Hospitalisation for COPD in Puglia: the role of hospital discharge database to estimate prevalence and incidence

P. Trerotoli[1], N. Bartolomeo[1], A.M. Moretti[2], G. Serio[1]

ABSTRACT: *Hospitalisation for COPD in Puglia: the role of hospital discharge database to estimate prevalence and incidence. P. Trerotoli, N. Bartolomeo, A.M. Moretti, G. Serio.*

Background and aim. Chronic Obstructive Pulmonary Disease (COPD), although largely preventable, is a great health burden in all the countries worldwide. Statistics of morbidity and mortality of COPD show the need for correct management of the disease. Chronic Obstructive Respiratory Diseases (DRG 88) are in 9th place for discharge in in-patient hospital admission. It is necessary to establish specific indicators which are efficacious and relevant for the patient, the doctor and the health manager. This study will analyse the information in respect of hospital admissions (Hospital discharge database) in Puglia for the period 2000-2005.

Methods. The analysis was carried out utilising the Puglia Region hospital patient discharge database, selecting those patients with admission for chronic respiratory disease as principal or secondary diagnosis.

Results. Chronic respiratory diseases are more frequent in males and in people over 45 years old with frequency increasing with age. Geographical distribution shows that there are greater rates of hospitalisation in big cities and in the neighbourhood of industrial areas. Although the trend over time is slight. A higher percentage of re-admission has been found for patients with COPD, and the interval between the two admissions occurs within one or two months; the diagnosis at the second admission is the same as for the first. 10.6% of discharge forms report one diagnosis, especially in patients older than 65 years of age. Little could be said about diagnostic procedures because these are not reported on the discharge form.

Conclusion. Hospitalisation data confirms expectations regarding age and sex of patients. The high hospitalisation rates indicate that in-patients care still remains the only viable treatment for COPD and other chronic respiratory diseases. The high number of exacerbations reflect the absence of out-patients service or community care, and the same diagnosis in more than one episode shows the lack of efficiency of health services and disease management. This data is necessary to understand disease distribution and the modification of disease management in order to reduce health care costs, to increase efficacy in disease control and to limit repeated exacerbation and so to obtain the maximum benefit for the patients.

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Introduction

Chronic Obstructive Pulmonary Disease (COPD), although largely preventable, is a great health burden in all countries worldwide. Looking into the future there is no indication that there will be a reduction in smoking or in atmospheric pollution. Statistics of morbidity and mortality of COPD show the need for correct management of the disease.

In the United States, from 1999 to 2004 COPD was the fourth cause of death, after cardiovascular disease, malignant tumours and cerebrovascular disease, accounting for approximately 5% of total deaths in both 2003 and 2004 [1]. In Italy in 2004, respiratory diseases were the third cause of death, after circulatory system diseases and tumours [2], with 50% of these attributable to COPD.

According to the forecasts of Murray and Lopez [3], there will be a large increase in worldwide COPD morbidity over the next years with it moving from 12th to 5th position in the scale of prevalence by 2020. It is now commonly held that the diagnosis of COPD is seriously underestimated with respect to the real occurrence of the disease, both because of medical discernment and a low level of awareness among patients. The rate of prevalence of recorded COPD in Italy is similar to that of other industrialised countries. From data supplied by ISTAT (Italian Statistical Institute) [4], chronic obstructive respiratory diseases are more common among males (4.8%) than among females (4.2%). Chronic bronchitis and emphysema are in 4th place for prevalence if we consider those older individuals: in the age range from 65-69 the prevalence is 11.8% for males and 8.6% for females, in

the range 70-74 it is 14.8% and 9.7% respectively, in the range 75-79 it is 22.4% and 12.1% respectively and for 80-year-olds and over it is 25.3% for males and 15.8% for females. The enormous health burden which is imposed by COPD can be found in the latest data available from 2003 [5]. This shows that DRG 88 (DRG: Diagnosis Related Group) i.e. Chronic Obstructive Respiratory Diseases, stands in 9th place in respect of those patients discharged after in-patient hospital admission with a total of 113,959 discharges (1,4% of total) and 997,724 bed-occupancy days for an average of 8.8 days.

The absence of symptoms in the early stages of COPD together with its slow progression and late appearance of disability can partly explain the absence of an active campaign of preventions but much could be done in terms of a diagnosis both nosologically sustainable and made earlier than usual, with the recognition of symptoms which are unfortunately often misinterpreted.

Today COPD as a cause of death is increasing, we can no longer put off a worldwide commitment to its early diagnosis.

It is necessary to establish specific indicators which are efficacious and relevant for the patient, the doctor and the health manager. Recent studies have confirmed that the most reliable indicator is the classification of the "acute exacerbation number": for the patient because the frequency of exacerbations greatly affects the quality of life; for the doctor because it greatly affects the type of treatment required with regard to hospitalisation and drug consumption; and for the manager because acute exacerbation greatly affects direct costs, drugs and hospitalisation, and also indirect costs [6-11].

The need to optimise resources and improve the quality of life of patients has led to an increase in home treatment even for situations which are complex and need technological applications and these include treatment for patients with chronic respiratory insufficiency, but as of now the lack of scientific evidence for its clinical and financial efficiency has not allowed its development especially in terms of costs and payments [12-15].

International evidence-based guidelines are necessary but are not sufficient for the correct management of this disease [16, 17].

It is a priority for the health service to tackle the problem of COPD [18], well identified by Italian National Health Service, that has considered specific action in the National Health Plan 2006-2008 [19] even though the outcome of proposed action is not yet known.

Knowledge of epidemiological data for COPD is essential for the definition of the best strategies to adopt and studies on prevalence must be included in these. Currently there are studies being carried out among general practitioners to evaluate patient compliance to treatment and for the gravity of COPD as defined by the GOLD (Global Initiative for Chronic Obstructive Lung Disease) guidelines. Other useful information can be gleaned from the databases for hospital admissions and deaths.

