Fixed Ratio Versus Lower Limit of Normal: Health Status and Risk Factors for COPD Overdiagnosis

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BACKGROUND: The threshold of the lower limit of the normal range of lung function has been suggested to be more accurate than the 0.7 fixed ratio (FEV_1/FVC < 0.7) for a diagnosis of COPD. We aimed to explore the health status and risk factors of patients overdiagnosed with COPD when using the lower limit of the normal range as a diagnostic reference. METHODS: Subjects with COPD diagnosed by a pulmonologist according to guidelines of the Global Initiative for Chronic Obstructive Lung Disease were recruited from October 2016 to April 2018. Overdiagnosed COPD was defined as FEV_1/FVC that meets the criterion of the 0.7 fixed ratio but not the the lower limit of the normal range criterion. Spirometry and questionnaires were performed by eligible subjects. RESULTS: Of the 513 subjects included in the final analysis, 20 (3.9%) were overdiagnosed when using the lower limit of the normal range as the diagnostic reference. The subjects who were overdiagnosed were older, weighed more, had better lung function, lower modified Medical British Research Council scores, and higher St. George's Respiratory Questionnaire and 36-item Short Form Survey scores than the subjects who were correctly diagnosed. Older age, heavier weight, exposure to cooking oil fumes, or a new-built or newly renovated home were associated with an increased risk of overdiagnosis of COPD (age adjusted odds ratio (OR) 1.17, 95% CI 1.09–1.26; weight adjusted OR 1.08, 95% CI 1.03–1.13; exposure to cooking oil fumes adjusted OR 3.00, 95% CI, 1.04–8.68; exposure to new-built or newly renovated home adjusted OR 10.88, 95% CI 1.46–80.87. CONCLUSIONS: The subjects with overdiagnosed COPD had a better health status and lung function than the subjects who were correctly diagnosed. Older age, heavier weight, and exposure to cooking oil fumes or a new-built or newly renovated home were factors associated with the overdiagnosis of COPD. These findings may help reduce overdiagnosis of COPD. *Key words: COPD; overdiagnosis; lower limit of the normal; FEV_1/FVC fixed ratio.* [Respir Care 2020;65(5):603–609. © 2020 Daedalus Enterprises]

Introduction

The diagnosis of COPD is frequently diagnosed by using the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines,[1] which is based on the fixed ratio FEV_1/FVC of <0.7. However, use of the fixed ratio criterion can lead to the overdiagnosis of COPD in > 30% of older men and underdiagnosis in younger women.[2-5] In the past decade, the threshold of the lower limit of the normal range of lung function was found to be more accurate in a COPD diagnosis than the fixed ratio criterion[4,6,7] because FEV_1/FVC reduction is most accurate when it is identified as an individual value of less than the lower limit of the normal range. In addition, the lower limit of the normal range is specific to the individual be-

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cause it is determined from an appropriate healthy, non-smoking, reference population.[8]

Most previous studies focused on subjects with under-diagnosed COPD according to GOLD criteria[9,10] when using the lower limit of the normal range as the diagnostic reference. In contrast, there is little attention payed to over-diagnosed COPD, which may lead to excessive treatment and the overuse of health resources. Thus, research to investigate the characteristics and risk factors of overdiagnosed COPD is necessary. In recent years, previous studies found that subjects who were overdiagnosed were older, had fewer symptoms, and better lung function than patients who were correctly diagnosed.[10,11] However, the health status and risk exposure of subjects with overdiagnosed COPD are rarely reported. Thus, we carried out a hospital-based study to explore the clinical characteristics, health status, and potential risk factors of patients with overdiagnosed COPD when using the lower limit of the normal range as the diagnostic reference.

