Hospital admissions of adults with community-acquired pneumonia in Portugal between 2000 and 2009

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Abstract

**Background:** Recent studies in the USA and northern Europe have shown an increase in community-acquired pneumonia (CAP). In southern Europe this increase has not yet been documented.

**Methods:** We carried out a retrospective analysis from encoded information from the Portuguese database for hospital admissions which included all individuals aged 18 or above, with a primary diagnosis of pneumonia, who were discharged between 2000 and 2009. We excluded patients infected with Human Immunodeficiency Virus, immunocompromised individuals as a result of anti-cancer or immunosuppressive treatment and transplant recipients.

**Results:** Of the 294 027 admissions for CAP, 56% were male. The average age was 73.1 and the median age 77. Between 2000 and 2009 there was a 5% increase in the average age of patients admitted with CAP. Admissions for CAP represented 3.7% of total admissions of adult patients. The average annual rate of hospital admissions for adults with CAP was 3.61 per 1000 total population, rising to 13.4% for those >65. From 2000-2004 and 2005-2009 the average annual rate of hospital admission for CAP per 1000 population increased 28.2%.

**Conclusion:** Hospital admissions for CAP in Portugal increased between 2000 and 2009. It has grown consistently over time varying according to age with males overrepresented.

**Keywords:** community acquired pneumonia, pneumonia, incidence
Introduction

Prospective studies prior to 1987 in the USA and in northern European countries estimated an annual rate of 5 to 11 cases of community acquired pneumonia (CAP) per 1000 adult population [1-3]. The percentage of adults having to be hospitalized is very variable. Depending on the country or region analysed, the length of the study and the period in which it took place, there were differences in the population studied and the organization of the health systems, in addition to climate variation and the annual and seasonal changes of circulating microorganisms. (e.g. *Mycoplasma pneumonia* and respiratory virus).

Data published before 2000, in the USA and Canada, documented global annual rates of adult hospital admissions with CAP of between 1.1 and 4 cases per 1000 inhabitants [4,5], which increased to 13.2 cases per 1000 inhabitants among those aged over 55 [6]. In the USA [7] and the countries of northern Europe, such as United Kingdom [8], Denmark [9] and Holland [10], recent studies have shown a steady increase in the number of hospital admission for pneumonia. In the United Kingdom, between 1997-1998 and 2004-2005, there was an increase of 34% in the annual average rate of admission of patients with a primary diagnosis of pneumonia [8].

In Portugal, a southern European country, data relating to 1998-2000 show that adult admission with CAP was 2.9% of the total hospital admissions for all causes [11]. During this period, there was an average annual rate of hospitalization of 2.66 per 1000 population ≥ 15 and 9.78 per 1000 for the age group ≥ 65. The average age for patient admission was 69.8 years [11]. This study aims to characterize the incidence of adult admission with CAP between 2000 and 2009 and analyze its evolution over these 10 years.

Methods

The Central Administration of the Health System (ACSS) of the Portuguese Ministry of Health contains administrative and clinical data of all admissions to National Health hospitals, which covers almost the whole resident population of mainland Portugal. The clinical information, including diagnoses and procedures, is encoded from the details of the hospital discharge report by medical staff who have been
specially trained in hospital coding, using the International Classification of Diseases, 9th Revision - Clinical Modification (ICD-9-CM).

In this study we analysed retrospectively the hospital admissions of adults with a primary discharge diagnosis of Pneumonia (ICD-9-CM: 480 to 486 and 487.0), who were discharged between 2000 and 2009. Patients under 18 and those where pneumonia was not the main diagnosis were excluded. As ICD-9-CM does not specify whether pneumonia is community acquired, we also excluded patients with Human Immunodeficiency Virus (ICD-9-CM: 042 to 044 and or Diagnosis Related Groups [DRG]: 488,489 and 490), individuals who were immunocompromised by anti-cancer or immunosuppressive treatment (external cause of disease: code E933.1) and transplant recipients (V42). The analysis of clinical information maintained patient anonymity.

The size of the population of mainland Portugal was obtained from the Info line of the National Institute of Statistics [12] and corresponds to the estimates of the resident population at the end of the year, subdivided by age and gender, for each year of the study.

