

Prevalence of Chronic Obstructive Pulmonary Disease in Korea

A Population-based Spirometry Survey

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Rationale: Although chronic obstructive pulmonary disease is a leading cause of mortality and morbidity worldwide, there are only limited data on its prevalence, especially in Asia.

Objectives: A population-based epidemiologic survey of chronic obstructive pulmonary disease in a representative national sample was conducted using spirometry.

Methods: A stratified multistage clustered probability design was used to select a nationally representative sample. The survey was performed in conjunction with the second Korean National Health and Nutrition Examination Survey of 9,243 adults over the age of 18 years. The participation rate was 88.8% for questionnaires and 52.1% for spirometry.

Results: The prevalence of chronic obstructive pulmonary disease based on Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria (a ratio of FEV₁ to FVC of less than 0.7) was 17.2% (men, 25.8%; women, 9.6%) among subjects older than 45 years. Among adults of all ages (age > 18 years), the prevalence of airflow obstruction was 7.8% (10.9% in men, 4.9% in women). The majority of these cases were found to be mild in degree, and only a minority of these subjects had received physician diagnosis or treatment. Multivariate analysis revealed that age over 65 years, male sex, smoking more than 20 pack-years, and low income were independent predictors for chronic obstructive pulmonary disease.

Conclusions: Seventeen percent of Korean adults over the age of 45 years have mild chronic obstructive pulmonary disease.

Keywords: chronic obstructive pulmonary disease; national prevalence; population-based survey; smoking; spirometry

Chronic obstructive pulmonary disease (COPD) is a major cause of chronic morbidity and mortality throughout the world and is the only major disease that is continuing to increase in both prevalence and mortality (1–5). However, few prevalence data are available. In particular, the number of epidemiologic studies using spirometry is surprisingly low (6–16), with most studies having been performed in Europe or America. Asia is represented by only one such study from Japan, published after the submission of this article (17). In that study, 10% of the original subjects had undergone spirometry. Furthermore, before establishment of the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines (18), international standards for the

diagnosis of COPD were lacking and diagnostic criteria differed from survey to survey (6–16), making geographic comparison difficult.

Korea has a high smoking rate and relatively high air pollution, and the prevalence of COPD is suspected to be high. However, because the term “COPD” is almost unknown to the general population, the prevalence data based on questionnaire surveys are likely to be unreliable. Therefore we performed a nationwide COPD prevalence survey in Korea, using spirometry together with questionnaires eliciting respiratory symptoms and history of physician-diagnosed diseases, as well as chest x-ray films. This survey was done in conjunction with the second South Korean National Health and Nutrition Examination Survey (Korean NHANES II) (19). We believe this study to be the first systematic, population-based epidemiologic survey of COPD, using nationally representative samples with spirometry, conducted in Asia to date. The preliminary results of this study have been previously reported in the form of an abstract (20).

METHODS

Study Design

A stratified multistage clustered probability design was used to select a representative sample of civilian, noninstitutionalized Korean adults aged 18 years and older. We divided Korea into 246,079 areas and, among these, a final 200 survey areas were randomly selected by geographic area, place of residence (urban/rural), and residential pattern (apartment/nonapartment).

Data Collection and Spirometry

This nationwide survey was conducted from October 15, 2001, to January 20, 2002. Trained interviewers visited subjects' homes and administered the standardized questionnaire on physician-diagnosed diseases (asthma, chronic bronchitis, emphysema, and COPD), socioeconomic factors, health status, and respiratory symptoms (*see* the online supplement) adopted from the U.S. NHANES III. A few days later, spirometry was performed by specially trained technicians according to the 1994 American Thoracic Society (ATS) recommendations (21), using the same type of dry rolling seal spirometer (Model 2130; SensorMedics, Yorba Linda, CA) for all subjects. The electronically generated spirometric data were transferred via Internet to the review center on the same day, where two trained nurses reviewed the test results and provided quality control feedback to the technicians. All the data were saved for further detailed analysis. Even though the ATS recommendations require three or more acceptable curves for an adequate test, this is not practical for a large-scale survey, so we analyzed only the data of subjects with two or more acceptable spirometry performances. Chest x-ray films were taken in specially equipped mobile examination cars at the time of spirometry, and two qualified radiologists subsequently evaluated the x-ray film. Spirometric prediction equations were derived from this survey data of the lifetime nonsmoking subjects with normal chest radiograph and without history of respiratory disease or symptoms (22).