This study will analyse the information relative to hospital admission (Hospital discharge database) in the Italian Region of Puglia for the period 2000-2005. The information in this database is especially reliable because of the quality of its compilation and the fact that the information therein contained has already been used to modify various aspects of the regional health system including the hospital reorganisation plan, the definition and application of essential care levels and the evaluation of appropriateness of admission.

Methods

The analysis was carried out using the Puglia Region hospital patient discharge database, selecting those discharges for chronic respiratory disease in the period 2000-2005 as principal or secondary diagnosis with following ICD-9-CM codes:

491.0 - Simple chronic bronchitis;
491.1 - Mucopurulent chronic bronchitis;
491.20 - Obstructive chronic bronchitis without mention of acute exacerbation;
491.21 - Obstructive chronic bronchitis with acute exacerbation;
491.8 - Other chronic bronchitis;
491.9 - Unspecified chronic bronchitis;
492   - Emphysema;
493   - Asthma;
518.81 - Respiratory failure.

In 2000 diagnosis ICD-9 was still in use and COPD was indicated as 491.2 and not until 2001 was it separated into 491.20 without acute exacerbation, and 491.21 with acute exacerbation. For those patients classified as 491.2 we have assigned the code 491.20.

For the creation of the hospitalisation map we have used rates adjusted for sex and age ranges. The adjustment was carried out using a direct standardisation, with the reference population that of Puglia for the entire period under consideration. For the analysis of re-admission we accept re-admission only if it is under the same regime as the previous admission. χ-square and Cochran-Armitage test for trend have been performed to evaluate difference and trends in percentage.

Analyses have been performed using software SAS 9.1 for personal computer.

Results

The number of discharge records which matched the criteria were 350,176 for discharge as in-patient (IP) and 17,499 as day hospital patients (DH) (table 1). Frequency of admission for males as in-patient was 67.4% and as day-hospital 65.6% giving ratios M/F of 2.0 for IP and 1.9 for DH. From table 1 we can see that males are always in the majority, it becoming more evident as age increases (χ^2=3567, $p<0.0001$; test for trend: $p<0.0001$). Over 70% of admissions for chronic respiratory disease are for people over 45 years of age with 73.9% for DH and for 93.6% IP.

Limiting the analysis to patients with chronic respiratory disease as the principal diagnosis (table 2) IP

Table 1. - Distribution for in-patient and day hospital, sex and age range for admission with a diagnosis of chronic respiratory disease in any diagnosis field of the discharge record

Age Range	In-Patients					Day-hospital				
	Sex				Totals	Sex				Totals
	Female		Male			Female		Male		
	N°	%	N°	%		N°	%	N°	%	
< 1 year old	1075	0.9%	1834	0.8%	2909	28	0.5%	43	0.4%	71
1 - 4	1643	1.4%	2557	1.1%	4200	222	3.7%	317	2.8%	539
5 - 14	1160	1.0%	2009	0.9%	3169	466	7.8%	828	7.2%	1294
15 - 24	966	0.8%	1079	0.5%	2045	261	4.3%	375	3.3%	636
25 - 44	3861	3.4%	5915	2.5%	9776	974	16.2%	1042	9.1%	2016
45 - 64	16914	14.8%	42708	18.1%	59622	1869	31.1%	3652	31.8%	5521
65 - 74	29322	25.7%	77340	32.8%	106662	1254	20.9%	3080	26.8%	4334
> 75	59186	51.9%	102607	43.5%	161793	937	15.6%	2151	18.7%	3088
Totals	114127	100.0%	236049	100.0%	350176	6011	100.0%	11488	100.0%	17499

Table 2. - Distribution for in-patient and day hospital, sex and age range for admission with a diagnosis of chronic respiratory disease in the principal diagnosis field of the discharge record

Age Range	In-Patients					Day-hospital				
	Sex				Totals	Sex				Totals
	Female		Male			Female		Male		
	N°	%	N°	%		N°	%	N°	%	
< 1 year old	877	2.0%	1494	1.6%	2371	22	0.6%	32	0.6%	54
1 - 4	1289	2.9%	2028	2.2%	3317	191	5.4%	274	5.0%	465
5 - 14	837	1.9%	1470	1.6%	2307	413	11.7%	744	13.7%	1157
15 - 24	639	1.4%	680	0.8%	1319	235	6.6%	342	6.3%	577
25 - 44	2171	4.9%	2898	3.2%	5069	810	22.9%	775	14.3%	1585
45 - 64	7594	17.1%	16219	17.9%	23813	1074	30.3%	1626	29.9%	2700
65 - 74	11287	25.4%	29169	32.2%	40456	512	14.4%	1045	19.2%	1557
> 75	19792	44.5%	36590	40.4%	56382	287	8.1%	598	11.0%	885
Totals	44486	100.0%	90548	100.0%	135034	3544	100.0%	5436	100.0%	8980

were 135,034 and DH 8,980. The M/F ratios were 2.0 for IP, 67.1% male, and 1.5 for DH, males 60.5%. Also in table 2 we can see that patients over 45-year-old are more frequent, a trend rising with age (χ^2=1114, p<0.0001; test for trend: p<0.0001). In the case of DH we can see an increase in admission in the age range of 25-44 and 45-64, followed by a decrease in over 65's.

