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# Trends in hospital admissions for obstructive lung disease from 2000 to 2010 in Portugal

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ABSTRACT

The burden of hospitalisations for obstructive lung diseases (OLD) has not been sufficiently studied. We aimed to characterise the hospitalisations for OLD from 2000 to 2010 in all Portuguese public hospitals. We analysed hospital discharges with a diagnosis of OLD regarding the patients' gender, age, residence and comorbidities. Of the 120 399 hospital admissions with a principal diagnosis of OLD, COPD (ICD-9-CM 491.x, 492.x, 496) was responsible for 81%. The change in patients discharged with OLD as a principal diagnosis was only 1% from 2000 to 2010 and did not change for COPD. Hospital admissions and deaths for COPD and other OLD increased with age and were more common in men than women. In-hospital mortality for COPD decreased 34.1% from 2000 to 2010, while the median length of stay was fairly constant at 8 days. Respiratory failure, insufficiency and/or arrest, and pneumonia, are the principal diagnoses often associated with COPD. When both pneumonia and COPD were diagnosed there was an increasing trend to classify pneumonia as the principal diagnosis (64.4%–72.9%), a sign that may lead to underestimation of COPD hospitalisations. In summary, a considerable decrease in in-hospital COPD mortality was observed while hospital admissions and the length of stay did not change substantially. These results suggest that better healthcare or other factors may be counteracting the expected increase of the burden of COPD.



## 1. Introduction

Obstructive lung diseases (OLD) include Chronic Obstructive Pulmonary disease (COPD), asthma and bronchiectasis [1,2]. COPD is a group of diseases characterised by persistent and progressive limitation of airflow, and classically includes emphysema and chronic bronchitis [3]. COPD will be the third major cause of death by 2030 [4]. COPD prevalence seems to be higher in men and increases with age [5,6]. Although COPD is often associated with other diseases, thus increasing its mortality rate, COPD as a secondary diagnosis is often underdiagnosed [7].

Hospitalisation of COPD cases already represent a major burden [8,9]. Khakban et al. showed that hospitalisations were the main driver of the high direct costs of COPD [10]. Studies on hospitalisations and the socio-economic burden of COPD in Portuguese healthcare are not available in the literature. Summarised information on COPD hospitalisations in Portugal is available in the reports issued by the Portuguese Observatory for Respiratory Diseases [11], but, since this covers all pulmonary diseases, COPD hospitalisations are mentioned only briefly.

In light of the socio-economic burden of OLD and the lack of information on OLD hospitalisations in Portugal, our study set out to analyse the evolution of in-hospital admissions, length of stay and mortality of patients admitted in Portuguese hospitals with a diagnosis of OLD, from 2000 to 2010.

## 2. Methods

### 2.1. Study design and data source

We conducted a retrospective observational study using data from the national hospitalisations database, provided by the Central Administration of the Health System of the Portuguese Ministry of Health (ACSS). This database compiles administrative and clinical data on hospitalisation episodes in the Portuguese National Health Service, but it does not include data from private hospitals [12].

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Diagnoses and procedures performed have been coded in Portugal, since 1989, using the International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM). The relative weight of each Diagnosis Related Group (DRG) has been set by the Portuguese Health Ministry [13]. The relative weight reflects the average cost of treating a patient with that DRG [14].

### 2.2. Study population

We included all inpatient episodes of patients aged 18 years and older with a principal or secondary diagnosis of obstructive lung disease – ICD-9-CM codes 491.x for chronic bronchitis, 492.x for emphysema, 493.x for asthma, 494.x for bronchiectasis and 496 for chronic airway obstruction, not elsewhere classified – with a discharge date between 2000 and 2010 in mainland Portuguese hospitals.

### 2.3. Data collection and estimation of variables

For each hospitalisation with a diagnosis of OLD, we collected data on age, gender, place of residence, length of stay and discharge status.

We organised the episodes coded by ICD-9-CM into two groups:

- OLD, which includes 491.x (chronic bronchitis), 492.x (emphysema), 493.x (asthma), 494.x (bronchiectasis) and 496 (chronic airway obstruction, not elsewhere classified);
- COPD, which includes 491.x (chronic bronchitis), 492.x (emphysema) and 496 (chronic airway obstruction, not elsewhere classified).

We recoded age into the following age groups: 18–29 years old, 30–39 years old, 40–49 years old, 50–59 years old, 60–69 years old, 70–79 years old, and 80 years and older.

We classified the place of residence by level of urbanisation, into urban (high level of urbanisation), moderate and rural (low level of urbanisation) [15]. The necessary information on the population (size and variation) was collected from the National Institute of Statistics (INE), which obtained these data by conducting population censuses.