Definitions

Airway obstruction is defined by GOLD criteria (GOLD stage I) as FEV₁/FVC of less than 70%. The severity of obstruction was also classified according to revised GOLD criteria (18). COPD was defined as airflow obstruction in persons aged 45 years or older. *See* the online supplement for more detailed definitions.

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Statistical Methods

To adjust for unequal probabilities of selection and to account for nonparticipation, all estimates were calculated on the basis of the sampling weight. They were poststratified to the Korean population as estimated by the Bureau of the Census 2001, with further stratification by either smoking status or age (23). Comparisons between variables were tested by χ^2 test and Student *t* test. All values are presented as means \pm SD. We constructed a logistic regression model with obstructive lung disease as the dependent variable and age, sex, residential area, economic status, and smoking status as independent variables. Statistical analyses were performed with SAS software version 8.0 (SAS Institute, Cary, NC). The prevalence and standard error of COPD in the total population were calculated using SUDAAN software version 8.0 (Research Triangle Institute, Research Triangle Park, NC), which adjusts for the complex sample design when calculating variance estimates (24).

RESULTS

Among 9,243 subjects (> 18 years old), 88.8% responded to the questionnaires, 52.1% (4,816) completed spirometry, and 3,981 (43.1%) subjects underwent at least two spirometry measurements acceptable by ATS criteria (these composed the “performer” group and the data of these subjects were analyzed). Within the target population of subjects with COPD and more than 45 years of age (3,755 subjects), 1,673 (44.6%) were performers with two or more technically adequate spirograms. Even though there were differences in the age, sex, and frequency of sputum production between performers and nonperformers (Table 1), the distribution pattern of the age and sex of the performers was more similar to this pattern in the whole subject group, suggesting the data are representative.

Prevalence of Smokers

Our survey showed that the prevalence of current smokers in Korea was 29.9% (Table 2). It was higher among men (60.6%) and lower among women (5.2%).

Results of Spirometry

Relationship of lung function and smoking. Mean level of lung function, expressed as FEV₁/FVC ratio, FVC, or FEV₁ percent

TABLE 1. COMPARISON BETWEEN PERFORMERS AND NONPERFORMERS OF SPIROMETRY AMONG SUBJECTS GREATER THAN 45 YEARS OF AGE

	Performer (%) [*]	Nonperformer (%) [†]	p Value [‡]
Age, yr			
45–64	78.4	63.7	
65–74	18.1	21.9	
\geq 75	3.5	14.4	< 0.0001
Male, %	47.2	42.2	0.0036
Smoking status, %			
Never	59.3	59.5	
Former	14.5	12.2	
Current	26.3	28.4	0.0952
> 20 pack-yr	23.5	23.2	0.4028
Urban, %	72.9	71.6	0.4196
Cough, %	5.3	5.1	0.7566
Sputum, %	9.3	7.3	0.034
Dx of COPD or asthma, %	11.1	8.8	0.0299

Definition of abbreviations: Dx = physician diagnosis; COPD = chronic obstructive pulmonary disease.

^{*} Performers are subjects who performed two or more acceptable tests of spirometry.

[†] Nonperformers are subjects not performing spirometry or who achieved fewer than two acceptable curves.

[‡] p value between performers and nonperformers; p < 0.05 was taken to be significant.

predicted, was lower among current smokers and former smokers compared with never-smokers (*see* Figure E1 in the online supplement).

Prevalence of airflow obstruction in all age groups. Among Korean adults over the age of 18 years, 7.8% (men, 10.9%; women, 4.9%) had airflow obstruction (Table 3). Beyond age 45 years, the prevalence of airflow obstruction increased with increasing age, and it was higher in men than in women. Most of the airflow obstruction was mild in degree (Figure 1).

