Time trends in hospital admissions in very elderly patients (≥85 years-old) in Spain: data from the Spanish National Discharge Database (2000 - 2015)

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Abstract

Background The aging population is an increasing concern in Western hospital systems. The aim of this study was to describe the main characteristics and hospitalization patterns in very elderly inpatients (≥ 85 years) in Spain from 2000 to 2015.

Methods Retrospective observational study analyzing data from the minimum basic data set, an administrative registry recording each hospital discharge in Spain since 1997. We collected administrative, economic and clinical data for all discharges between 2000 and 2015 in patients aged 85 years and older, reporting results in three age groups and four time periods to assess differences and compare trends.

Results There were 4,387,326 admissions in very elderly patients in Spain from 2000 to 2015, representing 5.32% of total admissions in 2000–2003 and 10.42% in 2012–2015. The pace of growth was faster in older age groups, with an annual percentage increase of 6% in patients aged 85–89 years, 7.79% in those aged 90–94 years, and 8.06% in those aged 95 and older. The proportion of men also rose (37.3% to 39.7%, $p<0.001$), and they had a higher risk of hospitalization than women (385 discharges/1000 men versus 280 discharges/1000 women in 2012–2015).

Mortality decreased from 14.64% in 2000–2003 to 13.83% in 2012–2015 ($p<0.001$), and mean length of stay from 9.98 days in 2000–2003 to 8.34 days in 2012–2015. Costs per hospital stay increased from 2000 to 2011, from EUR 4611 in 2000–2003 to EUR 5212 in 2008–2011, before dropping to EUR 4824 in 2012–2015.

The 10 most frequent discharge diagnoses in the period 2000-2003 were: femoral neck fracture (8.07%), heart failure (7.84%), neoplasms (7.65%), ischemic encephalopathy (6.97%), pneumonia (6.36%), chronic obstructive pulmonary disease (4.23%), ischemic cardiomyopathy (4.2%), other respiratory diseases (3.87%), other alterations of urethra and the urinary tract (3.08%), and cholelithiasis (3.07%).

Conclusions The very elderly population is growing in Spanish hospitals, and within this group, patients are getting older and more frequently male. Mean length of stay, cost of stay, and mortality are decreasing. Decompensation of chronic diseases, neoplasms and infections are the most common causes of admission.

Background

The elderly population, and especially those aged 85 and over (the very elderly), is the fastest-growing age segment in relative terms in Spain according to the National Statistics Institute (NSI) and the Human Mortality Database (1,2). In countries like Spain, where life expectancy exceeds 80 years of age, this trend is of the utmost importance. According to the NSI, people aged 85 years or older accounted for 3.2% of the total population in Spain in the year 2019(1). Their absolute number increased by 33% in recent years, from 2,258,317 in 2008 to 3,006,352 in 2018, while the number of people aged 95 or older increased by

80% in the same period (3). In addition, elderly patients have the most healthcare requirements and incur the highest health expenditure, with about half the health expenditure in developed countries devoted to patients over the age of 65 (4).

In the hospital setting, trends show increasingly frequent admissions at all ages; this is especially pronounced in the elderly population (5). Moreover, hospital care for this population segment involves special challenges, including more frequent clinical complications during the hospital stay and patients who have cognitive and functional impairment. These challenges require tailored efforts from hospital staff, which sometimes have a limited benefit for the patient.

In this context, the World Health Organization (WHO) and the Spanish Ministry of Health have developed strategies for improving quality of life in older people through prevention and better management of major chronic diseases and disability (6). These interventions have been applied in the last few years and could have had an impact on hospitalization trends in very elderly people.