Figure 1 shows for the Puglia Region the geographic distribution of admission (IP + DH) with a principal diagnosis of chronic respiratory disease. The rates are between 11.4/1000 and 140.6/1000 inhabitants. The areas with the highest rates are Salento, the Pro-

11.4 - 27.1
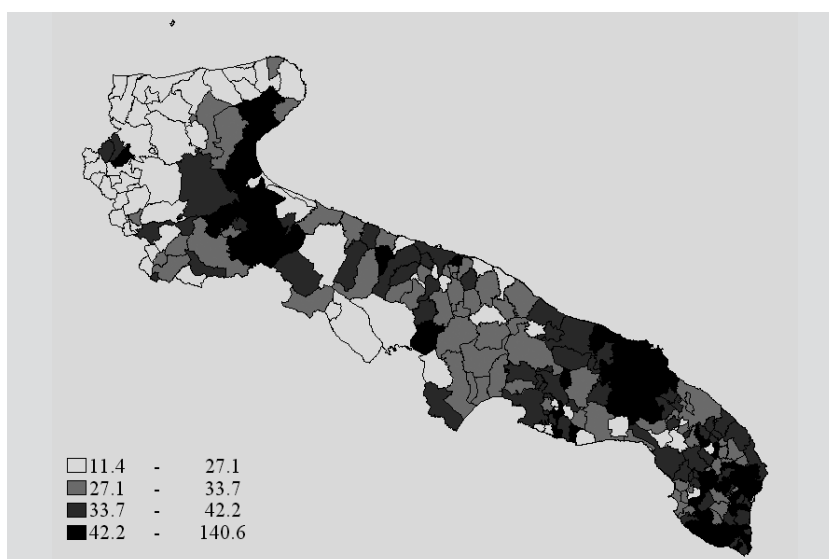27.1 - 33.7
33.7 - 42.2
42.2 - 140.6

Fig. 1. - Hospitalisation rate adjusted for gender and age range with principal diagnosis of chronic respiratory disease.

Table 3. - Distribution for sex and principal diagnosis of patients discharged in the period 2000-2005 both as in-patients and day-hospital

| Diagnosis | Sex | | | | Totals |
| | Female | | Male | | |
	N°	%	N°	%	
491.0 - Simple chronic bronchitis	745	2.2%	1050	1.9%	1795
491.1 - Mucopurulent chronic bronchitis	784	2.3%	1376	2.5%	2160
491.20 - Obstructive chronic bronchitis without mention of acute exacerbation	6099	17.7%	12518	22.7%	18617
491.21 - Obstructive chronic bronchitis with acute exacerbation	10458	30.3%	18053	32.7%	28511
491.8 - Other chronic bronchitis	469	1.4%	674	1.2%	1143
491.9 - Unspecified chronic bronchitis	831	2.4%	963	1.7%	1794
492 - Emphysema	105	0.3%	545	1.0%	650
493 - Asthma	7227	20.9%	7736	14.0%	14963
518.81 - Respiratory failure	7781	22.6%	12307	22.3%	20088
Totals	34499	100.0%	55222	100.0%	89721

vincial capital cities and surrounding areas as the southern part of Foggia, and the areas of high industrialisation as in the Provinces of Brindisi, Taranto and town near the gulf of Manfredonia.

Table 3 shows the frequency of the principal diagnoses found on the Discharge Records of the patients hospitalised with chronic respiratory disease. COPD with and without acute exacerbation (code ICD9-CM 491.20 e 491.21), respiratory failure (code ICD9-CM 518.81) and asthma (code ICD9-CM 493) are those most frequently found. The common cause of in-patient admission is acute exacerbation of COPD (31.8%; 28,544/89,721), followed by respiratory failure (22.4%; 20,088/89,721) and COPD without acute exacerbation (20,7%; 18,617/89,721). This third most common cause is also the second cause (29.4%; 2,442/8,308) for day-hospitalisation after asthma (41.8%; 3,473/8,308).

The age distribution shows that the principal diagnosis of COPD with or without acute exacerbation and/or respiratory failure are more frequent in the higher age groups (figure 2). In-patient admissions for COPD without acute exacerbation are 16,175 with 77.8% in the age groups 65-74 and over 75; day-hospital are 2,442 with only 49.9% in the same age groups. In-patients diagnosed with COPD with acute exacerbation were 27,345, principally in the older age groups with a rising trend as age increases: 17.1% for the age group 45-64, 29.5% in group 65-74 and 50.8% for the
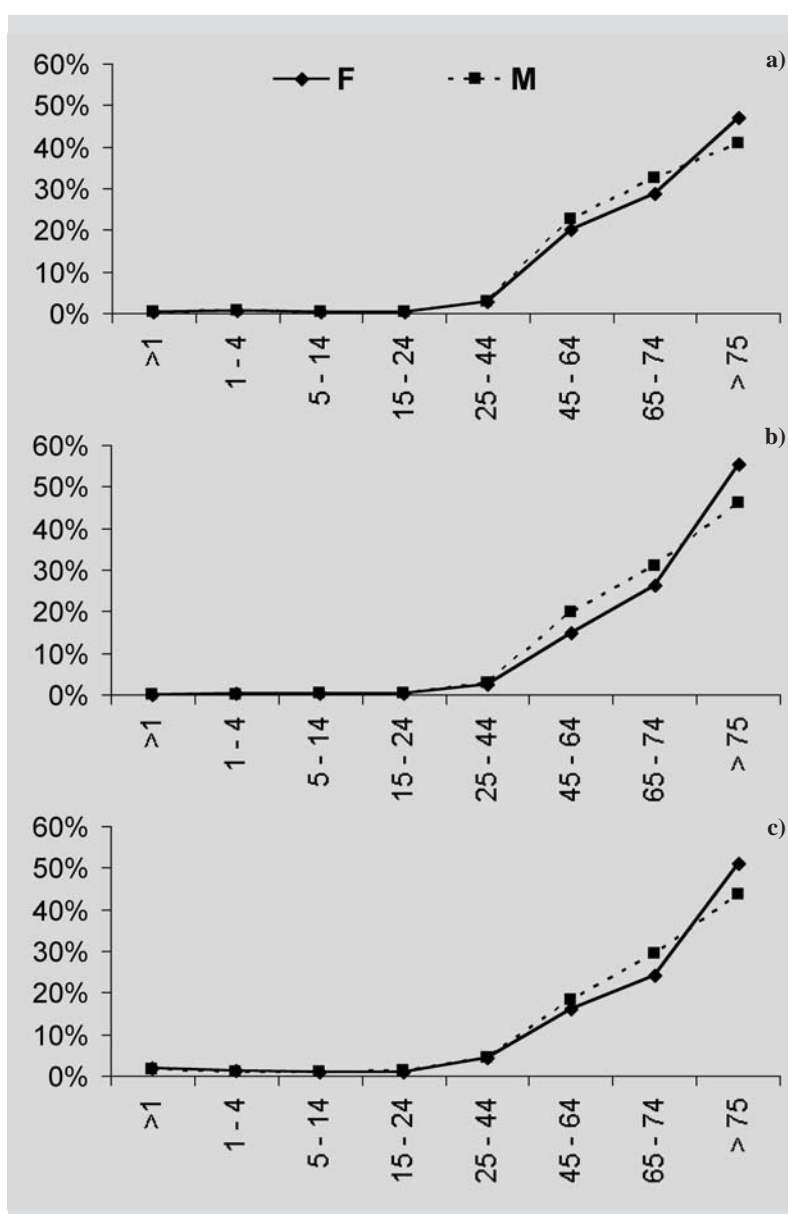