Prevalence of COPD among subjects more than 45 years of age. Among participants over 45 years of age, the prevalence of airflow obstruction (COPD) was 17.2% (men, 25.8%; women, 9.6%). Most of the subjects had mild disease. Among the subjects with COPD, 7.4% (men, 10.0%; women, 1.3%) had an FEV₁ less than 50% predicted. In other words, only 1.3% (men, 2.5%; women, 0.1%) of our total subjects had an FEV₁ less than 50% of the predicted value (Table 4).

Relationship between smoking and the prevalence of COPD. The prevalence of COPD was higher among smokers than nonsmokers, with a dose–response relationship. About 36% of Korean adults older than 45 years with more than 20 pack-years of smoking had COPD by GOLD criteria (Table 5). The frequency of severe disease was substantially higher among current (2.3%) and former smokers (4.1%) compared with nonsmokers (0.2%). More than 90% of those with severe COPD were current or former smokers, and 82% had a history of more than 20 pack-years (*see* Table E2). About one-third (32.1%) of those with COPD were nonsmokers. Eighty-eight percent of men with COPD were smokers, in contrast to 10.0% of women with COPD (data not shown).

Prevalence of Physician-diagnosed Disease and Respiratory Symptoms

Among the 8,209 subjects who responded to the questionnaires, the prevalence of physician-diagnosed chronic bronchitis, emphysema, or COPD was 4.9%. It rose with increasing age, more so for men than for women, and more so for current or former smokers than for never-smokers. The frequency of respiratory symptoms was more common among smokers compared with nonsmokers (data not shown).

Frequency of respiratory symptoms and physician diagnosis among subjects with COPD stratified by GOLD stage. With mild airflow obstruction, about 25% of the subjects had chronic cough or sputum but in severe COPD, two-thirds had symptoms. Overall, one-fourth of the subjects with COPD had a diagnosis of COPD, whereas two-thirds of those with severe COPD reported a physician diagnosis of chronic bronchitis, emphysema, or COPD. About 13% of the subjects with COPD had medication (*see* Table E3).

Risk Factors for COPD

By bivariate analysis, age, male sex, residential area, low income, and smoking were significant risk factors. By multiple logistic regression analysis, age older than 65 years (odds ratio [OR], 4.05; 95% confidence interval [95% CI], 2.92–5.61), male sex (OR, 2.62; 95% CI, 1.64–4.18), more than 20 pack-years of smoking (OR, 2.81; 95% CI, 1.76–4.5), and low income (OR, 2.13; 95% CI, 1.52–2.98) were independent predictors of COPD (Table 6).

DISCUSSION

Data showed that the prevalence of COPD in Korea by GOLD criteria was 17.2% among subjects over 45 years of age. The prevalence increases with increasing age, especially among males, and also with more than 20 pack-years of smoking and with low income. Most of the COPD found was mild in degree

TABLE 2. PERCENTAGE OF SMOKERS AMONG KOREAN POPULATION: STRATIFIED BY AGE AND SEX*

Smoking	Total			Male			Female		
	All Ages	< 45 yr	> 45 yr	All Ages	< 45 yr	> 45 yr	All Ages	< 45 yr	> 45 yr
Current status									
Never	61.5	62.7	59.8	22.1	23.5	20.0	93.2	94.7	91.1
Former	8.6	5.6	12.7	17.3	10.5	26.8	1.6	1.6	1.6
Current	29.9	31.7	27.5	60.6	66.0	53.2	5.2	3.7	7.3
Smoking amount†									
≤ 10 pack-yr	16.3	22.1	9.3	31.2	43.3	13.9	4.6	4.9	4.1
11–19 pack-yr	8.8	9.7	7.6	18.7	21.6	14.6	1.0	0.1	2.3
≥ 20 pack-yr	12.8	5.1	23.4	27.7	11.4	51.0	1.0	0.1	2.3

* Weighted frequencies (%).

† Includes former and current smokers.

(FEV₁ > 50%), and only a minority of these subjects had received physician diagnosis or treatment.