Methods

Study Population

From October 2016 to April 2018, patients diagnosed with COPD by a pulmonologist according to GOLD guidelines[1,12] were recruited from the Affiliated Hospital of Guilin Medical University, Guilin, China, for study inclusion. Subjects were included in our study if they were ≥45 y old and without evidence of acute upper respiratory tract infections. Exclusion criteria in the study were: (1) had a severe exacerbation in the last month, defined as a COPD-associated event that required either an emergency department visit or hospitalization, and treatment with systemic steroids and/or antibiotics[13,14]; (2) had other pulmonary disease besides of COPD; (3) had a history of intubation within 3 years of enrollment; or (4) had obstructive sleep apnea. The study protocol was approved by the institutional review board at the Affiliated Hospital of Guilin Medical University and conformed to the Declaration of Helsinki. Written informed consent was obtained from each subject.

The criterion of the fixed ratio was defined in the GOLD guidelines[1] as a post-bronchodilator FEV_1/FVC of <0.70.

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QUICK LOOK

Current knowledge

The lower limit of normal is more accurate in diagnosis of COPD than the 0.7 fixed reference of the Global Initiative for Chronic Obstructive Lung Disease. There have been few reports of the health status of individuals overdiagnosed for COPD and risk exposure for overdiagnosis.

What this paper contributes to our knowledge

Subjects with overdiagnosed COPD had better health status than those who were correctly diagnosed. Heavier in body weight and exposure to cooking oil fumes or to a new-built or newly renovated home were risk factors of overdiagnosed COPD when using the lower limit of the normal range as the reference diagnostic criterion.

The criterion for the lower limit of the normal range was defined as a post-bronchodilator FEV_1/FVC of less than the fifth percentile.[15,16] The subjects were categorized as with overdiagnosed COPD if their FEV_1/FVC was < 0.70 but fell within the lower limit of the normal range.

Spirometry

Spirometric data were collected by using a portable spirometer (Carefusion Master Screen Pneumo, Hoechberg, Germany) interfaced for pulmonary function data acquisition and quality control software (Lab Manager version 5.31.0, Carefusion, Hoechberg, Germany), which was calibrated daily. All spirometric measurements were performed according to the European Respiratory Society/American Thoracic Society standards.[17]

Questionnaire

A face-to-face interview was conducted with the subjects. We collected information on demographic characteristics; possible risk factors for COPD, such as related medical history, smoking history, occupational exposure, pollutant exposure at home (including biomass fuel, cooking oil fumes, and living in a new-built or newly renovated home in the recent year). In addition, the subjects' physical activity within the preceding month was tested by using Physical Activity Rating Scale 3[18] Dyspnea was assessed by using the modified British Medical Research Council (mMRC) questionnaire.[19] The health status of the subjects was evaluated by using the St George Respiratory Questionnaire (SGRQ) with a Mandarin version[20] and the 36-item Short Form (SF-36) survey.[21]
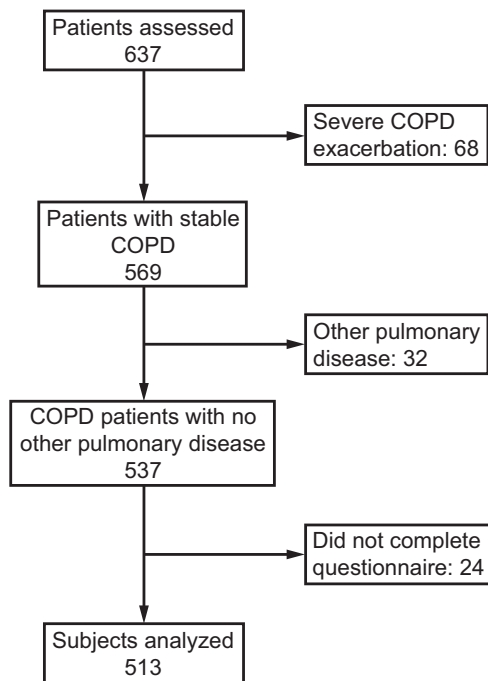
Fig. 1. Flow chart.