As examples, the National Health System has adopted the Strategy for Health Promotion and Prevention, which aims to generalize public health measures, improve territorial coordination, empower populations, and create healthy and safe environments for children and the elderly. The strategy also addresses factors such as nutrition, physical activity, alcohol and tobacco consumption, and environmental safety (7). Similarly, the National Strategy for Addressing Chronicity, last updated in 2012, lays out an intersectoral approach for stimulating health promotion, autonomy, and self care; decreasing the prevalence of risk factors for chronic diseases; and promptly diagnosing chronic conditions (8).

Collecting data on hospital admissions for elderly patients at the national level is relevant for understanding the incidence, patient characteristics, and clinical outcomes, as measured using variables like mean length of hospital stay, morbidity, mortality, and cost per hospital stay. To our knowledge, there are no epidemiological studies available addressing this issue in Spain. Describing hospital admissions, outcomes, and trends in elderly people could enable comparisons of health outcomes with other healthcare systems and inform planning for future provision of care.

In 2000, the NSI set average life expectancy in Spain at 75.9 years in men and 82.7 years in women (9). It is of interesting to know the main characteristics of those who outlived their life expectancy, so we chose to analyze discharges in patients aged 85 years or more, since this could reveal a specific pattern.

The aim of this study was to describe trends in the annual proportion of discharges, length of hospital stay, cost per hospital stay, in-hospital mortality and diagnoses causing hospitalization in all patients aged 85 years or more who were hospitalized in Spain from 2000 to 2015.

Methods

Since 1997, basic information has been collected for all patients discharged from Spanish hospitals, using an administrative system called the minimum basic data set (MBDS), which is managed by the

Ministry of Health. The MBDS includes demographic data (age and gender), the date of admission and discharge, the diagnosis that caused the admission, up to 13 secondary diagnoses, the circumstances of discharge (general practitioner, voluntary discharge, home, death, etc.), up to 20 procedural codes, and an estimate of the cost per hospital stay using the diagnosis-related groups (DRG), a health economics concept used to delineate a set of diseases requiring analogous management resources. Until 2016, when the MBDS implemented the most recent codes from the International Classification of Diseases (ICD), 10th revision (10), all procedures and diagnoses were coded in using the (ICD-9-CM (11)so this is the version of the ICD we used.

We included all admissions in patients aged 85 years or older who were discharged from all Spanish hospitals between 2000 and 2015, which are described as the number of admissions. We performed an individual analysis of three age groups: 85–89 years, 90–94 years, and ≥ 95 years, although in the case of mortality we made a group of 95–99 years instead of ≥ 95 years to prevent bias from changes in the mean age of the group along the study period. The annual percentage of very elderly hospital admissions was considered the number of admissions per 100 adult admissions each year. We calculated the annual cumulative incidence by dividing the number of cases per year by the corresponding number of people in that population group in Spain at the beginning of the year according to the NSI annual report (1). The cumulative incidence was expressed per 1000 inhabitants. Mortality was the number of inpatients aged 85 years or more who died during their hospital stay, divided by the number of annual discharges in patients aged 85 years or more. The mean length of hospital stay and costs per hospital stay were also estimated for each study year. Costs were calculated using diagnostic-related groups (DRG). All costs shown were adjusted for inflation during the same period in Spain to make them comparable with costs in 2000.

Analyses of main diagnoses

We conducted a temporal trends study of the most frequent diagnoses in very elderly hospitalized patients. We calculated the annual proportion (number of the specific diagnosis per 100 diagnoses in adults every year) for each ICD-9 category in 2000, and selected the 10 diagnoses with the highest annual proportion in that year; these were used as a basis for the designation of 10 clinically related ICD-9 categories.

Analysis of trends

To facilitate the analysis of trends, we grouped the data in four periods of four years and calculated the average annual percentage change (AAPC), with the following formula:

$$AAPC = \Sigma bi/n-1$$

where bi is the year-to-year relative change in the annual proportion or risk estimation and n the number of years analyzed.

Subsequently, we analyzed the time trends for the 10 selected disease categories. We compared the annual proportion for each diagnosis between 2000 and 2015 using the chi-squared test for trend.