Fig. 2. - Distribution for sex and age range for in-patients and day-hospital with a principal diagnosis of COPD without acute exacerbation (fig. 2a), COPD with acute exacerbation (fig. 2b) and respiratory failure (fig. 2c).

over 75's. Of the 1,166 day-hospital there were 38.2% in the age group 45-64, 24.4% in group 65-74 and 17.7% for the over 75's.

In-patients diagnosed with respiratory failure were 19,892 with almost half of them over 75 years of age. More precisely there were 17.4% in the age group 45-64, 27.3% in group 65-74 and 46.5% over 75. Day-hospital with the same diagnosis were relatively evenly divided among the age groups with 26% in the group 45-64, 30.6% in group 65-74 and 28.1% over 75.

Admissions for chronic respiratory disease showed that asthma is more frequent in a young age for both in-patients and day-hospital (IP: age group 1-4 23.1%, group 5-14 15.8%, group 15-24 7.1%, group 25-44 15.8%; DH: age group 1-4 10.2%, group 5-14 27.2%, group 15-24 13,2%, group 25-44 29.2%).

There is a substantial difference between the sexes in the age distribution for admissions. For males admission frequency already begins to rise from the age group 45-64 while for females there is a peak only in the over 75's with a higher increase than that for males. This difference in age distribution is evident in all three principal diagnoses examined ($\chi^2=455$; $p<0.0001$; test for trend: $p<0.0001$).

The total number of admissions, both in-patient and out-patient, for COPD with and without acute exacerbation increased from 15,913 in 2000 to 22.530 in 2005 with the largest yearly increase (19%) between 2000 and 2001 to 18.969 and a 10% increase from 2004 to 2005 (from 20,379 a 22,530) (figure 3). From 2001 with the new codes 491.20 without acute exacerbation, and 491.21 with acute exacerbation, it can be seen that the diagnosis with acute exacerbation is responsible for the majority of admissions. It can also be seen that admissions for COPD without acute exacerbation reduced between 2001 and 2002, becoming stable in the following years. Conversely admissions for COPD with acute exacerbation shows a small but constant rise from 2001 to 2005. More evident is the increasing trend for admission, for both IP and DH, with the diagnosis of respiratory failure.

The standardised rate shows, both in the case of COPD with and without acute exacerbation and of respiratory failure, a more evident rise for men than for women in hospitalisation (figure 4). In particular, the hospitalisation rate for
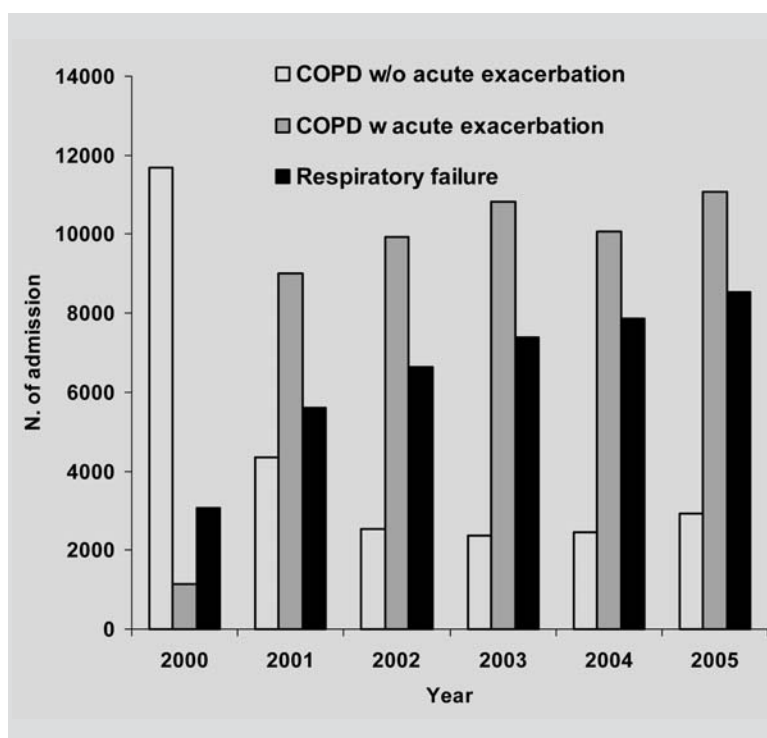

