iraqui G, Alzaabi A, Benkheder A, Koniski ML, et al. Smoking habits in the Middle East and North Africa region: results of the BREATHE study. ***Respir Med*** 2012; 106 (Suppl 2): S16-S24.
10. Afifi RA, Nakkash RT, Khawaja M. Social capital, women's autonomy and smoking among married women in low-income urban neighborhoods of Beirut, Lebanon. ***Womens Health Issues*** 2010; 20: 156-167.
11. Bassiony MM. Smoking in Saudi Arabia. ***Saudi Med J*** 2009; 30: 876-881.
12. Wali SO. Smoking Habits among medical students in Western Saudi Arabia. ***Saudi Med J*** 2011; 32: 843-848.
13. Hadidi KA, Mohammed FI. Nicotine content in tobacco used in hubble-bubble smoking. ***Saudi Med J*** 2004; 25: 912-917.
14. Maziak W, Ward KD, Eissenberg T. Interventions for waterpipe smoking cessation. ***Cochrane Database Syst Rev*** 2007; 4: CD005549.
15. Amin TT, Amr MA, Zaza BO, Kaliyadan F. Predictors of waterpipe smoking among secondary school adolescents in Al Hassa, Saudi Arabia. ***Int J Behav Med*** 2012; 19: 324-335.
16. Al Moamary MS, Al Ghobain MA, Al Shehri SN, Alfayez AI, Gasmelseed AY, Al-Hajjaj MS. The prevalence and characteristics of water-pipe smoking among high school students in Saudi Arabia. ***J Infect Public Health*** 2012; 5: 159-168.
17. Warren CW, Lea V, Lee J, Jones NR, Asma S, McKenna M. Change in tobacco use among 13-15 year olds between 1999 and 2008: findings from the Global Youth Tobacco Survey. ***Glob Health Promot*** 2009; 16: 38-90.
18. Ait-Khaled N, Enarson D, Bousquet J. Chronic respiratory diseases in developing countries: the burden and strategies for prevention and management. ***Bull World Health Organ*** 2001; 79: 971-979.
19. Tageldin MA, Khan JA, Nafti S, Nejjari C, Beji M, Mahboub B, et al. Distribution of COPD-related symptoms in the Middle East and North Africa region: results of the BREATHE study. ***Respir Med*** 2012; 106 (Suppl 2): S25-S32.
20. Al Ghobain M, Al-Hajjaj MS, Wali SO. Prevalence of chronic obstructive pulmonary disease among smokers attending primary healthcare clinics in Saudi Arabia. ***Ann Saudi Med*** 2011; 31: 129-133.
21. Ekici A, Ekici M, Kurtipek E, Akin A, Arslan M, Kara T, et al. Obstructive airway diseases in women exposed to biomass smoke. ***Environ Res*** 2005; 99: 93-98.
22. Akhtar T, Ullah Z, Khan MH, Nazli R. Chronic bronchitis in women using solid biomass fuel in rural Peshawar, Pakistan. ***Chest*** 2007; 132: 1472-1475.
23. Liu Y, Lee K, Perez-Padilla R, Hudson NL, Mannino DM. Outdoor and indoor air pollution and COPD-related diseases in high- and low-income countries. ***Int J Tuberc Lung Dis*** 2008; 12: 115-127.
24. Salvi SS, Barnes PJ. Chronic obstructive pulmonary disease in non-smokers. ***Lancet*** 2009; 374: 733-743.
25. Waked M, Salameh P, Aoun Z. Water-pipe (narguile) smokers in Lebanon: a pilot study. ***East Mediterr Health J*** 2009; 15: 432-442.
26. Eisner MD, Anthonisen N, Coultas D, Kuenzli N, Perez-Padilla R, Postma D, et al. An official American Thoracic Society public policy statement: Novel risk factors and the global burden of chronic obstructive pulmonary disease. ***Am J Respir Crit Care Med*** 2010; 182: 693-718.

Related Articles

Al Moamary MS, Tamim HM, Al-Mutairi SS, Al-Khouzaie TH, Mahboub BH, Al-Jawder SE, et al. Quality of life of patients with chronic obstructive pulmonary disease in the Gulf Cooperation Council countries. ***Saudi Med J*** 2012; 33: 1111-1117.

Al-Moamary MS, Al-Hajjaj MS, Tamim HM, Al-Ghobain MO, Al-Qahtani HA, Al-Kassimi FA. The reliability of an Arabic translation of the chronic obstructive pulmonary disease assessment test. ***Saudi Med J*** 2011; 32: 1028-1033.