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Cross-Sectional Study

Update on the Epidemiological Data of Chronic Obstructive Pulmonary Disease in People Aged 40 Years and Above in Yinchuan, Ningxia, China, in the Past 10 Years: A Cross-Sectional Study

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Abstract

Background and Aim: Chronic obstructive pulmonary disease (COPD) has become an important public health problem due to its high morbidity and disability. However, the epidemiological data of COPD in Yinchuan, Ningxia, China, are older, and with the development of society and changes in air quality, the epidemiological status of the prevalence of COPD and related risk factors in Yinchuan in recent years is still unclear; therefore, the aim of this study was to update the prevalence of COPD and related risk factors in Yinchuan people aged 40 years and older.

Methods: Questionnaires, physical measurements and pulmonary function tests were conducted from April 2019 to December 2022 using multi-stage stratified whole cluster sampling for permanent residents aged 40 years and above in Yinchuan district, Ningxia, China. Risk factor analysis was performed using logistic regression analysis.

Results: In this survey, 11,547 patients had satisfactory lung function measurements and complete questionnaires, and 1,841 patients with COPD were detected, with an overall prevalence of 15.9%, and only 10.5% indicated that they were aware of the disease. The results showed that male, advanced age, living in an urban area, low literacy, history of current smoking, history of former smoking, history of second hand smoke exposure, low body weight, history of biomass fuel use, and family history of respiratory disease were the main risk factors for COPD in Yinchuan, Ningxia, China.

Conclusion: The prevalence of COPD among people aged 40 years and older in Yinchuan, Ningxia, China, has increased significantly compared with 10 years ago and is higher than the national data. However, the population in this region has a very low rate of awareness of chronic lung disease and the situation of COPD prevention and control is grim, so active interventions should be taken to effectively prevent and control COPD by targeting the risk factors of tobacco smoke exposure, low body weight, and biomass fuel use.

Keywords: *Chronic Obstructive Pulmonary Disease; Epidemiological Characteristics; Prevalence; Risk Factors; Yinchuan; China*

Background

Chronic obstructive pulmonary disease (COPD) is one of the diseases with the highest disability rate and mortality in the world, ranking the third cause of death in the world [1]. In 2017, the prevalence rate defined by the global initiative on COPD was 3.9% [2]. In 2018, the prevalence rate of people aged 40 years and above in China was 13.7% [3], significantly higher than 8.2% in 2004 [4]. There are great differences in the prevalence of COPD in different regions. Understanding the prevalence and related risk factors in different regions can not only provide theoretical basis for the government to formulate relevant policies, but also is of great significance to guide the effective prevention, diagnosis, treatment and control of COPD in this region.

Zhang., *et al*. reported that the prevalence of COPD in Ningxia was 8.1% in 2011 [5], and no relevant data could be retrieved after that. In order to further update the epidemiological data of COPD in the Ningxia population, the present study was carried out based on the "Breathe Well - COPD Graded Diagnostic and Treatment Project" from April 2019 to December 2022 A cross-sectional study on the epidemiology of COPD in Yinchuan, Ningxia, China.

Object and Methods

Object of study

1. Object: Resident residents aged 40 and above in Xingqing District, Xixia District, Jinfeng District, Yongning County, Helan County and Lingwu City under the jurisdiction of Yinchuan City.

2. Inclusion criteria: Permanent residents who have household registration in Yinchuan and have lived in Yinchuan for more than two consecutive years, or those who are not registered in Yinchuan but have lived in Yinchuan for more than three consecutive years, are all included in the study.

3. Exclusion criteria: For nearly three months have a history of myocardial infarction and unstable angina pectoris history of stroke or frequent attacks; A history of trauma from chest, abdomen or eye surgery within the last 2 months; A history of massive gastrointestinal bleeding or hemoptysis in the past 2 weeks; Poor blood pressure control, namely, systolic blood pressure or greater 180 mmHg and/or diastolic blood pressure 120 mmHg or higher; Merge history of chest aortic aneurysm, cerebral aneurysm; history of hyperthyroidism; seizure period and other people.