Fig. 3. - Distribution for admission year with diagnosis of COPD without acute exacerbation (491.20), COPD with acute exacerbation (491.21) and respiratory failure (518.81).
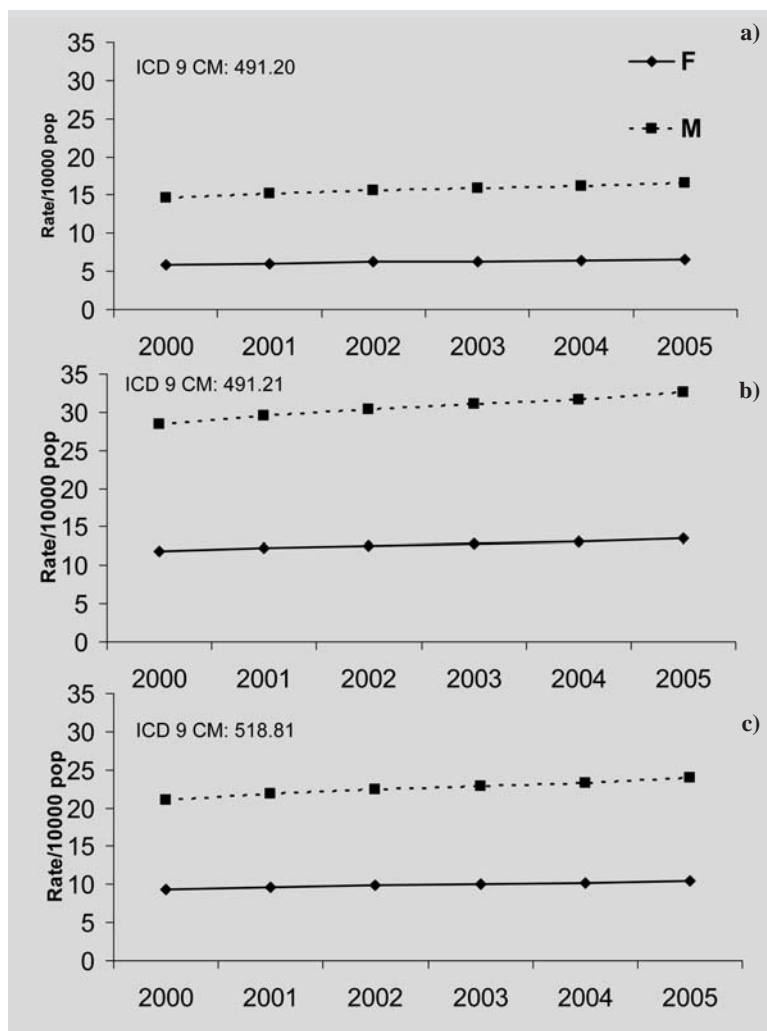

Fig. 4. - Standardised hospitalisation rate over time for COPD without acute exacerbation (fig. 4a), COPD with acute exacerbation (fig. 4b) and respiratory failure (fig. 4c).

COPD without acute exacerbation increases from 14.6/10,000 in 2000 to 16.6/10,000 in 2005 in males, while for females the increase is from 5.9/10,000 to 6.6/10,000 for the same period (figure 4a).

The rate is higher for COPD with acute exacerbation for both males and females in the same period. For males the rate progressively changes from 28.4 to 32.6 per 10,000 while for females it goes from 11.9 to 13.5 per 10,000 (figure 4b).

Hospitalisation for respiratory failure also shows a rising trend both in males and females with a larger rise for males. From 2000 to 2005 there is an increase from 21.1 per 10,000 to 23.9/10,000 while for females the rate increases less from 9.4 to 10.5 per 10,000 (figure 4c). The rise in respiratory failure is less than that of COPD with acute exacerbation.

Most of the discharged patients had only one hospital admission (table 4) but chronic respiratory problems caused more than one admission for many patients with a multiple admission rate varying from 13.1% to 32.8% in the period 2000-2005. For in-patients with respiratory failure, 13.6% have two hospital admissions, 5.5% have three, 2.8% have four and 5.0% have five or more with a total of 26.9% of patients with re-admissions. For in-patients with COPD with acute exacerbation the two-admission rate is slightly higher (15.2%) while for those without acute exacerbation the rate is at 14.1%. Comparing COPD with and without acute exacerbation the rates are for three admissions 5.5% compared to 6.1% while for those patients with 5 admissions or more the rate is 4.0% instead of 9.0% (test for trend: $p < 0.0001$). The

Table 4. - Frequency of the episodes of repeated admission in 2000-2005 in relation to the principal diagnosis at first admission. The upper table refers to in-patients; the lower table refers to day-hospital. The percentages are referred to the number of patients in each diagnosis

Diagnosis - Inpatients	Total N° DR	N° Patients (*)	Patients with 1 admission		Patients with 2 admissions		Patients with 3 admissions		Patients with 4 admissions		Patients with 5 admissions	
			n°	%	n°	%	n°	%	n°	%	n°	%
491.0 - Simple chronic bronchitis	1821	1234	987	80.0%	136	11.0%	52	4.2%	24	1.9%	35	2.8%
491.1 - Mucopurulent chronic bronchitis	3638	2076	1556	75.0%	251	12.1%	86	4.1%	52	2.5%	131	6.3%
491.20 - Obstructive chronic bronchitis without mention of acute exacerbation	33237	16175	10864	67.2%	2284	14.1%	989	6.1%	577	3.6%	1461	9.0%
491.21 - Obstructive chronic bronchitis with acute exacerbation	43703	27345	19925	72.9%	4149	15.2%	1507	5.5%	672	2.5%	1092	4.0%
491.8 - Other chronic bronchitis	1835	958	654	68.3%	131	13.7%	52	5.4%	44	4.6%	77	8.0%
491.9 - Unspecified chronic bronchitis	2310	1684	1376	81.7%	183	10.9%	60	3.6%	27	1.6%	38	2.3%
492 - Emphysema	1028	559	400	71.6%	75	13.4%	27	4.8%	23	4.1%	34	6.1%
493 - Asthma	14228	11490	9984	86.9%	991	8.6%	271	2.4%	103	0.9%	141	1.2%
518.81 - Respiratory failure	33234	19892	14527	73.0%	2715	13.6%	1101	5.5%	553	2.8%	996	5.0%
Totals	135034	81413	60273	74.0%	10915	13.4%	4145	5.1%	2075	2.5%	4005	4.9%

