Vital Surveillances

Distribution of Chronic Obstructive Pulmonary Disease — China, 2014–2015

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ABSTRACT

Introduction: Chronic obstructive pulmonary disease (COPD) has become a major public health problem in China. However, prevalence of COPD by demographics in different regions has not been estimated. This analysis aims to compare the prevalence of COPD by age and sex and the prevalence of disease severity by Global Initiative for Chronic Obstructive Lung Disease (GOLD) stages in the East, Central, and West of China.

Methods: Data from a nationwide surveillance in China between 2014 and 2015 were used, which recruited 66,752 adults aged 40 years or over. All participants underwent pre- and post-bronchodilator pulmonary function tests. COPD and the severity of disease were defined based on the 2018 GOLD lung function criteria.

Results: The prevalence of COPD was 13.7%, 10.9%, and 16.9% in the East, Central, and West, respectively. In all age and gender groups, the prevalence was highest in the West, followed by the East, with the lowest prevalence in Central. The prevalence of mild disease (GOLD stage I), moderate disease (GOLD stage II), severe disease (GOLD stage III), and very severe disease (GOLD stage IV) was also the highest in the West. The prevalence of COPD in each region increased significantly with age and was consistently higher in men than in women.

Conclusions and Implications for Public Health Practice: With the support of Healthy China 2030, the government should widely publicize the risk factors and early symptoms of COPD to promote the prevention on COPD and the awareness of early detection among population. The capacity of diagnosis and treatment of COPD among primary healthcare institutions and healthcare workers should be strengthened, particularly in the West, where the prevalence of COPD is comparatively high and health resources are relatively scarce.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a common disease in middle-aged and elderly people. COPD is characterized by persistent respiratory symptoms and airflow limitations that develop progressively. The main symptoms of COPD include shortness of breath, sputum, chronic cough, and wheezing, and further disease progression would lead to chronic pulmonary heart disease or heart and respiratory failure. COPD has become the third leading cause of death in China according to the results of the latest disease burden study (*1*). Our previous reports found that the prevalence of COPD among Chinese adults aged 40 years or older reached 13.6% (*2*) and increased by 60% when compared to an investigation of ten years ago (*3*). Better knowledge on the region-specific prevalence of COPD and the prevalence of different severities of COPD is crucial for the government to effectively allocate health resources and formulate tailored intervention policies. In this study, data from the National COPD Surveillance in China between 2014 and 2015 were used to estimate the prevalence of COPD in the East, Central, and West* of China, and evaluate the prevalence of various severities of airflow limitation among the patients with COPD in China.

METHODS

National COPD Surveillance was initiated in 2014–2015 and will be carried out every five years. The surveillance in 2014 and 2015 (the most recent available data) was conducted in 125 counties/districts in all 31 provincial-level administrative divisions (PLADs) across China based on National Disease Surveillance Points (DSPs) with national

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* East: Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Liaoning, Shandong, Guangdong, and Hainan. Central: Shanxi, Anhui, Jiangxi, Heilongjiang, Jilin, Henan, Hubei, and Hun. West: Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang. There are two reasons for this division. First, the East, Central, and West have the significantly different levels of economic development across China. It is a traditional geographical classification in disease surveillance in China. Second, the sample of 125 DSPs in the national COPD surveillance were selected based on the stratification of all DSPs into the East, Central, and West across the country.

representativeness (*4*). A multi-stage stratified cluster random sampling method was used to select the participants. Detailed sampling methods can be found in our previous paper (*2*). After estimating a sufficient sample size, 75,000 individuals were planned to be investigated. Finally, a total of 75,107 participants completed the interview (*2,5*).

The surveillance included interviews, anthropometric measurements, and pulmonary function tests that were conducted in local health stations or community clinics (*6–10*). All subjects underwent pulmonary function tests after excluding contraindications. Both pre-bronchodilator and post-bronchodilator forced expiratory volume in 1s (FEV_1) and forced vital capacity (FVC) were measured. The pulmonary function test was conducted with a portable spirometer by using forced expiratory volume (deep inhalation, flow-volume curve).

COPD was defined according to GOLD 2018 (a post-bronchodilator FEV_1: FVC was less than 70%). COPD was classified in accordance with GOLD staging standard: stage I (mild disease, $FEV_1 \geq 80\%$ predicted), stage II (moderate disease, $FEV_1 \geq 50\%$ to <80% predicted), stage III (severe disease, $FEV_1 \geq 30\%$ to <50% predicted), and stage IV (very severe disease, $FEV_1 < 30\%$ predicted).