To obtain the relevant indicators for this study we adopted a descriptive statistical analysis approach having calculated the following: rates of admission for CAP per 1000 population, percentage of admissions for CAP from total admissions for all diagnoses, proportional distribution of admissions by age group and gender and, finally, average and median ages of CAP admissions.

All the calculations presented were obtained using the statistical software package STATA SE 11 (StataCorp. 2009. Stata Statistical Software: Release 11. College Station, TX: StataCorp LP) and the Microsoft Excel spreadsheet.

Results

Patient characteristics

A total of 294,027 admissions for CAP were included in the study for the 10 year period between 2000 and 2009. Of this total 56% were men and 44% women. The median age was 77 and the average age was 73.1 (SD: 16.0), with a median age of 75 and average age of 71.3 (SD: 15.9) for men and a median age of 79 and an average age of 75.3 (SD: 15.7) for women. The greatest age was 109 years for
women and 111 for men. In the course of the study, we observed a consistent increase in the annual average age of patients of both sexes (Figure 1).

In the older patient age groups, 75-84 and ≥85 years old, there was an increase in the average age. From 2000 to 2009, the average age increased by 0.45 and 0.46 years for patients aged between 75-84 and ≥85, respectively.

Out of a total 294,027 patients studied, 10.3% were between 18 and 49 years old, 11.9% between 50 and 64, 19.5% between 65 and 74, 34.7% between 75 and 84 and 23.6% ≥ 85 years of age.

Admissions for CAP per total admissions
In mainland Portugal, from 2000 to 2009, a total of 7,849,266 hospital admissions occurred. Of this total, 294,027 (3.7%) were diagnosed with pneumonia and according to the criteria for inclusion of this study were considered to have CAP. The proportion of CAP admissions was greater in the older age groups, constituting 5.5% of those ≥ 50, 7.0% of those ≥ 65, 9.4% ≥ 75 and 13.8% ≥ 85 years old. For patients under the ages of 50 and 65, the percentage of admissions for CAP was 1.0% and 1.4% respectively.

Between the periods 2000-2004 and 2005-2009, there was an increased rate for admission for CAP in all age groups, this was independent of gender but more marked in patients over 65 years old (Table 1).

Throughout the 10 years of the study, we observed a growing tendency in the percentage of admissions for CAP in the total admissions; this was particularly marked in the older age groups (Figure 2).

Incidence of admissions for CAP per 1000 total population
Between 2000 and 2009, there was an average annual incidence of 3.61 admissions of adults with CAP per 1000 population. Between the age groups of <50 and ≥ 50 the incidence increased from 0.66 to 7.49. In the age groups <65 and ≥65 the incidence increased from 1.02 to 13.40. From 2000 to 2009, the incidence of admission per 1000 population went up 55.6%, from 3.02 to 4.70, and in the five-year periods from 2000-2004 and 2005-2009, it increased by 28.2%. With the exception of the 18 to 29 year olds, this increase was progressive year on year for all the other age groups (Table 2).
If we exclude the year 2009 from the analysis, because of the influenza pandemic, we can see that the increase in hospital admissions per 1000 population in the periods 2000-2004 and 2005-2008, was 23.5% and this increase was only observed in the age groups ≥50 years.

The average global admission incidence for CAP was higher for men than women, at 4.21 and 3.07 respectively per 1000 population (Table 2). In the over 50s, this figure increased to 9.14 for men and 6.14 for women. For those over 65, it grew to 16.73 for men and 10.64 for women.

Over the 10 years, it can be observed that the annual increase in CAP admissions per 1000 population was most noticeable in the age group ≥ 75 (Figure 3).

Discussion

The Portuguese Ministry of Health database is essentially administrative. The clinical information is coded from discharge documents; this work is carried out exclusively by medical doctors who have been formally trained in hospital coding, to make the process more rigorous. The Ministry of Health carries out regular audits, both internal and external, of this codification process.