6-Min Walk Test

The 6-min walk test was administered according to the American Thoracic Society guidelines.[22] It was performed indoors on a flat square course with 25-m long sides and was supervised by a pulmonologist. Each subject was asked to walk as far as possible around the course in 6 min.

Statistical Analysis

All statistical analyses were performed by using SAS 9.4 (SAS Institute, Cary, North Carolina). Group data are expressed as the mean $\pm$ SD. Differences in continuous variables of the participants were evaluated by using an independent-samples t test, or the Mann-Whitney U test. Differences in categorical variables were examined by using chi-square tests. Unconditional logistic regression models with LOGISTIC procedure (SAS) were used to assess the association between risk factors and overdiagnosed COPD. The results were presented as odds ratios (OR) and 95% CI. P values <.05 were considered to be statistically significant.

Results

The subject selection process is shown in Figure 1. We excluded subjects if they had a severe exacerbation within 1 month of study inclusion, another pulmonary disease ex-

cept for COPD, or did not complete one or more questionnaires; there was a total of 513 subjects for final analyses.

The proportion of COPD overdiagnosis was 3.9% (20/513) when using the lower limit of the normal range as the diagnostic reference. Demographics characteristics for all the subjects are shown in Table 1. The subjects who were overdiagnosed were older (mean $\pm$ SD age 70 $\pm$ 7 y vs 61 $\pm$ 8 y; $P <$ .001), weighed more (mean $\pm$ SD 65.7 $\pm$ 8.1 kg vs 57.8 $\pm$ 10.4 kg; $P =$ .001), and had higher body mass index (BMI) (mean $\pm$ SD 24.9 $\pm$ 3.3 kg/m^2 vs 22.2 $\pm$ 3.6 kg/m^2; $P =$ .001). These subjects also had a lower mMRC score (mean $\pm$ SD 0.9 $\pm$ 0.9 vs 1.5 $\pm$ 1.0; $P =$ .006) than patients who were correctly diagnosed.

Pre- and post-bronchodilator lung function are illustrated in Table 2. The lung function of the subjects who were overdiagnosed was better than that of the subjects with COPD for both pre- and post-bronchodilator testing (pre-bronchodilator: mean $\pm$ SD FEV$_1$ 1.55 $\pm$ 0.37 L vs 1.24 $\pm$ 0.55 L, $P =$ .01; mean $\pm$ SD FEV$_1$ 59.07 $\pm$ 12.58% of predicted vs 45.36 $\pm$ 18.23% of predicted, $P =$ .001; mean $\pm$ SD FEV$_1$/FVC 66.97 $\pm$ 2.43 vs 51.15 $\pm$ 11.63, $P <$ .001; and post-bronchodilator: mean $\pm$ SD FEV$_1$ 1.60 $\pm$ 0.38 L vs 1.31 $\pm$ 0.55 L, $P =$ .02; mean $\pm$ SD FEV$_1$ % of predicted 62.63 $\pm$ 17.11% vs 49.78 $\pm$ 19.94%, $P =$ .005; mean $\pm$ SD FEV$_1$/FVC 68.45 $\pm$ 0.97 vs 52.09 $\pm$ 10.84, $P <$ .001). The lower limit of the normal range of FEV$_1$/FVC in the subjects who were overdiagnosed was lower than that found in the correctly diagnosed COPD group (67.3 $\pm$ 1.8% vs 69.8 $\pm$ 2.4%, $P <$ .001).

The health status of the subjects is showed in Table 3. For SGRQ, mean $\pm$ SD symptoms score (32.9 $\pm$ 17.3 vs 45.8 $\pm$ 19.9, $P =$ .005), activity score (25.4 $\pm$ 17.0 vs 40.7 $\pm$ 21.3, $P =$ .002), impacts score (15.9 $\pm$ 12.1 vs 25.5 $\pm$ 17.9, $P =$ .02), and total score (21.2 $\pm$ 11.5 vs 32.0 $\pm$ 15.0, $P =$ .002) in the overdiagnosed group were lower than in the COPD group. For the SF-36 survey, the mean $\pm$ SD scores of the scale role physical (73.8 $\pm$ 40.1 vs 46.7 $\pm$ 47.2, $P =$ .008) and the scale role emotional (80.0 $\pm$ 36.5 vs 56.9 $\pm$ 46.8, $P =$ .01) in the overdiagnosed group were higher than in the COPD group.