This study has passed the first people's hospital of Yinchuan ethics committee approval, approval number: silver a medical ethics the first number (2019-039).

Methods

1. Sampling method: Multi-stage stratified cluster sampling was used.
2. Survey indicators and methods: Questionnaires, physical measurements and pulmonary function tests were conducted by trained and assessed professionals.

Questionnaire investigation: The questionnaire was developed with reference to the burden of obstructive lung disease (BOLD) project and combined with the actual situation in the local area, including: a. Basic information of the respondents: gender, age, place of residence, and level of education. b. Factors associated with disease exposure: smoking and second hand smoke exposure history, history of biomass fuel use, respiratory disease family history, history of chronic cough before age 14, etc. c. COPD symptoms, disease awareness and lung function. Related definitions: Never smokers are defined as those who have never smoked in their life; Current smokers were

defined as those who smoked at least 100 cigarettes and currently smoked daily; Former smokers were defined as those who had quit smoking for ≥ 3 months. Second-hand smoke exposure was defined as exposure to smoke from the end of a burning cigarette or exhaled by a smoker at least one day per week among non-smoking adults. Biomass fuel use is defined as the use of bio-based fuels for cooking or heating, such as corn stalks, charcoal, coal, firewood, or animal waste, among others, in the past 6 months or more. A family history of respiratory disease was defined as one of a parent or sibling with chronic bronchitis, emphysema, or COPD. Frequent cough before the age of 14 years was defined as a cumulative cough of > 3 months per year, occasional cough was defined as 1-3 months/year, and occasional cough was defined as < 1 month/year [3]. The above information was collected and recorded by question and answer.

Body measurement: The height and weight of the respondents were included, and the body mass index (BMI) was calculated and stratified according to the standards recommended by the working group on data aggregation and analysis of obesity in China [6].

Pulmonary function measurement: The "Breathing Home" lung function meter provided by the Happiness Respiratory project team was used to measure lung function, and the lung function meter was calibrated daily. Basic pulmonary function test was performed first, followed by bronchodilation test, that is, 400 micrograms of salbutamol was inhaled, and the measurement was repeated 15 minutes later. If the difference between the best measured value of Forced expiratory volume in 1s (FEV1) and the second best measured value of forced vital capacity (FVC) was less than 150 ml, the repeatability was considered to have reached the standard and the best measured value was taken and recorded [7].

Standard of diagnosis: According to a 2019 global initiative for chronic obstructive lung diseases, after inhaled bronchodilator FEV1/FVC < 0.7, indicating a continuous flow limited, and rule out other diseases after a diagnosis of COPD [8], lung function according to the global initiative for chronic obstructive lung disease (GOLD) standard for grading.

Quality control: Quality control was carried out by doctors of respiratory and critical care medicine department of Yinchuan First People's Hospital. Before the investigation, consult relevant literature and standards, and formulate a unified questionnaire and investigation process. The survey team members were trained in questionnaire and pulmonary function measurement technology and qualified. Take the way of face to face in the process of investigation by questionnaire and lung function measurement, to ensure that information is reliable, timely to someone will collect the data into the database. Quality control team throughout the course of the investigation of sampling in time and check the data accuracy and completeness.

Statistical analysis

Normal distribution of quantitative data using ($x \pm s$) said, qualitative data using frequency or percentage, said comparison between each layer by chi-square test. Logistic regression was used to explore the risk factors of COPD, and $P < 0.05$ was considered statistically significant.

