

Prevalence of Chronic Obstructive Pulmonary Disease in General Practice patients in the Central Region of Portugal

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Summary Background. COPD is a common worldwide condition associated with morbidity and mortality. Its symptoms can be easily overlooked, accounting for an elevated level of under-recognition and under-diagnosis. Knowledge of the prevalence of COPD and the significance of its associated factors in the population enables better management of medical resources.

Objectives. To establish the prevalence of COPD in General Practice patients in the Central Region of Portugal and analyze the correlation with associated factors.

Methods. Cross-sectional study of patients' data with COPD (R95, International Classification for Primary Care 2), anonymously gathered from the official database of the Central Health Administration of Portugal.

Results. Out of 937,817 individuals, 24,148 patients were identified with COPD, a prevalence of 2.57/100,000. 73.7% were above 65 years of age, and 60.2% were males. BMI was recorded in 60.2% patients, FEV₁(%) in 8.0%, and smoking pack-years in 37.1%. Age and BMI were significantly negatively correlated ($\rho = -0.032$, $p < 0.001$), with the same occurring between age and FEV₁(%) ($\rho = -0.073$, $p < 0.05$). A strong association of COPD with male gender and older age groups was found.

Conclusions. The prevalence of COPD was significantly higher in males, and age was identified as a risk factor for this condition. Higher age was non-significantly associated with lower FEV₁(%) and significantly associated with BMI. The lack of e-records calls for an improvement.

Key words: chronic obstructive pulmonary disease, prevalence, primary health care, smoking, age distribution, gender identity.

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Background

Chronic Obstructive Pulmonary Disease (COPD) is an obstructive pulmonary pathology characterized by a not fully reversible and progressive limitation of the airflow.

This pathology is described as a global health problem, with an elevated level of significance conferred by its high mortality and morbidity, as it is currently listed as the fourth leading cause of death worldwide [1, 2]. By the end of 2020, COPD is projected to be the third leading cause of death worldwide, with the disease burden constantly increasing over the next decades due to aging of the population, as well as continuous exposure to COPD-related risk factors [3, 4].

The genesis of this chronic disease is the persistent inflammatory response of the airspaces, responsible for the irreversible alteration of its properties, leading to remodeling and consequent deformation, causing a progressive decline of the patient's pulmonary function [5, 6].

The typical findings in this pathology are a persistent decrease of the percentage of forced expiratory volume in the first second FEV₁(%) during spirometry, accompanied by respiratory symptoms, usually in the form of a persistent cough with sputum (chronic phlegm) [7, 8].

In Portugal, the prevalence of this condition is estimated to be 9 to 14% [9], concomitant with an elevated level of the under-diagnosed population (86.2%) [10], while worldwide, the prevalence of COPD was estimated at 11.7% in 2010 [11].

Smoking is a leading risk factor associated with COPD. Smokers have a higher prevalence of respiratory symptoms, higher annual decline in FEV₁(%) and higher mortality associated with the disease when compared to non-smokers [12]. Other causes like bad breathing atmosphere and chronic dust exposure can be added [8–13].

Aging is also widely referred to as a risk factor for COPD, but whether this is due to aging of the airways and parenchyma itself or due to the cumulative effects of exposures throughout life still remains controversial [13].

Gender differences have also been described in COPD, with past studies showing a higher prevalence amongst males; however, more recent studies have shown a tendency toward a normalization of the prevalence among both genders. This phenomenon is largely attributed to the change in tobacco smoking patterns, with an increase of tobacco smoking among females throughout the years [14]. The clinical presentation of COPD can also vary according to gender, with females being less likely than males to report dyspnea as the main symptom [15, 16]. COPD is listed as the most probable diagnosis more often in males than in females, and thus it is associated with a greater level of under-diagnosis among females, indicating the great importance of spirometry in the diagnosis of this condition [17]. Females have also been described as more susceptible to smoke exposure, showing a greater pulmonary function decline associated with lower smoking exposure when compared to males [18].



Lung function specific measurements, such as FEV₁(%), are widely used as predictors of mortality in COPD, as well as in the general population [19–22]. However, other factors have been described as good predictors in the mortality associated with this condition [23], with prognostic tools such as the BODE index measuring the patient's BMI, degree of airflow obstruction, dyspnea and exercise capacity, showing better results in predicting the risk of death in COPD patients than using FEV₁(%) alone [24, 25].

There are estimations of the prevalence of COPD in the Portuguese population based on an analysis of clusters [10]. Portuguese General Practitioners in Central Portugal work daily with an informatics program for e-health records to classify diseases, namely COPD using the ICPC2, so making it possible to determine COPD's prevalence.

Objectives

1. To establish the prevalence of “Chronic Obstructive Pulmonary Disease (R95)” in the area of the Regional Health Administration of Central Portugal.
2. To characterize socio-demographics of COPD patients such as: age, gender, FEV₁(%), BMI and smoking burden.

Material and methods

This was a cross-sectional study of data gathered on December 31st of 2018. The study was approved by the ethics committee of the Regional Health Administration of Central Portugal. Data was granted by the IT department of the Regional Health Administration of Central Portugal.