We further explored the association between the risk factors and overdiagnosis of COPD (Table 4). In the overdiagnosed group, the subjects were heavier and had a higher BMI compared with those in the COPD group, although height was similar between the groups. We used weight instead of BMI in further analyses. We detected an association between age, body weight, and the risk of COPD overdiagnosis. The results showed that older age and heavier weight were associated with an increased risk of COPD overdiagnosis when using the lower limit of the normal range as a diagnostic reference (age adjusted OR 1.17, 95% CI 1.09–1.26; weight adjusted OR 1.08, 95% CI 1.03–1.13).

Table 1. Demographics Characteristics of the Subjects by COPD Overdiagnosis Statues Based on the Lower Limit of the Normal Range Criterion of FEV_1/FVC

Variable	Overdiagnosed Group ($n = 20$)	Correctly Diagnosed COPD Group ($n = 493$)	P
Men, n (%)	19 (95.0)	416 (84.4)	.23
Age, mean ± SD y	70 ± 7	61 ± 8	<.001
Height, mean ± SD cm	162.5 ± 4.4	161.3 ± 7.0	.29
Weight, mean ± SD kg	65.7 ± 8.1	57.8 ± 10.4	.001
BMI, mean ± SD kg/m²	24.9 ± 3.3	22.2 ± 3.6	.001
Education, n (%)			.34
≤9 y	14 (70.0)	391 (79.3)	
10–12 y	5 (25.0)	59 (12.2)	
13–16 y	1 (5.0)	31 (6.4)	
≥17 y	0 (0)	2 (0.4)	
Family income: 10,000 CNY (Chinese Yuan)/y, n (%)*			.22
<5.0 × 10,000 CNY (US$7,500)	14 (77.8)	371 (79.9)	
5.0–9.9 × 10,000 CNY (US$7,500–14,999)	2 (11.1)	72 (15.5)	
10.0–19.9 × 10,000 CNY (US$15,000–29,999)	1 (5.6)	18 (3.9)	
≥20 × 10,000 CNY (US$30,000)	1 (5.6)	3 (0.6)	
Smoker: yes, n (%)	15 (75.0)	406 (82.4)	.59
Smoking pack-years,‡ mean ± SD†	36.3 ± 32.1	33.9 ± 31.1	.74
Smoke-pack >1/d: yes, n (%)	3 (15.0)	139 (28.2)	.22
Self-reported occupational exposure: yes, n (%)	6 (20.0)	95 (19.3)	.37
Self-reported pollutants exposure at home: yes, n (%)	13 (65.0)	219 (55.6)	.11
Biomass fuel exposure: yes, n (%)†	1 (5.0)	33 (6.7)	>.99
Cooking oil fumes exposure: yes, n (%)†	10 (50.0)	171 (34.7)	.23
New-built or newly renovated home exposure: yes, n (%)†	2 (10.0)	13 (2.6)	.11
6MWT, mean ± SD m	312 ± 92	290 ± 115	.51
PARS-3 score, mean ± SD	7.8 ± 9.0	8.0 ± 13.7	.95
mMRC score, mean ± SD	0.9 ± 0.9	1.5 ± 1.0	.006
COPD exacerbation in the past 12 mo: yes, n (%)	7 (35.0)	201 (40.8)	.65

* According to the average exchange rate of the U.S. dollar to RMB in 2016 (1:6.64).
† Exposure at home.
‡ Number of pack-years = (number of cigarettes smoked per day/20) × number of years smoked. (1 pack has 20 cigarettes in China).
6MWT = 6-min walk test
PARS-3 = Physical Activity Rating Scale 3
mMRC = modified Medical British Research Council