Finally, to determine the most probable future trend to 2030, we tested the correlation coefficient for the annual proportion of each diagnostic group and the years of the study period. We considered an adequate correlation coefficient to be between 0.65 and 1 or −0.65 and −1. For results between 0.64 and −0.64, we analyzed the cause of the lack of correlation by observing the time trend in a linear graphic, aiming to distinguish the stability of annual proportion over time from heterogeneous changes in trend. Finally, we formulated the best trend line for the known annual proportionand estimated the annual proportionup to 2030, using the tool included in Microsoft Excel Version 14.

Statistical analysis

A descriptive statistical analysis of the most relevant characteristics of the studied population was performed. Quantitative variables were expressed as means, and qualitative variables as frequencies and percentages. Comparisons were performed using the chi-squared test or student t-test, as appropriate. We considered p values less than 0.05 to be statistically significant.

Ethical considerations

Data were treated with full confidentiality according to Spanish legislation. Patient identifiers were removed by the Spanish Ministry of Health before sharing the database with authors in order to strictly protect patient confidentiality. Given the anonymous and mandatory nature of the dataset, it was not necessary to obtain informed consent. The Spanish Ministry of Health evaluated our research protocols and determined that the anonymous database met all requirements according to Spanish legislation.

Results

We identified 4,387,326 patients aged 85 years or more who were hospitalized in Spain from 2000 to 2015, comprising 7.66% of total admissions. Two-thirds of those patients were aged 85–89 years; around 25%, 90–94 years; and 10%, 95 years or older.

Tables 1, 2, and 3 show the trends in the number of admissions, their distribution by age and gender, the results of the mortality analysis by age group and in relation with adult mortality, cost analyses (corrected for inflation) by age group, and mean length of hospital stay.

Between 2000 and 2015, the number of admissions in very old patients increased substantially, growing fastest the older the patient group. Moreover, we observed an increase in the number of admissions per 1000 population aged 85 years or more.

Table 1. Hospitalization trends in people aged ≥85 years old in Spain, by five-year age bracket and four-year period, 2000 to 2015

Admissions in patients aged ≥ 85 years	**2000-2003 (T1)**	**2004-2007 (T2)**	**2008-2011 (T3)**	**2012-2015 (T4)**	**AAPC**
N (average annual % of adult admissions)	177,511 (5.32%)	227,630 (6.35%)	308,272 (8.29%)	383,417 (10.42%)	6.61%
Admissions by **gender, N (% of very elderly admissions)**					
Men	66,262 (37.34%)	85,298 (37.43%)	119,034 (38.59%)	152,291 (39.7%)	7.06%
Women	111,206 (62.63%)	142,316 (62.56%)	189,230 (61.4%)	231,120 (60.29%)	6.33%
Admissions by age group					
85-89 years	12,034 (3.6%)	150,461 (4.19%)	207,176 (5.57%)	247,356 (6.72%)	6%
90-94 years	46,613 (1.39%)	61,964 (1.73%)	79,216 (2.13%)	109,331 (2.97%)	7.79%
≥95 years	10,864 (0.3%)	15,204 (0.4%)	21,879 (0.6%)	26,729 (0.7%)	8.06%
Cumulative incidence (admissions per 1000 pop. aged ≥ 85 years)	255	289	312	314	1.91%
Cumulative incidence by gender (admissions in men/women per 1000 men/women in pop. aged ≥ 85 years)					
Men	316	360	384	385	1.8%
Women	229	259	279	280	1.89%

AAPC: average annual percentage change.
Note: All variables were compared with proximate time period (T1 vs T2, T2 vs T3, and T3 vs T4), yielding $p < 0.001$ in all cases.

Mortality slightly decreased throughout the study period, with a modest increase in the oldest age group (table 2). There was an increase in the ratio of in-hospital deaths in the very elderly compared with all adults.