Data referring to age, gender, smoking burden, FEV₁(%) and BMI from patients 40 years of age or more classified with the ICPC-2 of “Chronic Obstructive Pulmonary Disease (R95)” was collected anonymously.

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS), version 25. Descriptive statistics included mean and standard deviation for continuous variables and absolute and relative frequency for categorical variables. Distribution normality was assessed using the Kolmogorov–Smirnov test. Chi-square and Mann–Whitney tests were used to establish associations and differences between variables, respectively. For correlation of variables, we used Spearman's correlation coefficient and Partial Correlations to adjust for gender. Correlations were considered very strong when a coefficient was greater than 0.90, strong if between 0.70 and 0.90, moderate if between 0.50 and 0.70, weak if between 0.30 and 0.50 and very weak if less than 0.30. The results were significant at $p < 0.05$.

Results

Out of of 937,817 individuals, 24,148 patients were classified as ICPC-2 “Chronic Obstructive Pulmonary Disease (R95)” and were included in this study. The prevalence of COPD was 2.57/100,000. The characteristics of the participants are shown in Table 1. Regarding gender, 60.2% (14,544) were male, and 39.8% (9,604) were female. The mean age was 71.9 ± 11.6 years, and the majority were above 65 years of age (73.7%; $n = 17,805$). The Baixo Mondego region was the most represented in our sample (20.1%; $n = 4,853$). Out of the 24,148 patients, only 15,470 had BMI records, 1,921 had FEV₁(%), and 8,957 had pack-years registered. Mean BMI was 28.6 ± 7.1 kg/m², mean FEV₁(%) was 62.8 ± 29.8 and mean pack-years was 10.3 ± 22.0.

Table 2 represents the gender comparison of the collected data. Females with COPD were significantly older (73.5 years old) compared to males (70.9 years old; $p < 0.001$), and the latter was significantly overrepresented in the age group below 65 years of age (28.2%; $p < 0.001$). Gender was associated with the participant's region ($p < 0.001$). Female patients with COPD had

a higher median BMI ($M = 29.3$; $p < 0.001$) and FEV₁(%) ($M = 66.1$; $p = 0.001$) but lower median pack-years ($M = 3.4 ± 11.5$) compared to males.

Table 1. Sample characteristics

Characteristics	<i>n</i>	% (<i>n</i>) or Mean ± SD
Gender, % (<i>n</i>)	24,148	
male		60.2 (14,544)
female		39.8 (9,604)
Age (years), mean ± SD	24,148	71.9 ± 11.6
Age group, % (<i>n</i>)	24,148	
< 65 years		26.3 (6,343)
≥ 65 years		73.7 (17,805)
Region, % (<i>n</i>)	24,148	
Baixo Mondego		20.1 (4,853)
Baixo Vouga		19.0 (4,586)
Beira Interior Sul		7.4 (1,780)
Pinhal Litoral		14.4 (3,485)
Dão Lafões		14.4 (3,468)
Pinhal Interior Norte		8.0 (1,930)
ULS Guarda		6.7 (1,617)
Cova da Beira		6.2 (1,496)
Pinhal Interior Sul		3.9 (933)
BMI (kg/m ²), mean ± SD	15470	28.6 ± 7.1
FEV ₁ (%) predicted, mean ± SD	1921	62.8 ± 29.8
Pack-years, mean ± SD	8957	10.3 ± 22.0

BMI – Body Mass Index, FEV₁(%) – Forced Expiratory Volume in the first second, *n* – number of patients with available data, SD – standard deviation.

Table 2. Gender comparison of clinical features in patients with COPD

Characteristics	Gender		<i>p</i>
	Male (<i>n</i> = 14544)	Female (<i>n</i> = 9604)	
Age (years), mean ± SD	70.9 ± 11.2	73.5 ± 11.9	< 0.001
Age group, % (<i>n</i>)			< 0.001
< 65 years	28.2 (4,097)	23.4 (2,246)	
≥ 65 years	71.8 (10,447)	76.6 (7,358)	
Region, % (<i>n</i>)			< 0.001
Baixo Mondego	20.6 (2,996)	19.3 (1,857)	
Baixo Vouga	19.0 (2,766)	19.0 (1,820)	
Pinhal Litoral	14.2 (2,067)	14.8 (1,418)	
Dão Lafões	14.1 (2,048)	14.8 (1,420)	
Pinhal Interior Norte	7.7 (1,123)	8.4 (807)	
Beira Interior Sul	7.4 (1,074)	7.4 (706)	
ULS Guarda	6.8 (988)	6.5 (629)	
Cova da Beira	6.9 (1,004)	5.1 (492)	
Pinhal Interior Sul	3.3 (478)	4.7 (455)	
BMI (kg/m ²), mean ± SD	28.1 ± 6.0	29.3 ± 8.5	< 0.001
FEV ₁ (%) predicted, mean ± SD	61.1 ± 27.9	66.1 ± 33.2	0.001
Pack-years, mean ± SD	14.9 ± 25.8	3.4 ± 11.5	< 0.001

MI – Body Mass Index, FEV₁(%) – Forced Expiratory Volume in the first second, SD – standard deviation.