Results

General characteristics

In this survey, 14666 cases were expected to be sampled, and 12079 cases actually obtained the results of the survey, with a response rate of 82.4%, and 11,547 cases were qualified in pulmonary function measurements as well as complete questionnaires, with a qualification rate of 95.6%. The average age of the respondents was 59.6 ± 9.6 years old, the average BMI was 24.8 ± 3.3 kg/m^2; the ratio of male to female and rural to urban population was similar (1.1:1); there were more working than retired people (60.8% vs 39.2%); there were more non-exposed people than exposed people (no history of smoking versus history of smoking was 74.4% versus 25.6%, no history of exposure to second hand smoke versus history of exposure to second hand smoke was 75.0% versus 25.0%, and 18.7% were current smokers. There were more non-smokers than exposed smokers (74.4% vs 25.6% for non-smokers and 75.0% vs. 25.0% for those

with no history of second hand smoke exposure), and 18.7% of current smokers, with males significantly outnumbering females (24.1:1); 19.6% of those who frequently coughed in childhood, 11.7% of those with a family history of respiratory disease, and 56.8% of those who had an educational level of 56.8% in elementary school and below, and 6.6% of those who had college and above; see table 1.

Project	Male (6139 cases)	Female (5408 cases)	Total (11547 cases)
Age (year, $\bar{x} \pm s$)	60.5 ± 9.7	58.7 ± 9.4	59.6 ± 9.6
BMI (kg/m^2, $\bar{x} \pm s$)	24.9 ± 3.3	24.7 ± 3.4	24.8 ± 3.3
Area [cases (%)]			
Urban	2887 (47.0)	2604 (48.2)	5491 (47.6)
Rural	3252 (53.0)	2804 (51.8)	6056 (52.4)
Career [cases (%)]			
Incumbency	3937 (64.1)	3079 (56.9)	7016 (60.8)
Retirement	2202 (35.9)	2329 (43.1)	4531 (39.2)
Smoking state [cases (%)]			
Never smoked	3300 (53.8)	5294 (97.9)	8594 (74.4)
Used to smoke	768 (12.5)	28 (0.5)	796 (6.9)
Smoking	2071 (33.7)	86 (1.6)	2157 (18.7)
History of second hand smoke exposure [cases (%)]			
Yes	905 (14.7)	1978 (36.6)	2883 (25.0)
No	5234 (85.3)	3430 (63.4)	8664 (75.0)
History of biofuel use [cases (%)]			
Yes	3179 (51.8)	2713 (50.2)	5892 (51.0)
No	2960 (48.2)	2695 (49.8)	5655 (49.0)
Chronic cough in childhood [cases (%)]			
Rarely	4637 (75.5)	4144 (76.6)	8781 (76.0)
Sometimes	253 (4.1)	249 (4.6)	502 (4.3)
Frequent	1249 (20.3)	1015 (18.8)	2264 (19.6)
Family history of respiratory disease [cases (%)]			
Yes	669 (10.9)	687 (12.7)	1356 (11.7)
No	5470 (89.1)	4721 (87.3)	10191 (88.3)
Educational attainment [cases (%)]			
Primary and below	3093 (50.4)	3466 (64.1)	6559 (56.8)
Junior	1704 (27.8)	1136 (21.0)	2840 (24.6)
Senior	861 (14.0)	527 (9.7)	1388 (12.0)
College and above	481 (7.8)	279 (5.2)	760 (6.6)

Table 1: *Basic information of surveyed residents ≥ 40 years old in Yinchuan area.*

Analysis of the prevalence of COPD

A total of 1841 patients with COPD were detected in this survey, with an overall prevalence of 15.9% (95% CI: 15.3 - 16.6), with males being higher than females (18.6% vs. 12.9%), and urban areas being higher than rural areas (17.3% vs. 14.7%); the prevalence of COPD in the age group of 40 - 49 years old was 11.7% (95% CI: 10.3 - 13.2), that in the age group of 50 - 59 years old 12.9% (95% CI: 11.8 - 14.0), 16.9% (95% CI: 15.8 - 18.1) for 60 - 69 years old, and 24.6% (95% CI: 22.6 - 26.6) for 70 years old and above, showing an increasing trend with age, $P < 0.05$.