Diagnosis - Day-Hospital	Total N° DR	N° Patients (*)	Patients with 1 admission		Patients with 2 admissions		Patients with 3 admissions		Patients with 4 admissions		Patients with 5 admissions	
			n°	%	n°	%	n°	%	n°	%	n°	%
491.0 - Simple chronic bronchitis	589	561	536	95.5%	22	3.9%	3	0.5%	-	-	-	-
491.1 - Mucopurulent chronic bronchitis	90	84	78	92.9%	6	7.1%	-	-	-	-	-	-
491.20 - Obstructive chronic bronchitis without mention of acute exacerbation	2673	2442	2252	92.2%	160	6.6%	22	0.9%	6	0.2%	2	0.1%
491.21 - Obstructive chronic bronchitis with acute exacerbation	1307	1166	1060	90.9%	80	6.9%	22	1.9%	3	0.3%	1	0.1%
491.8 - Other chronic bronchitis	202	185	171	92.4%	12	6.5%	1	0.5%	1	0.5%	-	-
491.9 - Unspecified chronic bronchitis	120	110	101	91.8%	8	7.3%	1	0.9%	-	-	-	-
492 - Emphysema	102	91	80	87.9%	11	12.1%	-	-	-	-	-	-
493 - Asthma	3679	3473	3297	94.9%	152	4.4%	20	0.6%	3	0.1%	1	0.0%
518.81 - Respiratory failure	218	196	179	91.3%	12	6.1%	5	2.6%	-	-	-	-
Totals	8980	8308	7754	93.3%	463	5.6%	74	0.9%	13	0.2%	4	0.0%

E.g. First line 80.0% = (987/1234)*100; 11.0% = (136/1234)*100.
(*) The patients have been classified in reference to the diagnosis at first admission.

multiple admission rate for patients with COPD with acute exacerbation is 27.2% and for COPD without acute exacerbation it is 32.8%.

A deeper analysis shows that in most cases the diagnosis in admission and in readmission is the same (figure 5). A principal diagnosis of COPD without acute exacerbation at first admission is repeated in 56% of cases of re-admission and in more than half of these (25.3% of total re-admission cases) the readmission is in the period from 2 to 6 months. Readmission with a diagnosis of COPD with acute exacerbation is 23.3% (figure 5a) with 10.6% in the period from 7 to 12 months. Only in 10.7% of patients with a diagnosis of COPD without complications was there a diagnosis of respiratory failure in the second admission with 3.1% of second admission within a month.

A principal diagnosis of COPD with acute exacerbation at first admission is repeated in 66.3% of cases of re-admission (figure 5b). In particular in 27.1% of total cases the re-admission is in the period from 2 to 6 months and 22.8% in the 7-12 month period. Instead 16.6% of patients are readmitted with a diagnosis of respiratory failure with 7.2% of cases within 2-6 months.

For those patients with a first admission with a diagnosis of respiratory failure in 73.1% of the cases the same diagnosis was made at the second admission with 31.3% of cases re-admitted within the first month. 17% of cases had a diagnosis at re-admission of COPD with acute exacerbation.

The quantity and types of secondary diagnoses presented on the discharge records help define the complexity of patients with obstructive bronchopneumopathy. Only 10.6% of the in-patient records show only a principal diagnosis (table 5) while 23% show one secondary diagnosis and 28% show two of them. It must be highlighted that some principal diagnoses are more easily associated with a larger number of secondary diagnoses: respiratory failure and non-specific chronic bronchitis, for example, are frequently linked to three secondary diagnoses 30.6% and 34.5% respectively. Of the records with a principal diagnosis of COPD with and without acute exacerbation respectively 29.8% and 29.6% show a secondary diagnosis.

Day-hospital records with only the principal diagnosis are the most common, there being 48.7% of them, and 31.4% show only one secondary diagnosis. However a principal diagnosis of respiratory failure, even in day-hospital, has 32.1% of records with three more diagnoses.

Examining in more detail COPD with and without acute exacerbation it can be seen that in the over 65's there is a higher percentage of records with three or more secondary diagnoses. Figure 6a shows this markedly for females with a diagnosis of COPD without acute exacerbation. In the cases of admission for COPD with acute exacerbation the majority of records have no or only one secondary diagnosis (figure 6b).

Tables 6 and 7 show the comorbidities more frequently associated with chronic respiratory disease. COPD with and without acute exacerbation is most frequently associated with the principal diagnosis of respiratory failure (18.8%) but also with other chronic pulmonary diseases. In a small number of cases, the same diagnosis is indicated as principal and secondary diagnosis (1.7% COPD without acute exacerbation and 2.6% COPD with acute exacerbation). This is certainly an error in the compilation of the record. Car-
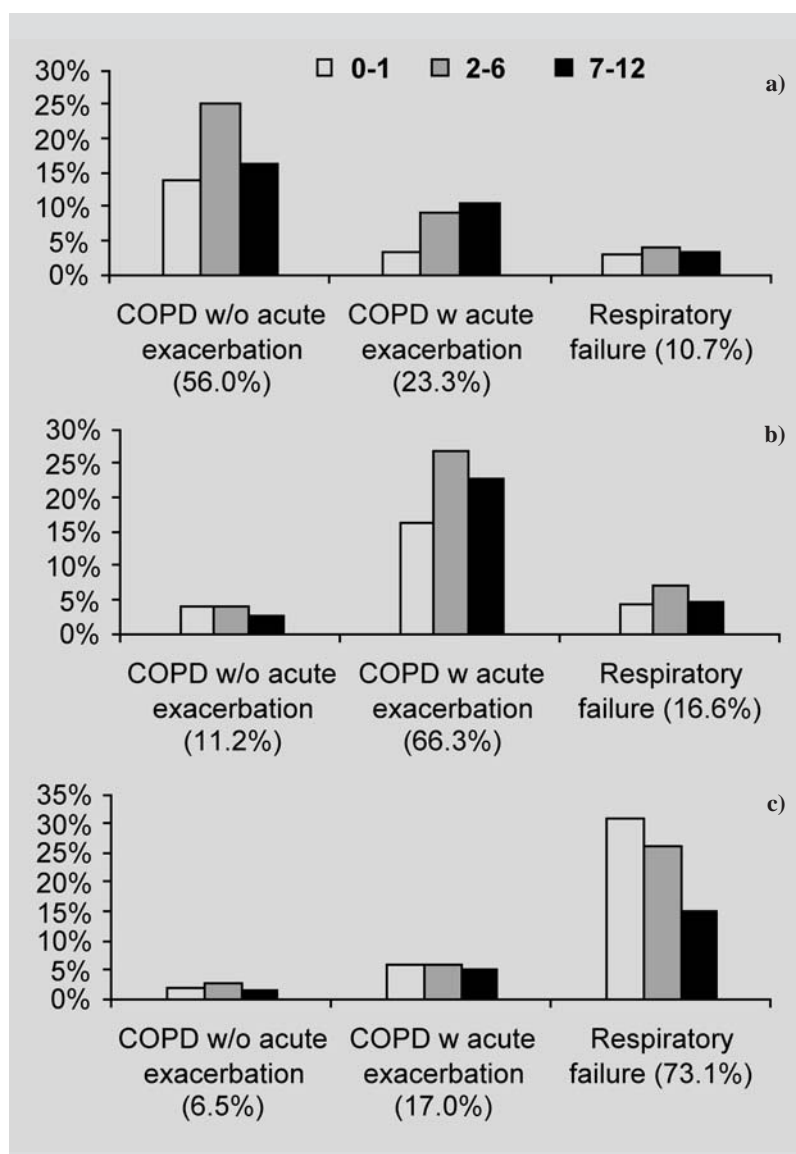