### 2.4. Analysis

For each hospital discharge with a principal or secondary diagnosis corresponding to an obstructive lung disease, we analysed the evolution of hospital admissions and calculated the yearly ratio between each disease and the total number of hospitalisations. We calculated the mean secondary diagnoses in hospitalisations with a principal diagnoses of OLD divided by mean secondary diagnoses in all hospitalisations to adjust all OLD hospitalisations to the mean number of secondary diagnoses coded each year. We made this adjustment, as we studied hospitalisations over a long time span and the mean number of secondary diagnoses that were registered increased during this period due to a better and more complete coding of secondary diagnoses (from 1.66 per hospitalisation to 3.20 per hospitalisation, accounting for an increase of 0.15 secondary diagnoses/hospitalisation per year [16]). We also collected data on hospitalisations and mortality, and calculated the hospitalisation and mortality ratio by age group, gender and residence. We further calculated age-adjusted OLD and COPD hospitalisations and mortality (principal diagnosis) over the study period using the European (Scandinavian 1960) Standard Population. We calculated median length of stay from 2000 to 2010, as length of stay did not follow a normal distribution. Regarding mortality, we calculated the mortality ratio in hospitalisations with a principal diagnosis of OLD/COPD, and the proportion of deaths in a hospitalisation with a principal diagnosis of OLD/COPD compared with all in-hospital deaths. We calculated Elixhauser comorbities [17] for COPD, OLD and for all diagnoses between 2000 and 2010. The Elixhauser comorbidities index was developed to identify comorbidities associated with an increase in the risk of in-hospital mortality, length of stay and its costs. We analysed the principal diagnoses most frequently associated with COPD as a secondary diagnosis. We grouped diagnoses according to the Clinical Classifications Software (CCS) for ICD-9-CM [18], and adjusted for the frequency of the diagnoses when COPD was not a secondary diagnosis. We selected all episodes with a diagnosis of COPD or pneumonia (whether as principal or secondary), and calculated the proportion of principal diagnoses of each of these clinical entities, as well as its DRG relative weights. We performed the same analysis for respiratory insufficiency, failure and/or arrest, and COPD. Finally, for time trends, we calculated the linear regression and tested the null hypothesis that the slope, $B$, was different from 0.

Descriptive statistical analysis was performed using IBM SPSS Statistics for Windows v23 (Armonk, NY: IBM Corp.).

## 3. Results

A total of 120 399 cases of hospital admissions with a principal diagnosis of OLD were recorded in the period studied. These amount to 1.41% of all hospitalisations between 2000 and 2010, of which 97 325 (81%) were due to COPD (Table 1). Although the absolute number of hospital discharges for OLD/COPD increased from 2000 to 2010, there was no relative increase in comparison with all hospital admissions. The variation in hospital discharges of patients with OLD as a principal diagnosis was only 1% (Table 1) (95% CI for *B:* 0.16–0.23). In total, we identified 441 088 hospitalisations of patients with a principal or secondary diagnosis of OLD (5.15% of the total hospitalisations) from 2000 to 2010. Of these, 338 590 (77%) were classified as COPD. In this time period, there was an increase of 42% in the proportion of hospital discharges with a diagnosis of COPD (either principal or secondary) (Table 1) (95% CI for *B*: 0.10–0.15). However, after adjusting these data for the mean number of secondary diagnoses coded each year, we found a significant increase only in hospitalisations with a principal or secondary diagnosis of Chronic Airway Obstruction, not elsewhere classified, from 2000 to 2010. After this adjustment, hospitalisations with a diagnosis of COPD fell significantly owing to the 34.1% decrease in chronic bronchitis hospitalisations. Furthermore, hospitalisations with a diagnosis of emphysema, asthma and bronchiectasis did not show any significant trend. Seventeen per cent of the hospitalisations with a principal diagnosis of bronchiectasis had COPD as a secondary diagnosis.

Of all the admissions with a principal diagnosis of OLD, 38% were patients 70–79 years old and 29% were more than 80 years old. OLD represents a larger burden for patients aged 80 years and older as it accounts for 2.3% of all hospital admissions of patients in that age group. Hospital admissions and mortality for OLD increase with age, with an age peak in the 80+ years old age group (Fig. 1).

Sixty per cent of patients admitted with a principal diagnosis of OLD were male. While 1.8% of all hospital admissions of men were due to OLD, in women OLD accounts for 0.7% of hospital admissions. Mortality is higher in male patients in all age groups (Fig. 1).

We studied the evolution in hospital admissions by place of residence, but we did not find any relevant differences between regions (*data not shown*).

The inpatient median length of stay for OLD was 8 days from 2000 to 2010 (interquartile range of 4.0–11.0 days, except in 2000 and 2001–3.0 to 11.0 days – and 2010–5.0 to 11.0 days). Median length of stay for admissions for COPD fell from 9.0 days in 2000