In Asia, this study is, to the best of our knowledge, the first large-scale population-based survey performed on representative national samples using spirometry. The samples were drawn from the entire Korean population by means of a multistage clustered probability sampling method, the same as used in the NHANES III study in the United States (7). Because the survey was performed in conjunction with Korean NHANES II, the results permit more detailed analyses of the association of COPD with other demographic and socioeconomic factors. Another strong point of our survey is the high-quality control in the performance of spirometry. The spirometry was performed with the same kind of equipment as in NHANES III, by trained technicians and standardized methods. The review center reviewed all data, and provided immediate feedback to the technicians. Only data from those subjects who had two or more adequate spirometric curves were analyzed (21). In addition, we used the normal predicted spirometry values derived from these survey data, and these values can be extrapolated to the entire population of Korea (22). This survey, however, does have several limitations. One limitation is the low participation rate, especially for the spirometry. Among subjects over the age of 45 years, mean age, sex, and the percentage of subjects with chronic sputum production and physician diagnosis of COPD were different between the two groups (performers and nonperformers; see Table 1). However, the proportion of smokers was not different, which is one of the most important risk factors for COPD. The other limitation stems from the inability to perform the bronchodilator test, resulting in potential overestimation of prevalence due to an overlap with asthma. However,

the bronchodilator response is also not a particularly good way to distinguish between asthma and COPD. It is well recognized that chronic persistent asthma may have features of irreversible airflow obstruction, thus being encompassed within the extent of the term “COPD” (25). In this large epidemiologic survey, we believe the prevalence of airflow obstruction is reasonable as a criterion of the prevalence of COPD, with a small overlap with asthma, especially after the age of 45 years. We further believe the use of objective spirometric data to identify the airflow obstruction in a large population survey mitigates these complications of interpretation.

Before this study, the actual prevalence data on COPD were scarce, especially in developing areas such as Asia, where risk factors such as cigarette smoking, biomass fuel exposure, and air pollution are high (26–29). Halbert and coworkers (6) reviewed the published studies on COPD prevalence and found that 16 studies had used a sampling strategy that was able to produce results representative of the entire population of a country. Among these, only four studies had used spirometry. The reported prevalence varies by the method used and ranged from 0.23 to 18.3% and symptom-based estimation exhibited the widest variation (range, 1.12–18.3%). The prevalence rates were highly variable even when an objective tool such as spirometry was used, not only because of real differences in prevalence, but also because of such differences as subject age and the employed definitions of COPD. Before GOLD proposed a new consensus definition of COPD, different scientific societies had endorsed different criteria (30–32), resulting in substantial variation in the ostensible prevalence rates even in the same population. Viegi and coworkers demonstrated that the prevalence of COPD in the same subjects ranged from 11% on the basis of European Respiratory Society (ERS) criteria, to 18% on the basis of “clinical” criteria (FEV₁/FVC < 70%, which is the same as with GOLD), to 40.4% by the 1986 ATS criteria (10). In this survey we used the consensus GOLD criteria, which will be adopted for future studies. Our study, like others, shows that the prevalence of airflow obstruction increases with the increasing age of subjects. This finding makes direct comparison between survey results more difficult, because the ages of the subjects differ from survey to survey.

An effort was made to compare our data with previously reported prevalences, using the same criteria in the same age group. The result of U.S. NHANES III (6.8% by British Thoracic Society criteria), which was available only for adults more than 18 years of age, was significantly higher than ours for the same age group (3.8%; see Table E4) (7). However, the prevalence in Norway in the same age group (4.5%) was similar to ours (15). Using the GOLD criteria, the prevalence among Koreans (7.8%)

TABLE 3. AGE-SPECIFIC PERCENTAGE OF SUBJECTS WITH AIRFLOW OBSTRUCTION BY GOLD CRITERIA*

Age (yr)	Total	Male	Female
18–24	1.9	1.1	2.7
25–44	2.5	3.6	1.6
45–64	10.7	17.4	4.9
65–74	35.0	52.4	19.0
> 75	41.4	60.0	21.4
Age > 45	17.2	25.8	9.6
Total	7.8 ± 0.4†	10.9 ± 0.5†	4.9 ± 0.5†

Definition of abbreviation: GOLD = Global Initiative for Chronic Obstructive Lung Disease.

* GOLD criteria: FEV₁/FVC ratio < 70%.

† Mean ± SEM: In females, standard errors are more than 10% of prevalence.