Moreover, we assessed the association between smoking, occupational exposure, pollutant exposure at home, and the risk of overdiagnosed COPD. The present study showed that pollutant exposure at home was associated with an increased risk of overdiagnosed COPD (adjusted OR 4.21, 95% CI 1.40–12.71). We further assessed the association between the risk of overdiagnosed COPD and exposure to biomass fuel exposure, cooking oil fumes exposure, or new-built or newly renovated home. We found that exposure to cooking oil fumes or to a new-built or newly renovated home was associated with an increased risk of COPD overdiagnosis (cooking oil fumes exposure adjusted OR 3.00, 95% CI 1.04–8.68; new-built or newly renovated home exposure adjusted OR 10.88, 95% CI 1.46–80.87).

Discussion

In our study, subjects over-diagnosed with COPD were older, had heavier weight, had better lung function, and had lower mMRC score than non-over-diagnosed patients. The health status of the subjects who were overdiagnosed was better than the subjects who were correctly diagnosed based on the SGRQ and SF-36 survey scores. Furthermore, older age, heavier weight, and exposure to cooking oil fumes or a new-built or newly renovated home, were associated with an increased risk of overdiagnosed COPD.

In our study, the lung function of the subjects with overdiagnosed COPD was better than that of the subjects who were correctly diagnosed with COPD. FEV_1/FVC-LLN in the subjects who were overdiagnosed was also lower than that in the correctly diagnosed COPD group, which may be related to older age in the overdiagnosed group. In addition, the mMRC score was lower in the subjects who were overdiagnosed than in the subjects who were correctly diagnosed, which indicated less dyspnea in the subjects who were overdiagnosed than in the subjects who were correctly diagnosed. These findings

Table 2. Lung Function of Subjects by COPD Overdiagnosis Statues Based on the Lower Limit of the Normal Range Criterion of FEV_1/FVC

Variable	Overdiagnosed Group (n = 20)	COPD Group (n = 493)	P
Before inhaling short-acting bronchodilator			
FVC, L	2.31 ± 0.52	2.38 ± 0.85	.72
FEV_1, L	1.55 ± 0.37	1.24 ± 0.55	.01
FEV_1, % predicted	59.07 ± 12.58	45.36 ± 18.23	.001
FEV_1/FVC, %	66.97 ± 2.43	51.15 ± 11.63	<.001
After inhaling short-acting bronchodilator			
FVC, L	2.34 ± 0.55	2.48 ± 0.74	.40
FEV_1, L	1.60 ± 0.38	1.31 ± 0.55	.02
FEV_1, % predicted	62.63 ± 17.11	49.78 ± 19.94	.005
FEV_1/FVC, %	68.45 ± 0.97	52.09 ± 10.84	<.001
FEV_1/FVC, lower limit of the normal range, %	67.3 ± 1.8	69.8 ± 2.4	<.001

Data are presented as mean ± SD.

Table 3. Health Status of Subjects by COPD Overdiagnosis Status Based on the Lower Limit of the Normal Range Criterion of FEV_1/FVC

Variable	Overdiagnosis Group (n = 20)	COPD Group (n = 493)	P
SGRQ score			
Symptoms	32.9 ± 17.3	45.8 ± 19.9	.005
Activity	25.4 ± 17.0	40.7 ± 21.3	.002
Impacts	15.9 ± 12.1	25.5 ± 17.9	.02
Total	21.2 ± 11.5	32.0 ± 15.0	.002
SF-36 score			
Body pain	10.2 ± 6.5	10.7 ± 5.6	.73
Physical functioning	77.0 ± 19.4	69.9 ± 22.0	.15
Role physical scale	73.8 ± 40.1	46.7 ± 47.2	.008
General health	53.5 ± 6.8	56.0 ± 7.5	.14
Vitality	10.3 ± 9.8	13.3 ± 9.3	.15
Social functioning	61.3 ± 9.9	62.3 ± 15.4	.75
Role emotional scale	80.0 ± 36.5	56.9 ± 46.8	.01
Mental health	58.2 ± 8.3	61.5 ± 9.8	.14
Reported health transition	61.3 ± 22.2	67.1 ± 20.0	.21