Prevalence by region (east, central, and west), age, and sex were estimated. Weighted prevalence was calculated using weighted coefficients to represent the overall Chinese adults aged 40 years or over. Weighted coefficients accommodated the sampling scheme for unequal probabilities of sample selection and the post-stratification weights, which harmonized the sample structure of the surveillance with that of the 2010 census of the Chinese population. The prevalence of different stages of the disease in the three regions were also estimated. All statistical analyses were conducted using the "*survey*" package in software R (version 3.4.2, R Foundation for Statistical Computing).

RESULTS

After removing participants with unqualified pulmonary function tests, 66,752 participants were included for analysis. The numbers of participants in the East, Central, and West were 23,703, 19,721, and 23,328, respectively. Participants aged 50–69 years accounted for the greatest proportion in the East, while participants aged 40–49 years accounted for the greatest proportion in the Central and West. There were more female participants in the East and Central, and more male participants in the West (Table 1).

Figure 1 shows the age- and sex-specific COPD prevalence. The prevalence of COPD in the overall population was 13.6%, and it increased with age and was consistently higher among men than women in all age groups. COPD prevalence was highest among men aged 75 years or older (42.9%) and the lowest among women aged 40 to 44 (3.1%).

Table 1 shows the prevalence of COPD by region, age, and sex. In all age and gender groups, the prevalence was highest in the West, followed by the East, with the lowest prevalence in Central. Men aged 70 years or older in the West had the highest prevalence (49.0%), while women aged 40 to 49 years in Central had the lowest prevalence (3.2%).

TABLE 1. Chronic obstructive pulmonary disease (COPD) prevalence by region, age, and sex among Chinese adults aged 40 years or older, 2014–2015*.

Item	East (23,703)		Central (19,721)		West (23,328)	
	Case/Total	Prevalence (%)	Case/Total	Prevalence (%)	Case/Total	Prevalence (%)
Men						
40–49 yr	47/3,079	8.6	264/3,126	7.7	403/4,196	11.1
50–59 yr	679/3,804	17.5	452/3,023	15.3	663/3,646	21.5
60–69 yr	967/3,314	28.8	708/2,756	27.3	963/2,975	36.3
≥70 yr	511/1,225	44.5	319/938	33.1	459/1,055	49.0
Women						
40–49 yr	120/3,547	3.8	97/3,498	3.2	184/4,174	5.2
50–59 yr	284/4,347	7.8	187/3,380	5.9	277/3,934	8.9
60–69 yr	386/3,364	12.2	188/2,321	8.4	327/2,591	14.7
≥70 yr	218/1,023	21.5	78/679	9.7	153/757	24.7

* East: Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian; Liaoning; Shandong; Guangdong; Hainan. Central: Shanxi, Anhui, Jiangxi, Heilongjiang, Jilin, Henan, Hubei, Hunan. West: Inner Mongolia; Guangxi; Chongqing; Sichuan; Guizhou; Yunnan; Tibet; Shaanxi; Gansu; Qinghai; Ningxia; Xinjiang.
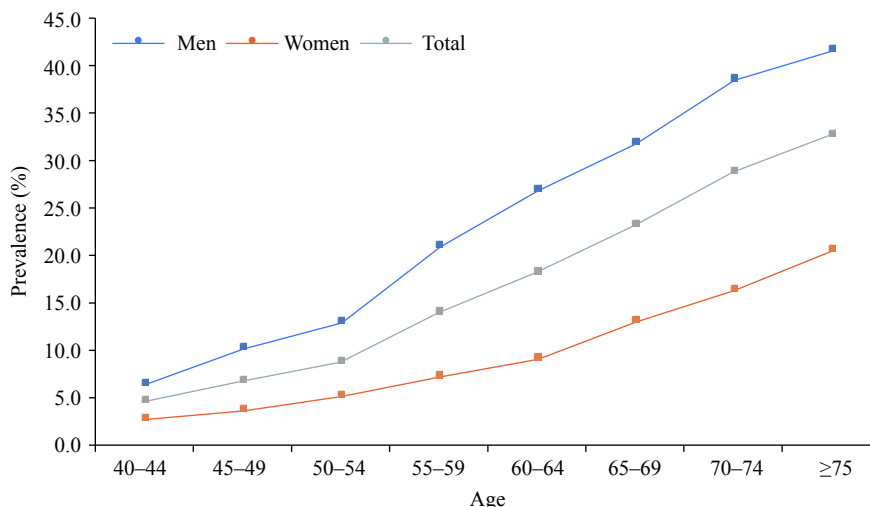
FIGURE 1. Age- and sex-specific chronic obstructive pulmonary disease (COPD) prevalence among Chinese adults aged 40 years or older, 2014–2015.