Fig. 5. - Distribution of repeated admissions for the principal diagnosis of the second admission and the months between the two successive events for the admissions on the first occasion with principal diagnosis of a) COPD without acute exacerbation; b) COPD with acute exacerbation; c) respiratory failure.

Table 5. - Distribution of the discharge records for principal diagnosis and number of secondary diagnoses reported on discharge record. Puglia 2000-2005

| Principal diagnosis In-patients | Number of secondary diagnoses | | | | | | | | | | Total |
| | 0 | | 1 | | 2 | | 3 | | 4 or more | | |
	n	%	n	%	n	%	n	%	n	%	
491.0 - Simple chronic bronchitis	221	12.1%	473	26.0%	512	28.1%	395	21.7%	220	12.1%	1821
491.1 - Mucopurulent chronic bronchitis	386	10.6%	957	26.3%	1194	32.8%	780	21.4%	321	8.8%	3638
491.20 - Obstructive chronic bronchitis without mention of acute exacerbation	3429	10.3%	8336	25.1%	9842	29.6%	8173	24.6%	3457	10.4%	33237
491.21 - Obstructive chronic bronchitis with acute exacerbation	4044	9.3%	10165	23.3%	13003	29.8%	10182	23.3%	6309	14.4%	43703
491.8 - Other chronic bronchitis	172	9.4%	483	26.3%	533	29.0%	431	23.5%	216	11.8%	1835
491.9 - Unspecified chronic bronchitis	141	6.1%	442	19.1%	553	23.9%	797	34.5%	377	16.3%	2310
492 - Emphysema	122	11.9%	274	26.7%	311	30.3%	206	20.0%	115	11.2%	1028
493 - Asthma	5000	35.1%	4921	34.6%	2429	17.1%	1238	8.7%	640	4.5%	14228
518.81 - Respiratory failure	815	2.5%	5040	15.2%	9424	28.4%	10183	30.6%	7772	23.4%	33234
Totals	14330	10.6%	31091	23.0%	37801	28.0%	32385	24.0%	19427	14.4%	135034

| Principal diagnosis Day-hospital | 0 | | 1 | | 2 | | 3 | | 4 or more | | Total |
	n	%	n	%	n	%	n	%	n	%	
491.0 - Simple chronic bronchitis	244	41.4%	208	35.3%	100	17.0%	27	4.6%	10	1.7%	589
491.1 - Mucopurulent chronic bronchitis	30	33.3%	25	27.8%	22	24.4%	13	14.4%	0	0.0%	90
491.20 - Obstructive chronic bronchitis without mention of acute exacerbation	1355	50.7%	717	26.8%	321	12.0%	211	7.9%	69	2.6%	2673
491.21 - Obstructive chronic bronchitis with acute exacerbation	475	36.3%	511	39.1%	190	14.5%	83	6.4%	48	3.7%	1307
491.8 - Other chronic bronchitis	115	56.9%	50	24.8%	29	14.4%	7	3.5%	1	0.5%	202
491.9 - Unspecified chronic bronchitis	46	38.3%	32	26.7%	21	17.5%	18	15.0%	3	2.5%	120
492 - Emphysema	43	42.2%	32	31.4%	17	16.7%	9	8.8%	1	1.0%	102
493 - Asthma	2034	55.3%	1185	32.2%	351	9.5%	91	2.5%	18	0.5%	3679
518.81 - Respiratory failure	27	12.4%	57	26.1%	70	32.1%	46	21.1%	18	8.3%	218
Totals	4369	48.7%	2817	31.4%	1121	12.5%	505	5.6%	168	1.9%	898

diological diagnoses are often associated with chronic respiratory diseases, and hypertensive cardiopathy is indicated in 7.4% of the cases of COPD without acute exacerbation and 9.7% of COPD with acute exacerbation. For arterial hypertension the relative figures are 9.3% and 7.6%. The first 14 secondary diagnoses explain over 50% of the comorbities indicated in the records. In day-hospital hypertensive cardiopathy is most frequently associated with the diagnosis of COPD with and without acute exacerbation.

Spirometry and arterial blood gas analysis (ABG) (table 8) are the procedures most frequently shown on the discharge records of those patients affected by obstructive pulmonary diseases. For in-patients 3.2% and 7.7% respectively and for day-hospital 18.3% and 12.0% respectively.

For in-patients the principal diagnoses more frequently associated with hemogasanalysis were COPD without acute exacerbation, mucopurulent chronic bronchitis and emphysema. Spirometry is indicated in only 6.6% of the discharge records for COPD without acute exacerbation and in 7.0% of those for simple chronic bronchitis.

These two procedures are more common in day-hospital. Those with respiratory failure as a principal diagnosis had ABG in 29.3% of cases and for COPD with acute exacerbation the procedure was carried out in 21.4% of cases. Spirometry was more often associated with emphysema, 22.0% and asthma, 22.7%. For cases of COPD it was carried out in 15.3% of cases of the acute form and 16.8% of cases of COPD without acute exacerbation.