SGRQ = St. George's Respiratory Questionnaire
SF-36 = 36-item Short Form survey

were consistent with previous studies,[10,11] and suggested that the subjects with better lung function and fewer dyspnea symptoms were more likely to be overdiagnosed with COPD based on the fixed-ratio criterion of $FEV_1/FVC < 0.7$. Thus, clinicians should be careful in diagnosing patients with COPD who have these characteristics when using the fixed-ratio criterion of FEV_1/FVC of <0.7.

Our results for the SGRQ and SF-36 survey scores showed that the health status of the subjects with overdiagnosed COPD was better than that of the subjects who were correctly diagnosed. SGRQ is accepted as a measure of health-related quality of life and was designed to assess health status in patients with chronic air-flow limitation.[20] SGRQ is widely used in COPD studies with Chinese subjects to evaluate health status.[23-25] In our study, based on the SGRQ, symptoms score, activity score, impacts score, and total score in the overdiagnosed group were lower than in the COPD group. These results indicated that better health status of the subjects who were overdiagnosed than in the patients who were correctly diagnosed.

Additional confirmation in our study comes from the SF-36 survey, with higher scores in the overdiagnosed group from the scales role physical and role emotional compared with the correctly diagnosed COPD group. The SF-36 survey is a valid and reliable tool for assessing health-related quality of life in the Chinese population.[26] The better health status of the subjects who were overdiagnosed may mainly be due to better lung function and less dyspnea. Because a higher SGRQ score is a significant predictor of fewer exacerbations, hospital admissions, and death,[27] patients who are overdiagnosed would have a better prognosis than patients who are correctly diagnosed, even though they were diagnosed with COPD based on the fixed-ratio criterion of $FEV_1/FVC < 0.7$ according to GOLD guidelines.[1] However, our study could not assess the prognosis of the subjects who were overdiagnosed. Future study with a long-term follow-up may validate this hypothesis.

In our study, the subjects with overdiagnosed COPD were older and weighed more, and had higher BMIs then the patients who were correctly diagnosed. These findings were similar to a previous report.[10] Although no significant difference in BMI was found in the study by Liu et al,[10] BMI in the overdiagnosed group was slightly higher than that in the correctly diagnosed group. In addition, although the study by Liu et al[10] did not report weight or height, we found that the subjects were heavier in the overdiagnosed group but still within the normal range for weight. However, obesity as a cause of overdiagnosis in COPD has attracted more attention from researchers.[28,29] Thus, other than BMI and obesity, body weight should also be a concern when diagnosing COPD based on the fixed-ratio criterion FEV_1/FVC 0.7.

Furthermore, we explored the association between risk factors and overdiagnosis of COPD. Although older age and heavier weight may enhance the risk of overdiagnosed COPD (age adjusted OR 1.17; weight adjusted OR 1.08), their effects were not as serious as the effects to environmental exposure. We assessed the effect of exposure to smoking and to occupational and home pollutants. However, we did not find a significant association between the risk of overdiagnosed COPD and smoking, occupational

Table 4. Adjusted and Unadjusted Relative Risks of COPD Overdiagnosis Based on the Lower Limit of the Normal Range of FEV_1/FVC