Table 2. Mortality trends in very elderly inpatients (≥ 85 years), by five-year age bracket and four-year period, 2000 to 2015

Deaths in very elderly inpatients	2000-2003 (T1)	2004-2007 (T2)	2008-2011 (T3)	2012-2015 (T4)	Mortality AAPC
Average annual n (average annual mortality rate in admitted patients)	26,032 (14.63%)	33,837 (14.87%)	43,855 (14.23%)	53,059 (13.83%)	0.00%
85-89 years	15,914 (13.24%)	19,827 (13.19%)	26,003 (12.56%)	29,753 (12.03%)	−0.33%
90-94 years	7959 (17.02%)	10,702 (17.27%)	13,169 (16.64%)	17,654 (16.16%)	−0.03%
95 -99 years	1926 (20.77 %)	2955 (21.62 %)	4172 (21.1 %)	4952 (20.68 %)	0.47 %
Deaths in inpatients aged ≥85 years/total in-hospital deaths in adults (%)	20.85%	23.83%	28.72%	33.52%	4.04%

AAPC: average annual percentage change
Note: All variables were compared with proximate time period (T1 vs T2, T2 vs T3, and T3 vs T4), yielding $p < 0.001$ in all cases.

The economic analysis showed an increase in costs per hospital stay from 2000 to 2011 and a decrease in the final four-year period (table 3). Costs were positively correlated with patient age. The ratio between costs in the very elderly and the general adult hospitalized population was positive in the first periods but then began to equalize.

Finally, the mean length of hospital stay decreased by 1.64 days from 2000–2003 to 2012–2015. Nevertheless, the average stay was positively correlated with patient age and was consistently longer in very elderly people compared to the general population of hospitalized adults.

Table 3. Cost trends, corrected by CPI, and length of hospital stay in very elderly inpatients, by five-year age bracket and four-year period, 2000 to 2015

	2000-2003 (T1)	2004-2007 (T2)	2008-2011 (T3)	2012-2015 (T4)	AAPC
Cost/admission in inpatients aged ≥85 years (EUR)	4610.63	4941.58	5212.19	4824.12	1.2%
85-89 years	4587.54	4938.15	5236.08	4851.41	1.2%
90-94 years	4648.36	4941.43	5161.86	4776.99	1.07%
>94 years	4708.27	4994.19	5178.68	4766.03	0.91%
% change, cost in inpatients aged ≥85 years relative to general adult inpatients	+13.88%	+8%	+2.23%	−0.44%	—
Total cost in inpatients aged ≥85 years/total cost in adult inpatients, %	6.06%	6.84%	8.45%	10.38%	4.67%
Mean length of hospital stay in patients aged ≥85 years, days	9.98	9.73	9.19	8.34	−1.27%
85-89 years	10.09	9.84	9.28	8.45	−1.26%
90-94 years	9.84	9.56	9.56	8.45	−1.18%
≥ 95 years	9.35	9.32	8.80	7.92	−1.22%
% change, mean length of stay in inpatients aged ≥85 years relative to general adult population	+24.95%	+25.42%	+23.90%	+18.87%	−0.35%
Mean difference in length of stay (inpatients aged ≥85 years – all adult inpatients), days	1.99	1.97	1.77	1.32	—

AAPC: average annual percentage change; CPI: consumer price index
Note: All variables were compared with proximate time period (T1 vs T2, T2 vs T3, and T3 vs T4), yielding $p < 0.001$ in all cases.

Time trends in the main diagnoses

In 2000, there were 665,045 very old inhabitants in Spain and 164,713 hospital admissions in this age group. The most frequent ICD-9 diagnostic categories recorded at discharge were, in descending order: femoral neck fracture (ICD-9 820), heart failure (ICD-9 428), occlusion of cerebral arteries (ICD-9 434), pneumococcal pneumonia (ICD-9 481), chronic bronchitis (ICD-9 491), acute myocardial infarction (ICD-9 410), cholelithiasis (ICD-9 574), other disorders of the urethra and urinary tract (ICD-9 599), and other respiratory diseases (ICD-9 518).