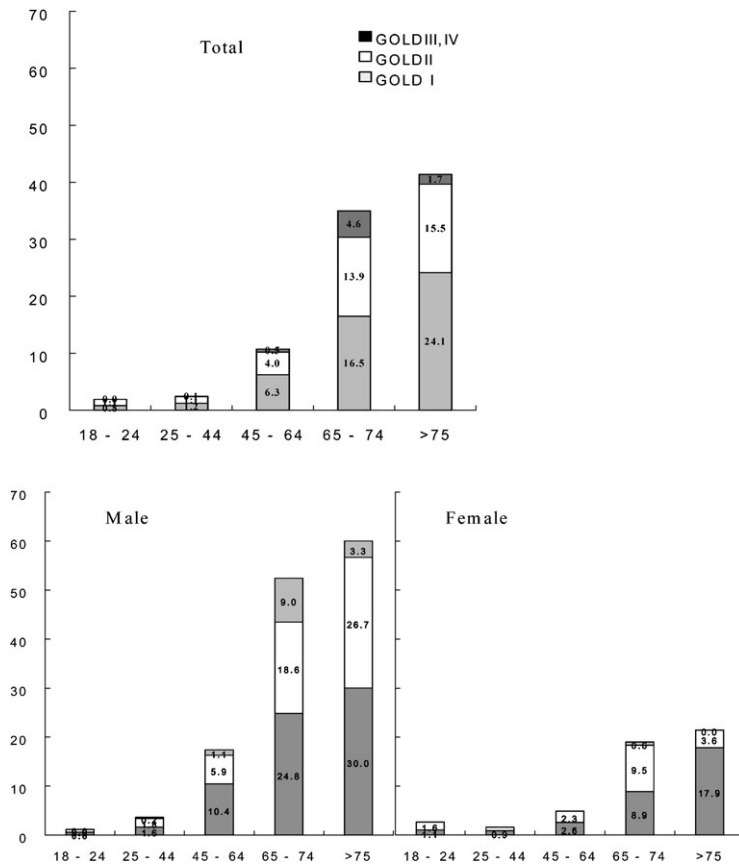


Figure 1. Age-specific percentage of airflow obstruction stratified by severity (numbers represent age ranges in years). Global Initiative for Chronic Obstructive Lung Disease (GOLD) I, FEV₁/FVC < 0.70 and FEV₁ > 80%; GOLD II, FEV₁/FVC < 0.70 and FEV₁ 50–80%; GOLD III and IV, FEV₁/FVC < 0.70 and FEV₁ < 50% of the predicted value.

was also lower than that of U.S. NHANES III (13.9%). However, data from the survey conducted by Viegi and coworkers in Italy yielded an even higher result (18.3% in the same age group with the same GOLD criteria) than U.S. NHANES III (*see* Table E5), even though the sample analyzed by Viegi and coworkers was not representative of the entire Italian population (10). For subjects older than 45 years, the result produced by Viegi and coworkers also was substantially higher than ours. In detailed subgroup comparisons between our study and that by Viegi and coworkers, among subjects older than 45 years, Italians had a higher COPD prevalence among women (which might be due to the reported higher smoking rate among Italian women, compared with Korean women) and also among nonsmokers of both

sexes, whereas the difference among male smokers was rather small. This difference in the prevalence of COPD between two populations is even greater when the 1986 ATS criteria for COPD are used (*see* Table E6). For subjects over 45 years of age, 33.8% of Koreans and 57% of Italians had airflow obstruction; for adults more than 18 years of age, it was 18.4% of Koreans and 40.4% of Italians. Interestingly, using ERS criteria, on the other hand, the prevalence of airflow obstruction was similar in the two populations in all age groups (*see* Table E7). The prevalence of airflow obstruction in Spain (IBERPOC; Estudio Epidemiológico de la EPOC [Enfermedad Pulmonar Obstructiva Crónica] en España) in adults older than 45 years by ERS criteria was also not much different (9.1%) (9). The

TABLE 4. PREVALENCE OF AIRFLOW OBSTRUCTION STRATIFIED BY GOLD SEVERITY CLASSIFICATION

GOLD Stage*	All Ages (> 18 yr)			Age > 45 yr		
	Total	Male	Female	Total	Male	Female
I	4.2	5.7	2.7	9.5	14.0	5.6
II	3.1	4.1	2.1	6.4	9.3	3.9
III	0.4	0.8	0.1	1.1	2.2	0.1
IV	0.1	0.2	0.0	0.2	0.3	0.0
Total	7.8	10.8	4.9	17.2	25.8	9.6

For definition of abbreviation, *see* Table 3. Entries indicate percentage values.