The total prevalence of smoking in the survey population was 25.6% (95% CI: 24.8 - 26.4), and it was significantly higher in men than in women (46.2% vs. 2.1%), and similar in urban and rural areas (27.6% vs. 23.7%); the prevalence rates of current smokers and ex-smokers were 24.4% (95% CI: 22.6 - 26.2) and 24.6% (94% CI: 21.6 - 27.6) and 24.6% (94% CI: 21.6 - 27.6), respectively, which were significantly higher than that of never smokers [13.0% (95% CI: 12.3 - 13.7)]; the prevalence of those with a history of exposure to second hand smoke was significantly higher than that of those without (22.6% vs. 13.7%), those with a history of biomass fuel use was significantly higher than that without (20.0% vs. 11.7%), and those with a family history of respiratory illness was significantly higher than that without (27.4% vs. 14.5%). (27.4% vs. 14.4%), with statistically significant differences. The prevalence of seldom cough, sometimes cough, and often cough in childhood (< 14 years old) was 16.3% (95% CI: 15.5 - 17.1), 15.9% (95% CI: 12.7 - 19.1), and 14.5% (95% CI: 13.0 - 15.9), respectively, with the difference being not statistically significant ($\chi^2 = 4.506$, $P = 0.105$); the prevalence of low weight The prevalence rates of low weight, normal weight, overweight and obese were 28.8% (95% CI: 22.7 - 34.9), 16.8% (95% CI: 15.7 - 17.9), 15.2% (95% CI: 14.2 - 16.2), and 14.2% (95% CI: 12.6 - 15.9), respectively, and the prevalence rates of low weight were significantly higher, and the difference was statistically significant. There were differences in prevalence rates by education level, with 17.1% (95% CI: 16.2 - 18.0), 13.8% (95% CI: 12.5 - 15.0), 15.3% (95% CI: 13.4 - 17.2), and 15.4% (95% CI: 12.8 - 18.0) in primary school and below, junior high school, senior high school, and university and above, respectively, with statistically significant differences; prevalence rates by occupational status were significantly higher in low-body weight individuals, with statistically significant differences; prevalence rates by occupation status were significantly higher in low-body weight individuals, with statistically significant differences. There were statistically significant differences in the prevalence rates by occupational status, with those who were retired being higher than those who were working (18.4% vs. 14.4%), $P < 0.05$, see table 2.

Project	Total [% (95% CI)]	χ^2 value	P value
Gender		16.701	< 0.001
Female	18.6 (17.6-19.6)		
Male	12.9 (12.0-13.8)		
Age group (years)		152.644	< 0.001
40 - 49	11.7 (10.3-13.2)		
50 - 59	12.9 (11.8-14.0)		
60 - 69	16.9 (15.8-18.1)		
≥ 70	24.6 (22.6-26.6)		
Area		14.397	< 0.001
Rural	14.7 (13.8-15.6)		
Urban	17.3 (16.3-18.3)		
Educational attainment		17.113	0.001
Primary and below	17.1 (16.2-18.0)		
Junior	13.8 (12.5-15.0)		
Senior	15.3 (13.4-17.2)		

College and above	15.4 (12.8-18.0)		
Career		33.756	< 0.001
Incumbency	14.4 (13.5-15.2)		
Retirement	18.4 (17.3-19.5)		
Smoking state		214.240	< 0.001
Never smoked	13.0 (12.3-13.7)		
Smoking	24.4 (22.6-26.2)		
Used to smoke	24.6 (21.6-27.6)		
History of second hand smoke exposure		127.622	< 0.001
Yes	22.6 (21.1-24.1)		
No	13.7 (13.0-14.4)		
BMI range (kg/m^2)		30.695	< 0.001
≤ 18.5	28.8 (22.7-34.9)		
18.5 - 23.9	16.8 (15.7-17.9)		
24.0 - 27.9	15.2 (14.2-16.2)		
≥ 28	14.2 (12.6-15.9)		
History of biofuel use		145.994	< 0.001
Yes	20.0 (19.0-21.0)		
No	11.7 (10.9-12.6)		
Family history of respiratory disease		149.421	< 0.001
Yes	27.4 (25.0-29.7)		
No	14.4 (13.7-15.1)		
Chronic cough in childhood (< 14 years)		4.506	0.105
Rarely	16.3 (15.5-17.1)		
Sometimes	15.9 (12.7-19.1)		
Frequent	14.5 (13.0-15.9)		