In this study, to exclude patients with complications from nosocomial pneumonia, only those cases with a primary discharge diagnosis of pneumonia were analysed. However, it is likely that some cases of nosocomial pneumonia may have been included due to coding error or because the database did not allow for the identification of patients re-admitted soon after a recent discharge from hospital. Patients living in nursing homes or in institutions for long-term care could not be identified from the database so it is likely that cases of pneumonia have been included that are healthcare related, particularly among the elderly. However, this concept and its inclusion in nosocomial pneumonia is not universally agreed on and for some authors would not be valid for Europe [13]. The fact that hospitalization is more accessible and the reluctance to let patients die at home without support may explain the inclusion in the study of elderly patients with end-of-life pneumonia.

In this study, the information about the length of stay in hospital, which could have helped to make the methodology more specific, was not measured [14]. Likewise there was no data available relating to the vaccination status of hospitalized patients, nor was it possible to evaluate the impact of co-morbidities in hospital admissions.
The exclusion of patients infected with human immunodeficiency virus, transplant recipients and those admitted for causes external to the disease such as anticancer treatment or immunosuppressors, could have increased the accuracy of identification of admissions with CAP.

Apart from these limitations, the methodologies are similar to those which have been used in other countries [6,8,11,15]. One advantage of this study is that it covers a period of 10 years, a fact that can minimize the impact of years that deviate from the norm, such as 2009 when the flu pandemic H1N1 happened. Official data in Portugal estimate that, in 2009 and 2010, 2400 patients were admitted to hospital as a result of the influenza pandemic A(H1N1) 2009 [16]. Our analysis does not cover the year 2010 and it was not possible to separate out the admissions due to the pandemic which occurred in 2009 from those that occurred in 2010 [16]. It is possible that hospital admissions for the A (H1N1) pandemic could represent up to 0,8% of the total admissions on our database and 6,2% of the admissions in 2009. We do not have information on the average age of patients admitted, but official data document that the 124 deaths caused by the pandemic correspond to a mortality rate of 1,17 deaths per 100,000 population, with an average age at death of 47,6 years [17]. According to this data, it is possible that the influenza pandemic could have had an impact on the increased numbers of hospital admissions which occurred in 2009, particularly in the age groups under 50 years old.

In the period from 2000 to 2009, the average age of patients admitted for CAP and the median age were respectively 73.1 and 77 years (71.3 and 75 for men; 75.3 and 79 for women). The reduction in average age of patients admitted in 2009 (Figure 1), could have been related to the influenza pandemic. The age factor is patently clear: 89.7% of admissions were ≥50, 77.8% were ≥65, 58.3% were ≥75 and 23.6% were ≥85 years of age.

These data are very similar to those that Ewig et al found in Germany, between 2005 and 2006 [18]. In our study, we also confirmed the impact of age on the increase of admissions for CAP. The average age grew from 70.1 in 2000 to 73.6 in 2009, which corresponds to an increase of 5.0% in the average age over a decade. This increase is greater than the increase in average life-expectancy in Portugal which between 2000 and 2009 changed from 73 to 76 for males and from 80 to 82 for females [19]. The half-year increase in the average age of the older patients, those aged between 75-84 and more than ≥85 years old, between 2000 and 2009, could
be one of the contributing factors to the increased numbers of admissions among these age groups.

As recorded in other recent publications [15,18,20] more men (56%) were admitted than women (44%); the percentages are similar to those in Germany [18].

Between 2000 and 2009, the total number of episodes of hospital admissions for all causes was relatively stable, varying 3.3% between the two five-yearly periods of 2000-2004 and 2005-2009. Admission for CAP represented 3.7% of all admissions. Between 2000-2004 (3.3 %) and 2005-2009 (4.2%) there was an increase of 27.3%. In relation to 1998-2000, the increase was 27.6% [11]. These figures confirm the increase in admission for CAP in absolute and percentual numbers.

The increase in percentage of admissions for CAP is equally dependent on age, above all in the over 65s of which the ≥75 had the highest percentages. Admission for CAP for patients ≥65 is five times greater than for those <65 years of age.

For the 10 years of the study the average annual incidence for hospital admissions for adults with CAP per 1000 population was 3.61. Analysis by age group appears to confirm the importance of age and gender. This value always increased with age, from 7.49 and 13.40 per 1000 population in the age groups ≥50 and ≥65 respectively, up to a maximum value of 44.30 for patients over 85. In the same way, it can be seen that the incidence of admission for CAP per 1000 population for the age group ≥65 is 13 times greater than for the age group <65. The incidence of admissions was always greater for men than for women, in all age groups.