In order to make the analysis clinically relevant, we created 10 groups by adding the annual proportions for related ICD-9 codes to the ones above. Moreover, we considered it likely that neoplasms were not included among the 10 most frequent disease categories due to the 99 categories into which this chapter is divided, so we added this significant chapter as a whole to the analysis. Table 4 describes the 10 most frequent clinically relevant groups, their annual proportion trend along the study period and the estimation of annual proportion in 2030.

The correlation coefficient between date and annual proportion for each diagnostic group was adequate in all groups but pneumonia and cholelithiasis. We made a linear graphic with the known annual proportion of hospitalizations due to pneumonia and cholelithiasis between 2000 and 2015 (Fig. 1), which shows stability throughout the study period, with an AAPC of only 0.67% and −0.41% respectively; thus, we considered pneumonia and cholelithiasis to show a stable trend during the study period, which will probably, hold in the years to come.

As seen in table 4, there was an increase in the annual proportion of heart failure (AAPC 1.34%), other respiratory diseases (AAPC 5.74%), and other disorders of the urethra and urinary tract (AAPC 3.64%). There was also a decrease in the number of admissions due to femoral neck fractures (AAPC −2.1%), neoplasms (AAPC −1.64%), ischemic encephalopathy (AAPC −2.39%), chronic obstructive pulmonary disease (COPD) (AAPC −2.9%), and ischemic cardiomyopathy (AAPC −2.65%). Cholelithiasis and pneumonia showed the same annual proportion during the study period. The correlation coefficients and the annual proportion of each diagnosis are presented in table 4. According to current trends, the 10 main diagnostic groups will comprise around 53% of total diagnoses at discharge in 2030.

We also analyzed the 10 most frequent diagnoses in 2015, observing that ischemic cardiomyopathy fell to the 11th position. On the other hand, heart arrhythmias ranked 7th in 2015, compared to 12th in 2000.

Table 4. Annual proportion trend of the 10 most frequent ICD-9 diagnostic groups in 2000 in 4-year periods, according to the MBDS. Estimation of annual proportion in 2030

	Average annual N (% of total adult diagnoses)						Coefficient of correlation	Annual proportion 2030 (% of total adult diagnoses)
Disease (ICD-9)	2000-2003	2004-2007	2008-2011	2012-2015	P value	AAPC		
Femoral neck fracture (820)	14,317 (8.07%)	17,320 (7.46%)	21,875 (7.1%)	25,911 (6.77%)	<0.001	−2.1%	−0.97	3.19%
Heart failure (428)	13,925 (7.84%)	20,124 (8.63%)	30,031 (9.72%)	40,722 (10.62%)	<0.001	1.34%	0.97	11.33%
Neoplasms (2)	13,581 (7.65%)	18,585 (7.99%)	24,639 (8%)	28,007 (7.34%)	<0.001	−1.64%	−0.81	5.07%
Ischemic encephalopathy (430-438)	12,367 (6.97%)	14,895 (6.41%)	19,543 (6.34%)	22,374 (5.85%)	<0.001	−2.39%	−0.99	2.85%
Pneumonia (480-486)	11,303 (6.36%)	15,012 (6.46%)	20,940 (6.79%)	28,267 (7.36%)	<0.001	0.67%	0.06	—
COPD (490-492)	7505 (4.23%)	8784 (3.8%)	10,217 (3.32%)	12,124 (3.17%)	<0.001	−2.9%	−0.91	0.74%
Ischemic cardiomyopathy (410-414)	7473 (4.2%)	9377 (4.04%)	10,896 (3.54%)	12,028 (3.15%)	<0.001	−2.65%	−0.93	0.9%
Other respiratory diseases (518-519)	6907 (3.87%)	14,532 (6.15%)	25,716 (8.34%)	32,556 (8.49%)	<0.001	5.74%	0.86	12.99%
Other alterations of urethra and urinary tract (599)	5484 (3.08%)	8022 (3.43%)	14,050 (4.54%)	19,973 (5.2%)	<0.001	3.64%	0,97	6.67%
Cholelithiasis (574)	5453 (3.07%)	7105 (3.06%)	10,137 (3.28%)	12,574 (3.28%)	<0.001	−0.41%	−0.57	—