* GOLD stage I, FEV₁/FVC < 0.70 and FEV₁ > 80% of the predicted value; GOLD stage II, FEV₁/FVC < 0.70 and FEV₁ 50–80% of the predicted value; GOLD stage III, FEV₁/FVC < 0.70 and FEV₁ 30–50% of the predicted value; GOLD stage IV, FEV₁/FVC < 0.70 and FEV₁ < 30% of the predicted value.

TABLE 5. AGE-ADJUSTED PERCENTAGE OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE BY GOLD CRITERIA* AMONG THE SUBJECTS OLDER THAN 45 YEARS OF AGE: STRATIFIED BY SMOKING STATUS

Smoking	Total	Male	Female
Current status			
Never	8.8	14.6	7.6
Former	27.3	27.8	12.5
Current	26.9	28.6	12.5
Smoking amount			
≤ 10 pack-yr	12.8	15.1	3.7
11–19 pack-yr	18.8	19.7	12.5
≥ 20 pack-yr	35.6	35.7	30.8

For definition of abbreviation, *see* Table 3. Entries indicate percentage values.

* GOLD criteria: FEV₁/FVC ratio < 70%.

TABLE 6. RISK FACTOR ANALYSIS OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE BY MULTIPLE LOGISTIC REGRESSION ANALYSIS

	Total (No.)	COPD		Bivariate Analysis			Multivariate Analysis		
		%	No.	OR	p Value	95% CI	OR	p Value	95% CI
Age, yr									
< 65	1,312	10.7	141						
≥ 65	361	36.0	130	4.67	< 0.0001	3.54–6.17	4.05	< 0.0001	2.92–5.61
Sex									
Female	883	7.9	70						
Male	790	25.4	201	3.95	< 0.0001	2.96–5.31	2.62	< 0.0001	1.64–4.18
Area									
Urban	1,219	14.7	179						
Rural	454	9.2	41	1.48	0.0061	1.12–1.95	1.02	0.9318	0.73–1.42
Monthly income									
High	1,116	12.1	135						
Low	423	26.5	112	2.62	< 0.0001	1.98–3.47	2.13	< 0.0001	1.52–2.98
Smoking amount									
Never	991	8.8	87						
0–19 pack-yr	271	15.9	43	1.96	0.0008	1.32–2.9	1.11	0.6908	0.66–1.87
≥ 20 pack-yr	388	35.6	138	5.74	< 0.0001	4.24–7.76	2.81	< 0.0001	1.76–4.5

Definition of abbreviations: CI = confidence interval; COPD = chronic obstructive pulmonary disease; OR = odds ratio.

slightly lower prevalence in Spain may be due to the fact that the IBERPOC survey used postbronchodilator values, in contrast to the prebronchodilator data used in the other two studies. We do not know the reason for the large discrepancy in prevalence between Koreans and Italians, using GOLD criteria, whereas they were similar when ERS criteria were used. The ERS criteria use predictive values for the FEV₁/FVC ratio rather than the fixed number of the GOLD criteria (32). Fixed criteria for the FEV₁/FVC ratio might result in an overestimation of the prevalence of COPD, especially among the elderly. It may be helpful to compare the results of the large surveys by applying the various criteria to the same age groups. Unfortunately, NHANES III data based on ERS criteria are not available, and IBERPOC data based on British Thoracic Society/NHANES or GOLD criteria are also unavailable for comparison purposes.