In Portugal the values for incidence of admission per 1000 population between 2000 and 2009, are much higher than those recorded in the period 1998 to 2000 [11]. These values are also higher than those found in recent studies in other countries. In Germany, in 2005 and 2006, we found an average value of 2.86 admissions per 1000 adults [18]. In Spain, from 2003 to 2007, the values were 6.27 and 10.29 per 1000 population in the age groups ≥50 and ≥65, respectively [15] as opposed to the 7.49 e 13.40 per 1000 population in our study. In England, in 2004-2005, the age-standardized incidence of hospital admissions with a primary diagnosis of pneumonia was 22.18 per 1000 population in the age group ≥85 [8]. Even allowing for differences in methodology, given the significant contrast with the figures for Portugal for the ≥85 age group (44.30 versus 22.18), the implication of these figures about the impact of pneumonias at end-of-life in our series must be looked into.

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With the exception of the ages 18 to 29, in the rest of the age groups there has been a progressive increase in the incidence of admission for CAP per 1000 population between the five-year periods of 2000-2004 and 2005-2009, with a global increase of 28.2%. If we exclude the year 2009 from our analysis, because of the influenza pandemic, the incidence of hospital admissions per 1000 population increased by 23.5% in the periods 2000-2004 and 2005-2008 and this increase is only in the age groups ≥50. Excluding the year 2009 confirms that the steady increase of admissions per 1000 population preceded the influenza pandemic and suggests that the pandemic had impacted on the increased of hospital admissions in the age groups <50 years old.

The percentage of increase of hospital admissions per 1000 population in Portugal is lower than that found in England, 34% between 1997-98 and 2004-2005, in an age-standardized study, which did not exclude patients who were immunocompromised and did include paediatric patients [8].

In Portugal, there has been a steady increase in the proportion of hospital admissions for CAP. This variation has been growing steadily over time, increasing with age and is more marked among males. The study did not identify the causes of this increase nor explain the differences to other countries. These differences could be due to any or all of the following: an aging population, increase in co-morbidities, and greater ease of access to hospital services and inadequate implementation of preventive measures. In Portugal, the official data does not include information about pneumococcal vaccines and show that in the period from 1998-99 to 2007-08 the rate of coverage of the anti-flu vaccine in the population in general remained at 14.2 to 14.5%, but increasing from 31.3% to 51.0% for people over ≥65 years old [21].

We do not know whether this increase in the hospital context is matched by an increase in the incidence of the disease in outpatients. We conclude that now is the time to get a more accurate characterization of patients hospitalized and also to re-evaluate the global incidence of pneumonia in the community.
References