AAPC: average annual percentage change (on percentage of total discharges); COPD: chronic obstructive pulmonary disease; ICD-9: International Classification of Diseases, 9th revision

Discussion

This study shows some important features about very elderly hospitalized patients in Spain. There is a wide gap between the number of men and women in the analyzed population, with men accounting for just over a third of the very old inpatients. The reasons for this imbalance probably reside in the differential life expectancy between genders and the subsequent smaller proportion of men among very elderly inhabitants in Spain, as in fact men had a higher probability of being admitted to hospital than

women. This result is consistent with other recent studies that show differences in hospitalization patterns depending on gender in elderly patients: women admitted in Spanish hospitals tend to be older and with lower Charlson index scores than men (12).

Previous studies analyzing trends in hospitalized patients have focused on specific diseases (13,14) or single centers, limiting the size of the population analyzed (15,16). To our knowledge, this is the first study to analyze the general trends in very elderly hospitalized patients in Spain, although the Spanish Ministry of Health does periodically provide a summary of the information contained in the MBDS. In 2012, they analyzed the characteristics of hospitalized patients aged over 65; as in our study, their results showed an increase in that population group, combined with a decrease in the mean length of stay, comparable to what we observed in the very elderly population (17). We also found that the number of very old hospitalized patients increased faster in the oldest age segments, with the most rapid increase in people aged 95 and older.

Regarding the causes of hospitalization, there is some overlap between our data and the summary from the Spanish Ministry of Health: diseases of the circulatory and respiratory systems; neoplasms; and diseases of the muscular, skeletal and genitourinary apparatus were among the most frequent diagnoses. However, wounds and poisoning was the fifth most frequent chapter in the Ministry report, while this category did not even rank among the top 10 diagnoses at discharge in our study. This difference could be explained because people tend to cut down on their activity levels as they age, so very elderly people carry a lower risk of wounds or poisoning. Other differences reside in the chapters related to symptoms, signs and poorly defined states as well as endocrine, nutritional, and metabolic diseases, which were among the most frequent diagnoses in the Ministry summary but were much less prominent in our study population.

In 2008, the US Agency for Healthcare Research and Quality (AHRQ) published a statistical brief that presented data from the Healthcare Cost and Utilization Project (17). Authors described patient characteristics and hospital utilization among the oldest adults, including those aged 85 years and older. Diagnoses were quite similar to those in our cohort, with heart failure, pneumonia, urinary tract infection, hip fracture, stroke and COPD among the 10 most frequent diagnoses. However, blood infection (septicemia), kidney failure, and electrolyte and water misbalances were also top diagnoses in the USA, unlike in Spain. Variations in coding practices between countries could explain some of this difference.

The MBDS data show that all causes of admission increased, since the number of admissions went up. However there is a downward trend in the annual proportion of some of the most frequent diagnoses in Spanish hospitals, including femoral neck fractures, COPD, ischemic encephalopathy and ischemic cardiomyopathy. These disease categories share a strong correlation with vitamin D deficiency, osteoporosis, hypertension, diabetes, obesity, tobacco and alcohol consumption, diet, insufficient physical activity and dyslipidemia—all risk factors that public health policies have been addressing in the last decades. Our data are suggestive of the effectiveness of such policies (10,11).