Exposure Category	Unadjusted OR, 95% CI	P	Adjusted OR, 95% CI	P
Age*	0.88, 0.82–0.93	<.001	1.17, 1.09–1.26	< .001
Weight†	0.93, 0.90–0.97	.001	1.08, 1.03–1.13	.001
Smoker‡	0.64, 0.23–1.82	.40	0.38, 0.11–1.41	.15
Smoke > 1 pack/d‡	0.47, 0.13–1.76	.27	0.60, 0.13–2.70	.51
Occupational exposure§	0.71, 0.20–2.48	.59	1.21, 0.30–4.87	.79
Pollutants exposure at home‖	2.42, 0.95–6.17	.064	4.21, 1.40–12.71	.01
Biomass fuel¶	0.73, 0.10–5.65	.77	0.54, 0.05–5.86	.61
Cooking oil fumes**	1.88, 0.77–4.61	.17	3.00, 1.04–8.68	.043
New-built or newly renovated home††	4.10, 0.86–19.55	.076	10.88, 1.46–80.87	.020
COPD exacerbation in past 12 mo‡‡	0.75, 0.29–1.91	.55	1.04, 0.36–2.98	.95

Exposure Category: Adjusted for sex, weight, family income, level of education, COPD exacerbation in the past 12 mo, 6-MWT, PARS-3 score, including
* Smoker, occupational exposure, and exposure at home.
† Smoker, occupational exposure, and exposure at home; excluding weight.
‡ Occupational exposure and exposure at home.
§ Smoker and exposure at home.
‖ Smoker and occupational exposure.
¶ Smoker, occupational exposure, exposure to cooking oil fumes, and exposure to new-built or newly renovated home.
** Smoker, occupational exposure, exposure to biomass fuel, and exposure to new-built or newly renovated home.
†† Smoker, occupational exposure, exposure to biomass fuel, and exposure to cooking oil fumes.
‡‡ Smoker, occupational exposure, and exposure at home; excluding age and COPD exacerbation in the past 12 mo.
OR = odds ratio
6-MWT = 6-min walk test
PARS-3 = Physical Activity Rating Scale 3

exposure, or biomass fuel exposure, which was not consistent with the study by Liu et al.[10] These findings may partly be due to our small sample size, which only included 20 subjects in the overdiagnosed group. Future study with a larger sample size is needed to confirm the relationship between smoking, occupational exposure, and the risk of overdiagnosed COPD.

Interestingly, we found a significant association between pollutant exposure at home and an increased risk of overdiagnosed COPD. We further found that exposure to cooking oil fumes and to a new-built or newly renovated home in the past year were associated with an increased risk of overdiagnosed COPD. Previous studies reported that cooking oil fumes without cigarette smoking were associated with pulmonary disease, particularly lung cancer,[30,31] which indicates the negative effect of cooking oil fumes on the lungs. Similarly, indoor air pollutants from building materials in a new-built or newly renovated home, mainly formalin and volatile organic compounds, were associated with an increased risk of COPD.[32] Thus, we conjectured that exposure to cooking oil fumes or new-built or newly renovated homes in the past year may be related to the decline in lung function to the lower limit of the normal range, whereas meeting the 0.7 FEV_1/FVC fixed-ratio criterion for a COPD diagnosis and leads to a misdiagnosis.

We acknowledge limitations in the present study. There were disparate sample sizes in each group. The low prevalence of the subjects with overdiagnosed COPD led to the large difference in the number of subjects in each group, which was a common issue in similar studies.[10,11] The majority of our study results were consistent with previous reports, which indicated that the between-group sample-size difference was not a serious issue in our study. In addition, exposure to risk factors was self-reported; however, occupational exposure was typically self-reported in similar studies.[10,33,34] Nevertheless, home pollutant exposure was recollected within the past year before study enrollment, which may limit recall bias. Thus, self-reported information on exposure may not be a serious bias in our study.

Conclusions

The subjects with overdiagnosed COPD were in a better health status and had better lung function than the subjects who were correctly diagnosed. Older age, heavier weight, and exposure at home, particularly exposure to cooking oil fumes or to a new-built or newly renovated home in the past year, were factors associated with overdiagnosed COPD when using the lower limit of the normal range as the diagnostic reference. Those findings may help reduce overdiagnosis of COPD based on the 0.7 FEV_1/FVC fixed ratio.

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