Table 2: *Prevalence of COPD in Yinchuan residents aged ≥ 40 years.*

Survey on clinical symptoms, pulmonary function classification, disease awareness and pulmonary function test rate in patients with chronic obstructive pulmonary disease

1. Clinical symptoms: 1,841 patients with COPD presented with cough, sputum, and shortness of breath in 721 (39.2%), 833 (45.2%) and 1,303 (70.8%) cases, respectively, and about 81.3% had at least one respiratory symptom.
2. Lung function grading: lung function grading of patients with COPD was performed according to the GOLD criteria, with GOLD class I accounting for 26.7% (95% CI: 24.6 - 28.7), GOLD class II accounting for 50.8% (95% CI: 48.6 - 53.1), GOLD class III accounting for 19.7% (95% CI: 17.8 - 21.5), and GOLD class IV accounting for 2.8% (95% CI: 2.1 - 3.6).

3. Disease awareness and pulmonary function tests: 10.5% (95% CI: 9.1 - 11.9) of patients with COPD were aware of the disease and 17.4% (95% CI: 15.7 - 19.2) had ever had a pulmonary function test.

Multifactorial regression analysis of risk factors for COPD

Logistic regression analyses of factors that may influence the prevalence of COPD, such as gender, age, region, and education level, revealed that older age, being male, primary school education or less, living in an urban area, history of current or former smoking, history of second hand smoke exposure, history of biofuel use, family history of respiratory disease, and low body weight (BMI ≤ 18.5 kg/m^2) were associated with an risk was associated with increased risk. See table 3.

Variate	β	Standard error	WaldX2	OR (95%CI)	P
Gender	0.300	0.068	19.330	1.350 (1.181, 1.543)	< 0.001
Age	0.035	0.003	114.923	1.036 (1.029, 1.042)	< 0.001
Area	0.265	0.064	16.901	1.303 (1.148, 1.478)	< 0.001
Educational attainment					
Junior	-0.216	0.071	9.248	0.806 (0.701, 0.926)	0.002
Senior	-0.233	0.091	6.523	0.792 (0.662, 0.947)	0.011
College and above	-0.156	0.119	1.739	0.855 (0.678, 1.079)	0.187
Career	0.119	0.065	3.408	1.127 (0.993, 1.279)	0.065
Smoking state					
Smoking	1.090	0.079	189.277	2.975 (2.547, 3.475)	< 0.001
Used to smoke	0.981	0.104	88.479	2.667 (2.174, 3.271)	< 0.001
Second-hand smoking	1.399	0.069	358.680	3.670 (3.208, 4.198)	< 0.001
BMI range (kg/m^2)					
≤ 18.5	0.725	0.167	18.838	2.064 (1.488, 2.863)	< 0.001
24.0 - 27.9	-0.199	0.059	11.518	0.819 (0.730, 0.919)	0.001
≥ 28	-0.299	0.083	12.858	0.742 (0.630, 0.873)	< 0.001
History of biofuel use	0.751	0.059	163.974	2.118 (1.888, 2.376)	< 0.001
Family history of respiratory disease	0.625	0.072	75.597	1.868 (1.623, 2.151)	< 0.001

Table 3: *Logistic regression analysis of risk factors for COPD.*

Discussion

This survey supplemented the gaps in the epidemiological data on COPD in Yinchuan, Ningxia, China, over the past 10 years, and found that the prevalence of COPD among people aged 40 years and older in Yinchuan was 15.9%, which was higher than the prevalence of COPD in China reported by the team of Academician Wang Chen in 2018 and the prevalence of COPD in Ningxia reported by Zhang Yanan., *et al*. in 2011 [3,5], and the update of data from this survey responded to a prevalence rate of COPD in Yinchuan that was about 96.1% increase. The prevalence of COPD varies in different regions of China, ranging from a high of 20.2% in Southwest China to a low of 10.2% in Central China [9], and specifically in the Yinchuan region, the prevalence of COPD predicted by modelling by Wang Ning., *et al*. in 2015 was 13.1% [10], and the present investigation suggests that the modelling-predicted prevalence of COPD may underestimate the actual

prevalence of COPD in this region. Although the comparability of the survey results is not entirely reliable due to differences in survey methodology and population base, the significantly higher figures indicate to some extent that the prevalence of COPD in Yinchuan is increasing rapidly.