Our data confirmed the effect of cigarette smoking on COPD: not only did the prevalence of COPD increase in a dose–response manner among smokers (Table 5) but all the parameters of lung function were low (see Figure E1). Furthermore, the percentage of smokers in the patients with more severe disease was higher than the percentage of smokers in the patients with relatively mild disease (see Table E2). However, not all subjects with COPD were smokers. In our survey, about 30% of those with COPD were nonsmokers. Although 88% of men with COPD smoked, 90% of women with COPD did not. It may be that the women studied had a higher prevalence of asthma. Passive smoking is another possibility, but there was no difference in the prevalence of COPD between nonsmoking female subjects with or without the presence of household smokers (data not shown). Another possibility is biomass fuel exposure, because in the past, wood and coal have been used for heating and cooking in Korea. However, we cannot confirm or refute this hypothesis, because of the lack of information about past environmental exposure to biomass fuels.

Men not only had a much higher prevalence of COPD but also more severe disease. This may be due to the difference in the prevalence of smokers between the sexes; however, on multivariate analysis, sex was an independent risk factor for COPD after adjustment for smoking. There is controversy about the contribution of sex. Lange and coworkers reported no differences in the prevalence of COPD between sexes (9). Studies suggest that the adverse effects of smoking on lung function may

be greater in females than in males, and women might actually be at higher risk of developing COPD (33–35). However, in the IBERPOC study, sex was determined to be an independent risk factor. Multivariate analysis of our data showed low income to be another independent predictor of COPD even after adjustment for smoking and other risk factors, whereas educational level, residential area (rural or urban), and occupation are not. Many studies have reported that a low socioeconomic level, as measured by education, income, or other indices of social class, is a risk factor for COPD (36–38), and our results support this finding.

During the preparation of this report, a single-city community-based prevalence survey performed in Korea was published, with results significantly different from our survey (see Table E5) (39). Their prevalence rate (18%), based on ATS criteria, among subjects over the age of 45 years was much lower compared with this survey. This discrepancy between two reports from Korea, together with the large geographic variation in the prevalence rate reported in Spain (9), emphasizes the importance of nationally representative sampling. In accordance with other reports, our subjects with COPD were found to be underdiagnosed and undertreated; only a small minority of COPD cases found in our study had been previously diagnosed or treated. Even in cases of severe COPD (FEV₁ < 50%), two-thirds had not received any kind of treatment for their respiratory disease.

In conclusion, our study found that 17.2% of Korean adults over the age of 45 years have mild COPD and only a minority had been diagnosed and/or treated.

Conflict of Interest Statement: None of the authors have a financial relationship with a commercial entity that has an interest in the subject of this manuscript.

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training and management, Chae-Man Lim; spirometry protocol, Jae Jeong Shim; review center, Jae Ho Lee; radiology, Soo-Taek Uh and Woo Jin Lew.

COPD Survey Active Members: Min Jong Kang, Jae Yeol Kim, Hyung Jung Kim, Gee Young Suh, Dong Ho Shin, Youngsoo Ahn, Ho-kee Yum, Jee Hong Yoo, Hyoung Kyu Yoon, Soo Jeon Choi, Kwan Hyoung Kim, Dong Gyu Kim, Tae-Hyung Kim, Jeong-Seon Ryu, Gye Young Park, Kwang Joo Park, Jang Won Shon, So Hyang Seong, Sung Soon Lee, Ji Hyun Lee, Mee Kyung Kim, Chong Ju Kim, Wan Park, Suk Joong Yong, Seung-Joon Lee, Sang-Bum Hong, Yong Hoon Kim, Jae Seuk Park, Ji-Won Suhr, Sung Ja Kim, Yeon Jae Kim, Sung Soo Jung, Min Soo Han, Jae Yong Park, Dae Sung Hyun, Jin Hong Chung, Kyeong Woo Kang, Hyeon Hye Bae, Choon Hee Son, Ki Man Lee, Min Ki Lee, Young Min Lee, Jong Deok Lee, Tae Won Jang, Ki Whan Kim, Sei Hoon Yang, Yong Chul Lee, Jin Young Kwak, Kyung Haeng Koh, Soo Ock Kim, Young Chul Kim, Yu Il Kim, Jong O Kim, Eun Woo Lee, Seung Il Lee, Yoo-Chul Joo, In Jae Oh, Man Jae Lee, Jun Hwa Hwang, and Eun Ha Jang.

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