Region-specific prevalence of COPD and different disease stages are presented in Figure 2. The prevalence of COPD was 13.7%, 10.9%, and 16.9% in the East, Central, and West, respectively. In the overall patients, the prevalence of mild disease (GOLD stage I), moderate disease (GOLD stage II), severe disease (GOLD stage III), and very severe disease (GOLD stage IV) were 7.7%, 4.9%, 0.9%, and 0.1%, respectively. The prevalence of moderate and more severe disease were 6.0%, 5.4%, and 6.7% in the East, Central, and West, respectively.
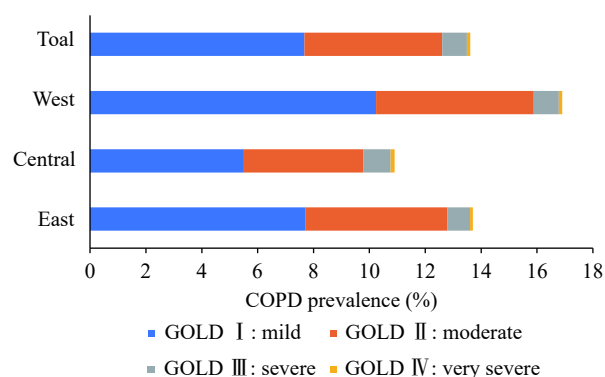

FIGURE 2. Region-specific prevalence of chronic obstructive pulmonary disease (COPD) and different disease stages among Chinese adults aged 40 years or older, 2014–2015. GOLD=global initiative for chronic obstructive lung disease.

DISCUSSION

The results of this surveillance found a varied prevalence of COPD and a varied prevalence of the four disease stages in different regions. An estimated 43.6, 28.0, 5.0, and 0.7 million patients with COPD nationally were at mild, moderate, severe, and very severe stages, respectively, based on the population aged 40 years or older in 2010 (568.0 million). We found that the prevalence of COPD in all ages and gender groups in the West were the highest, and the prevalence of each disease stage were also the highest in the West.

The global prevalence of COPD was estimated at 11.7% (*11*), which is lower than the prevalence of COPD in China found in this study. The results of this study are similar to findings from a study in the US which presented the prevalence of COPD in the US population with same demographic characteristics was 14.0% (*12*). Another study in Latin American cities found that the prevalence in Mexico was 19.7%

(*13*), which is higher than that found in this study.

This study found that more than half of the patients with COPD were at a mild stage and that the West had the highest prevalence of mild patients. Studies show that there were widespread under-recognition and under-diagnosis of COPD (*14*). At the mild stage, patients rarely have detectable symptoms and are less likely to be diagnosed. Health education on COPD-related risk factors and early symptoms among Chinese adults should be public health priorities, particularly in the West in order to improve the prevention and early diagnosis of the disease. Fortunately, the Chinese government has put several health policies in place such as Healthy China 2030, which emphasizes the importance of COPD prevention and control and sets the objective of undertaking spirometry test once a year

for population aged 40 years or over and for high-risk population with chronic respiratory diseases. This policy would greatly promote the early detection of the disease.

In addition to mild stage, the prevalence of the patients with COPD at the moderate, severe, and very severe stages was also the highest in the West. These patients are susceptible to respiratory infectious diseases and are more likely to progress to severe conditions, which increases the risk of mortality. However, in the West, the level of socioeconomic development is relatively low, and health resources are relatively scarce. If respiratory infectious diseases such as 2019 coronavirus disease (COVID-19) spread in the West, there would be a big challenge for public health. This calls for a much stronger and more integrated public health system in the West. More specifically, programs to strengthen the capacities of early diagnosis and standardized treatment of COPD among primary healthcare institutions are urgently needed in the West including the training of healthcare workers and the investments of spirometers and drugs for diagnosis and treatment of COPD.

We also found that the prevalence of COPD in each region increased significantly with age. The future burden of COPD prevalence in China is anticipated to increase considerably due to rapid population aging, which calls for more powerful and more intensified strategies on COPD prevention and control.

Conflict of interest: No conflicts of interest were reported.

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