Tobacco smoke exposure is a known major risk factor for COPD, with 90% of deaths from COPD directly attributable to smoking [11]. The present findings showed that the prevalence of COPD was significantly higher in people with a history of smoking than in people without a history of smoking. When the population with a history of smoking was further divided into current smokers and ex-smokers, the prevalence of ex-smokers was found to be slightly higher than that of current smokers, and although the difference was not statistically significant in the comparison of the two groups, the findings imply that the destruction and remodelling of the lung structure caused by exposure to cigarette smoke is permanent and irreversible, and that cessation of smoking behaviour may slow down the progression of the disease, but does not reverse the above mentioned changes. It was found that symptoms, hypoxaemia, carbon dioxide retention and lung function impairment were less severe in patients with COPD who had quit smoking for a long period of time [12]. In any case, advocacy for smoking cessation is an important part of prevention and control of chronic obstructive pulmonary disease. Second hand smoke and air pollutants have been identified as risk factors for COPD in non-smokers [13,14], and exposure to second hand smoke significantly increases the risk of COPD, and the prevalence of COPD was significantly higher among those with a history of second hand smoke exposure than among those without such exposure in the present investigation. Relevant studies have shown that health education and other interventions for patients with COPD can improve the regression of the patient's condition and improve the quality of life [15], so the system of prohibiting smoking in public places should be strengthened to actively advise smoking cessation and strengthen the public's awareness of the hazards of second hand smoke.

13.0% of never-smokers were diagnosed with COPD, indicating that the disease is also influenced by other factors. Logistic regression analyses of factors for the prevalence of COPD in the present investigation revealed that in addition to tobacco exposure, biofuel use and living in an urban area were also risk factors for the prevalence of COPD. Previous data have shown that smoke from incomplete combustion of biofuels is an important risk factor for the development of chronic obstructive pulmonary disease in China, which is consistent with our findings [9]. It has been shown that patients with COPD associated with biomass smoke have a similar risk of exacerbation as those with COPD associated with tobacco smoke [16]. Therefore, attention should be paid to the impact of indoor air pollutants produced by biomass fuel combustion and ambient air pollutants produced by vehicle exhaust, industrial emissions, power plants, etc., on the disease of chronic obstructive pulmonary disease, to raise the consciousness of the public to take precautions, to actively advocate the use of cleaner fuels, and to strengthen the removal of pollutants from the city, which should be one of the priorities for the future work. Secondly, low body weight (BMI ≤ 18.5 kg/m^2), being male, older age, primary school education or less, and family history of respiratory diseases may be correlated with the prevalence of COPD. Low body weight is not only an independent risk factor for the development of chronic obstructive pulmonary disease [3], but also leads to a significantly increased risk of death from chronic obstructive pulmonary disease [17]. The incidence of COPD is significantly higher in underweight populations, which may be due to malnutrition and poorer immune response to infection [18]. The relationship between overweight and obesity and COPD is still controversial, in this study, overweight and obesity may be a protective factor for COPD, but some studies have shown that the adipose tissue of obese people promotes the secretion of inflammatory factors which in turn leads to the development of COPD [19,20], and the relationship between overweight and COPD needs to be further explored. The gradual decline in lung function with age and the significantly higher proportion of smokers in the male population than in the female population may be the main reasons for the association of the "older, male" variable with the prevalence of COPD, but more basic research is needed to confirm the existence of factors such as genetic predisposition or hormonal differences. The data from this survey showed that the higher the literacy level, the lower the prevalence of COPD, and it has been shown that literacy level of primary school and below is independently associated with the prevalence of COPD [21], which is consistent with the