Hospitalization costs changed significantly during the study period. The pronounced increase from 2000 to 2007 was attenuated in 2008–2011 before dropping in 2012–2015. This reversal could be due to the health budget adjustment in Spain following the 2008 economic crisis. Mean length of stay gradually decreased between 2000 and 2015 in all age segments, coinciding with efforts from within the Spanish healthcare system to improve the efficiency of hospital care.

Similarly to our study, the AHRQ data show that very elderly people made up 8% of inpatients in 2008. Although they showed a lower mean length of stay (5.6 days in the USA versus 9.19 days in Spain), the total cost of the hospital stay was higher (USD 9400 versus EUR 5212, respectively). (18) These figures are in accordance with the different healthcare financing systems between the two countries, with private hospital providers dominating in the USA, in contrast to the public hospitals that provide most care in Spain.

To our knowledge, few studies have focused on mortality in the very elderly. In addition, the diversity of the patient populations, reasons for hospitalization, ages at discharge, and lengths of hospital stay make comparisons difficult. The rate of in-hospital mortality has been estimated at 8.2% in those older than 65 years (16), compared to 13.3% in patients older than 90 (19). An Italian study published in 2003 analyzed in-hospital mortality in the very elderly in a cohort of 987 patients. The authors observed a 16.2% mortality rate in their population, which is slightly higher than the 14.64% to 13.83% seen in our study.

In addition, with regard to the mortality rate among very elderly inpatients, overall mortality declined. However, due to the increase in the very old hospitalized population, deaths in inpatients aged 85 years and older (relative to total adult deaths)have progressively increased. Our data show a downward trend in the mortality of those aged 85–89 years, stability in the group aged 90–94 years, and an upward trend in individuals aged 95-99. These results could be explained by the progressive medicalization of advanced age and death, which is more frequent in urban areas (demographic trends in Spain show an increasing concentration around large cities). This pattern is in accordance with previous data published in Spain (19) showing that deaths occur more frequently in a hospital setting in cities and that this tendency is becoming more pronounced with time.

The strengths of our findings lie in the large sample size, the 15-year follow-up period, and the reliability of the data, which come from a well-established administrative system. However, our study has some limitations that should be considered when interpreting its results. The source of our data is the MBDS, an administrative database that includes data collected from each discharge report in Spain. This kind of database is of good quality for administrative data, but it shows low sensitivity and high specificity for clinical data such as main diagnoses (20,21). Another limitation is the anonymity of the database (patients are not identified by clinical history number or name), which prevents any analysis of readmissions; moreover, patients who were transferred from one hospital to another would have duplicate entries.

In the clinical field, the database is limited because it uses ICD-9-CM diagnostic codes to identify the main cause of hospitalization. The major concern in this case is the questionable accuracy of these diagnoses,

which cannot be verified.

Despite these limitations, the MBDS discharge data is a mandatory register with an estimated coverage of 98% (22). Data are also audited periodically, minimizing inaccuracies. Finally, the Spanish health system provides universal healthcare coverage, allowing the standardization of data from patients with different socioeconomic backgrounds or living in different Spanish regions.

Conclusions

The number of very elderly patients in Spanish hospitals is rapidly increasing; this increase is most notable among the oldest patients. The classic gap between hospitalization rates among very old women and men is progressively converging. Mortality, average stay, and costs are decreasing. Finally, the most prevalent diagnoses causing hospitalizations in this age group are neoplasms, heart failure, ischemic cardiomyopathy, pneumonia, COPD, other respiratory diseases, femoral neck fracture, other alterations of the urethra and urinary tract, and cholelithiasis.

List Of Abbreviations

NSI: National Statistics Institute

MBDS: minimum basic data set

WHO: World Health Organization

ICD-9: International Classification of Diseases, 9th revision

AAPC: Annual Average Percentage Change

COPD: chronic obstructive pulmonary disease

AHRQ: Healthcare Research and Quality

DRG: Diagnosis-Related Groups

Declarations

This study was performed in accordance with the Declaration of Helsinki and all applicable Spanish laws.