Mean age and BMI were highest in the Pinhal Interior Sul region and lowest in Baixo Vouga. Mean FEV₁(%) was higher in the interior regions of Cova da Beira and Pinhal Interior do Sul and lower in the seaside locations (Pinhal Litoral and Baixo Mondego). Mean pack-years were higher in Baixo Mondego and Cova da Beira but lower in Pinhal Interior Sul and Dão Lafões.

There were significant differences in terms of age ($p < 0.001$), BMI ($p < 0.001$), FEV₁(%) ($p < 0.001$) and pack-years ($p < 0.001$) between regions.

Unadjusted and adjusted correlations between continuous variables using Spearman's correlation coefficient are shown in Table 3. There were negative correlations between age, BMI and FEV₁(%). Age and pack-years showed a positive correlation. Partial correlations controlling for gender showed a negative correlation between age and FEV₁(%) ($r_s = -0.065$) and positive correlations between age and pack-years ($r_s = 0.223$) and between pack-years and BMI ($r_s = 0.058$). All significant correlations were deemed as very weak (coefficient < 0.3).

Variables (unadjusted)	Age	BMI	FEV ₁
BMI (kg/m ²)	-0.032**		
FEV ₁ (%)	-0.073*	0.034	
Pack-years (greater than 0)	0.219**	0.005	-0.051
Variables (adjusted for gender)	Age	BMI	FEV ₁
BMI (kg/m ²)	0.046		
FEV ₁ (%)	-0.065*	0.052	
Pack-years (greater than 0)	0.223**	0.058*	-0.010

Discussion

We identified 24,148 patients that were classified with ICPC-2 "Chronic Obstructive Pulmonary Disease (R95)" out of 937,817 individuals, resulting in a prevalence of COPD of 2.57 per 100,000. The calculated prevalence of COPD in the Central Region of Portugal was significantly lower than the prevalence estimated for this disease in past studies, both worldwide and in Portugal [9, 10, 26–29]. There are many aspects that can contribute to such a low prevalence in this study: the methodology used in most observational studies being different from the clinical one we used, which is based on existing records. The authors cannot confirm the realization of spirometry with set criteria for COPD diagnosis in every patient, even though the low prevalence may reflect the lack of availability of spirometry in this setting. This study was based on records of chronic patients' problems and a documented diagnosis of COPD for the calculation of the prevalence of COPD [10]. The low prevalence can be explained by lack of clinical findings, lack of ease of spirometry or even due to the lack of a doctor's interest concerning this important health topic [29].

Age was identified as a risk factor for this condition, with the age group above 65 years of age being the most represented in our population. A higher age was also associated with greater pulmonary function decline (lower FEV₁(%)) and lower BMI, both being criteria for a worse prognosis [19–25]. Smoking burden was also found to increase with age.

Airway obstruction for this disease was found to be more severe (with lower FEV₁(%)) amongst patients in seaside locations.

The prevalence was significantly higher in males, with a concomitant higher smoking burden in this gender. It is safe to assume that even though recent studies have shown a tendency toward normalization of the prevalence amongst genders [13], in the Central Region of Portugal, the prevalence of COPD was

higher in males, probably due to a lack of change in smoking patterns, with smoking still being highly associated with the male gender in this area.

All the data was gathered thanks to the existence of a Primary Health Care national health database, containing information about people assisted with acute and chronic problems classified according to ICPC2 in the e-records made by doctors of General Practice/Family Medicine using the comprehensive e-platform. Despite this, there was a considerable lack of registrations regarding FEV₁(%), BMI and smoking burden in the form of pack-years for the patients classified with COPD. For FEV₁(%) registrations, the collected data was related to spirometry results in the study year. Lack of knowledge of spirometry does not mean it has not been made some years ago. FEV₁(%) is a highly reproductive measurement, strongly related to mortality [22, 30], and its registration in the clinical records of patients with COPD is highly recommended.

Limitations of the study

Although the ICPC-2 criteria for the classification of COPD [31] define the need for "objective evidence of airway obstruction, not/only partially relieved by bronchodilators", we cannot guarantee that all doctors, when classifying with ICPC-2 R95, had access to the results of spirometry according to the guidelines of the Global Initiative for Chronic Obstructive Lung Disease (GOLD) [32]. We recognize that probably not all patients who actually suffer from COPD are in this database for medical underdiagnosis, and since this is a study based on recording consultation data, we have no way of ensuring that all doctors followed the criteria expressed when classifying with the R95. Most complete diagnoses should take in consideration the pathophysiology that leads to chronic airway obstruction [33–35].

Strengths

This a large volume data study, encompassing a whole health region in Portugal.

Opportunities

To change for better the diagnosis of COPD and to have better epidemiologic data on this medical issue.

Conclusions

COPD is a pathology mostly associated with the male gender and with older age groups in the Central Region of Portugal. Smoking burden was also higher amongst males when compared to females in this region.

The calculated prevalence of COPD was considerably low in Central Portugal Primary Care databases. There is a need to improve classification, quantitatively and qualitatively, by doctors in Primary Health Care, especially for associated factors such as FEV₁(%), BMI and smoking burden.

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