results of this study. As the quality of the nation improves, perhaps low education is no longer a risk factor for the prevalence of chronic obstructive pulmonary disease, which needs to be further verified by later research studies. A family history of respiratory disease is associated with a higher prevalence of COPD, which may result from a complex interaction of genes and the environment. The above findings indicate that the prevalence of COPD is affected by multiple factors, and the intervention of COPD involves a full range of factors such as nutrition, environment, education, and rehabilitation, etc. The implementation of the six-pronged closed-loop management of "Promotion, prevention, diagnosis, control, treatment, and recreation" is the key to the effective prevention and control of COPD.

About 81.3% of the 1841 patients with COPD in this survey had at least one respiratory symptom, namely shortness of breath (70.8%), sputum (45.2%), and cough (39.2%). Therefore, for people over the age of 40 years old, it is necessary to gradually exclude the risk factors of COPD if they have respiratory symptoms, and to confirm the diagnosis with a pulmonary function test, which is crucial for the effective prevention and control of COPD. Among all the patients, 50.8% were in pulmonary function GOLD class II, and the disease awareness rate and previous pulmonary function examination rate were extremely low, indicating that the public's awareness and attention to COPD is seriously inadequate, and the rate of proactive consultation is low. This phenomenon also suggests that healthcare resources should be sunk to the grassroots level, and that disease health education, pulmonary function screening and health follow-up, and standardised management should be implemented in the community to achieve the early detection of COPD, early treatment and standardised management. The attention of the whole society to the early diagnosis and treatment of chronic obstructive pulmonary disease (COPD) has been aroused through a variety of ways, so as to increase the public's awareness of COPD [22]. The "14th Five-Year Plan" for national health in 2022 proposes to "incorporate pulmonary function tests into the routine physical examination of people over 40 years of age, implement the measurement of pulmonary function in the first visit of high-risk groups, and improve the early screening and intervention capacity of respiratory diseases" [23], which is an important impetus to the prevention and control of COPD. Our survey is based on the "Happy breathing - chronic obstructive pulmonary disease graded diagnosis and treatment programme", which further clarifies the importance of early screening, diagnosis and prevention of COPD, and will have a positive effect on raising the public's awareness of the disease, as well as being a good implementation of the 14th Five-year plan.

Limitations of the Study

There are some limitations of this study, firstly, this study used multi-stage stratified whole population sampling, but the response rate was 82.4%, which may have some bias, and secondly, this is a cross-sectional study, which may have recall bias, such as family history of respiratory diseases and chronic cough in childhood.

Conclusion

In conclusion, this survey has important public health implications. The epidemiological trend of COPD in Yinchuan, Ningxia, China, is still severe, and this survey found that the knowledge rate of the disease and the lung function follow-up rate of COPD patients are still at a low level even when they are diagnosed with COPD. Through the survey, we obtained data on the epidemiological situation of COPD in Yinchuan, which can promote the attention of the government, healthcare organisations, and the population to the disease, and also have a certain degree of significance as reference for the development of the relevant preventive and control strategies. The identification of risk factors for the prevalence of COPD in the survey is useful in updating the public's knowledge and providing a basis for future work in counselling smoking cessation, reducing the use of large vehicles such as automobiles, and optimising the implementation of environmental protection policies.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of the First People's Hospital of Yinchuan City, all subjects granted written informed consent to participate.

Consent for Publication

Not applicable.

Availability of Data and Materials

The data analysed during the current study are not publicly available but are available from the corresponding author on reasonable request.

Competing Interests

All authors declare no conflict of interest.

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Authors' Contributions

LC was involved in conceptualising and designing the study, implementing the study, analysing and interpreting the data, drafting the article. WX was involved in the conceptualisation and design study. ML was involved in drafting articles, statistical analyses. HZ was involved in research implementation, statistical analyses. JC was involved in data collection, analysing and interpreting the data. YL was involved in study implementation, data collection. XM was involved in the conceptualisation and design of the study, guiding the content of the article. All authors read and approved the final manuscript.

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