Ethics approval and consent to participate

Its performance did not require approval from an ethics committee since it did not involve human participants, human material or human identifiable data.

Consent for publication

Not applicable.

Availability of data and materials

The data that support the findings of this study are available from the Spanish Ministry of Health, but restrictions on the availability of these data apply. In our study they were used under license and so are not publicly available.

JMRR has full access to and is the guarantor for the data. The datasets generated are available from the corresponding author on reasonable request and with permission of the Spanish Ministry of Health.

The summarized data that support the findings of this study are publicly available from [Spanish Ministry of Health: Hospital Discharge Records in the National Health System. CMBD: https://www.mscbs.gob.es/en/estadEstudios/estadisticas/cmbdhome.htm].

Competing interests

The authors declare that they have no competing interests.

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Author's contributions

SPF contributed to the conception and design of the work along with the acquisition, analysis, and interpretation of data.

MS contributed to the conception of the work and the analysis and interpretation of data, and has substantively revised the manuscript.

GGA. contributed to the conception and design of the work, plus the analysis and interpretation of data, and has substantively revised the manuscript.

JMRR. contributed to the conception and design of the work, along with the analysis and interpretation of data, and has substantively revised the manuscript.

All authors have approved the submitted version and have agreed both to be personally accountable for their own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

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Not applicable

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Figures

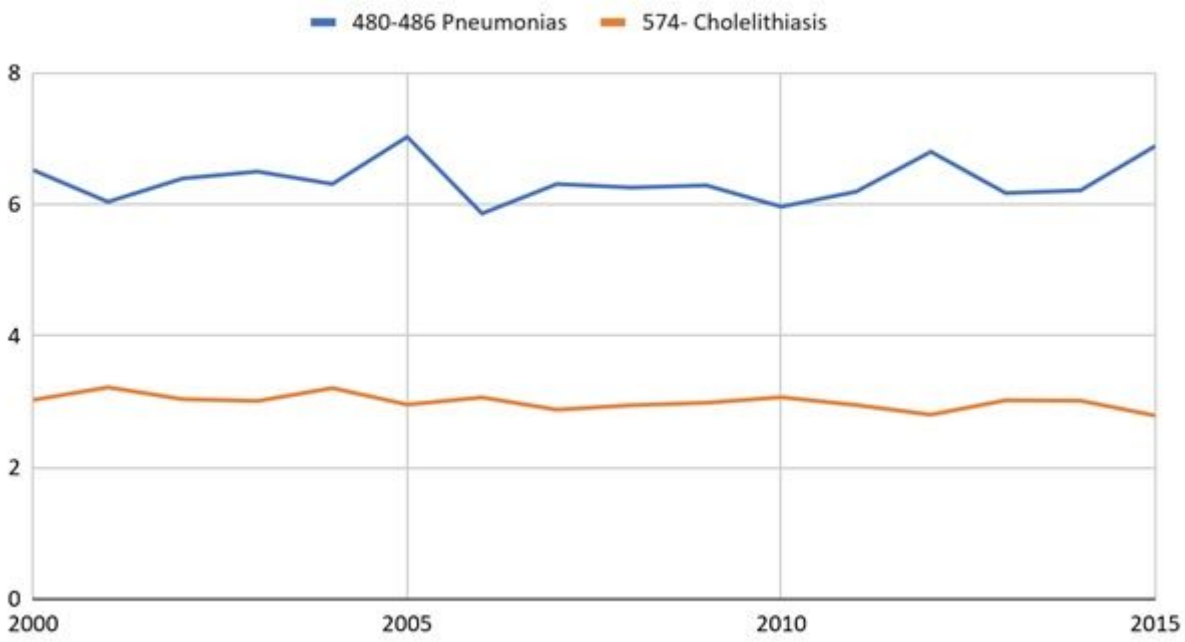

Figure 1

Time trend of pneumonias and choleithiasis (%)