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Figure 1 – Evolution of the average age of adult admissions for CAP, by gender and year, from 2000 to 2009 in mainland Portugal.
Table 1 – Percentage of admissions for CAP from total adult admissions, by gender, age group, in the five year periods between 2000-2004 and 2005-2009, and 2000-2009 in mainland Portugal.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Period</th>
<th>18-29</th>
<th>30-49</th>
<th>50-64</th>
<th>65-74</th>
<th>75-84</th>
<th>&gt;85</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2000-2004</td>
<td>1.3%</td>
<td>2.2%</td>
<td>2.7%</td>
<td>4.4%</td>
<td>8.1%</td>
<td>14.6%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Men</td>
<td>2005-2009</td>
<td>1.5%</td>
<td>2.4%</td>
<td>2.9%</td>
<td>4.9%</td>
<td>9.6%</td>
<td>17.3%</td>
<td>5.4%</td>
</tr>
<tr>
<td></td>
<td>2000-2009</td>
<td>1.4%</td>
<td>2.3%</td>
<td>2.8%</td>
<td>4.6%</td>
<td>8.9%</td>
<td>16.2%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Women</td>
<td>2000-2004</td>
<td>0.3%</td>
<td>0.6%</td>
<td>1.6%</td>
<td>3.2%</td>
<td>5.9%</td>
<td>11.0%</td>
<td>2.5%</td>
</tr>
<tr>
<td></td>
<td>2005-2009</td>
<td>0.4%</td>
<td>0.7%</td>
<td>1.7%</td>
<td>3.5%</td>
<td>7.1%</td>
<td>13.5%</td>
<td>3.3%</td>
</tr>
<tr>
<td></td>
<td>2000-2009</td>
<td>0.4%</td>
<td>0.6%</td>
<td>1.7%</td>
<td>3.3%</td>
<td>6.6%</td>
<td>12.5%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Overall</td>
<td>2000-2004</td>
<td>0.6%</td>
<td>1.2%</td>
<td>2.2%</td>
<td>3.8%</td>
<td>7.0%</td>
<td>12.3%</td>
<td>3.3%</td>
</tr>
<tr>
<td></td>
<td>2005-2009</td>
<td>0.6%</td>
<td>1.3%</td>
<td>2.3%</td>
<td>4.2%</td>
<td>8.3%</td>
<td>15.0%</td>
<td>4.2%</td>
</tr>
<tr>
<td></td>
<td>2000-2009</td>
<td>0.6%</td>
<td>1.2%</td>
<td>2.3%</td>
<td>4.0%</td>
<td>7.7%</td>
<td>13.8%</td>
<td>3.7%</td>
</tr>
</tbody>
</table>
Figure 2 – Evolution of the annual percentage of admissions for CAP out the total adult admissions, by age group, from 2000 to 2009 in mainland Portugal.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Period</th>
<th>Age group (years)</th>
<th>18-29</th>
<th>30-49</th>
<th>50-64</th>
<th>65-74</th>
<th>75-84</th>
<th>&gt;85</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>2000-2004</td>
<td>18-29</td>
<td>0.45</td>
<td>1.05</td>
<td>2.53</td>
<td>7.70</td>
<td>20.83</td>
<td>46.61</td>
<td>3.72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30-49</td>
<td>1.06</td>
<td>2.78</td>
<td>8.57</td>
<td>25.88</td>
<td>64.73</td>
<td>4.68</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2000-2009</td>
<td>18-29</td>
<td>0.44</td>
<td>1.06</td>
<td>2.66</td>
<td>8.14</td>
<td>23.53</td>
<td>56.33</td>
<td>4.21</td>
</tr>
<tr>
<td>Women</td>
<td>2000-2004</td>
<td>18-29</td>
<td>0.36</td>
<td>0.52</td>
<td>1.27</td>
<td>3.91</td>
<td>11.24</td>
<td>30.24</td>
<td>2.65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30-49</td>
<td>0.58</td>
<td>1.36</td>
<td>4.31</td>
<td>13.77</td>
<td>41.69</td>
<td>3.47</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2000-2009</td>
<td>0.36</td>
<td>0.55</td>
<td>1.32</td>
<td>4.11</td>
<td>12.59</td>
<td>36.41</td>
<td>3.07</td>
</tr>
<tr>
<td>Overall</td>
<td>2000-2004</td>
<td>18-29</td>
<td>0.40</td>
<td>0.78</td>
<td>1.87</td>
<td>5.60</td>
<td>15.06</td>
<td>38.15</td>
<td>3.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30-49</td>
<td>0.82</td>
<td>2.04</td>
<td>6.22</td>
<td>18.59</td>
<td>49.25</td>
<td>4.05</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2000-2009</td>
<td>0.40</td>
<td>0.80</td>
<td>1.96</td>
<td>5.92</td>
<td>16.94</td>
<td>44.30</td>
<td>3.61</td>
</tr>
<tr>
<td>Variation to 2005-2009 (%)</td>
<td></td>
<td></td>
<td>-2.5%</td>
<td>+5.1%</td>
<td>+9.1%</td>
<td>+11.1%</td>
<td>+23.4%</td>
<td>+29.1%</td>
<td>+28.2%</td>
</tr>
</tbody>
</table>

Note: The numbers represent the incidence of admission per 1000 adult population for Community Acquired Pneumonia (CAP) for different age groups and periods.
Figure 3 – Evolution of the annual incidence of admission for CAP per 1000 population, by age group, between 2000 and 2009 in mainland Portugal.