Discussion

COPD is one of the most widespread diseases in the world and it has the highest direct costs to the health system. For chronic diseases it is also the disease more frequently associated, in the case of hospitalisation, with a high comorbidity and
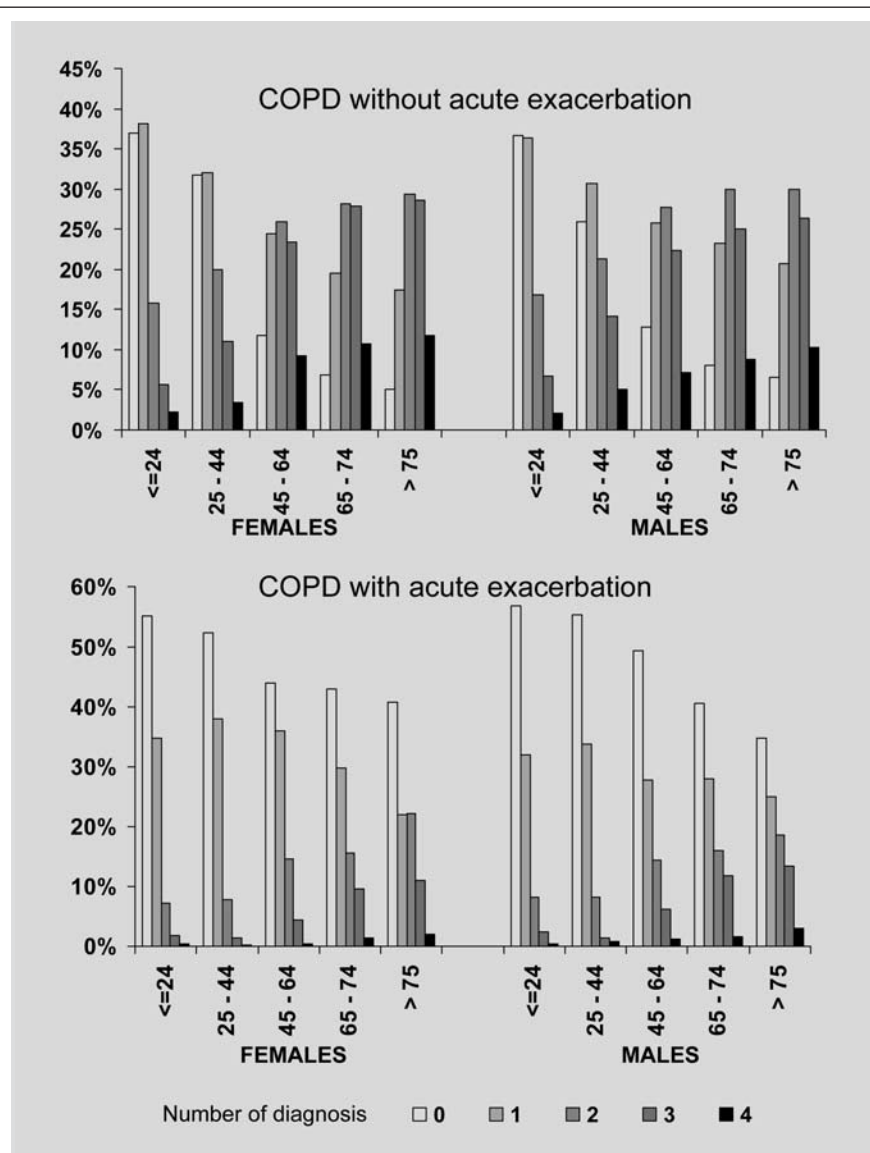
Fig. 6. - Distribution of admissions with a diagnosis of chronic respiratory disease in principal diagnosis in relation to the number of secondary diagnoses reported on the discharge record and age range.

of chronic diseases without recourse to hospitalisation. Although it is possible that a result has been obtained in the reduction of admissions in the age group 45-65, without however producing a useful effect on the older age groups.

In the American health system it was believed possible to obtain a reduction in hospitalisation for chronic respiratory diseases, including COPD, thanks to changes in health policies such as the introduction of DRG for financing and pressure on the system to reduce hospital use. These actions however produced only a more efficient use of the hospitals, they were not able, in the case of chronic respiratory disorders, to reduce the number of hospitalisations that have actually increased from 1995, with a relative increase in mortality [20].

The problem of managing chronic disorders in old age does not benefit from policies alone aimed at improving efficiency, but must be addressed in a more complex way, with more integration between the resources available for the hospital and those available for care in the community [18]. Specific studies could allow the identification of avoidable hospital admissions which are now necessary owing to the lack of other viable care.

Also in Italy, health policies geared towards efficiency have produced a reduction in hospital admissions but they have not fostered a reduction in admissions for COPD and respiratory failure as demonstrated not only by the information here present but also by the statistics of the Italian Ministry of Health on hospital admissions. In fact there is a progressive increase in nationwide admissions for COPD with acute exacerbation (from 102,297 del 2000 to 188,562 in 2004) and respiratory failure (from 49,314 in 2000 to 187,660 in 2004) [21]. Even if this large increase shown here and in the national data could be due to an improvement in the description of the cases caused by the codes ICD9-CM, which allow the distinction between COPD with (code 491.20). and without (code 491.21) acute exacerbation. A confirmation of this hypothesis is in the downward trend of nationwide admissions for COPD without acute exacerbation from 248,539 cases in 1999 to 162,170 in 2000 and 53,034 in 2004.

mortality. Its high comorbidity makes it difficult to evaluate the costs of COPD care [18].

The data obtained from this analysis allows us to hypothesise that Chronic Obstructive Pulmonary Disease has a high incidence in so far as it was found in more than 81,000 subjects in the period 2000-2005 (table 3), who represent only a part of the cases of COPD in the Puglian Territory to whom must be added those who are not treated in hospital. This hypothesis is supported by the fact that in-patients are older than those treated as day-hospital and by the fact that the disease can arise in a young age and require hospital treatment. It is however its clinical complexity and the presence of comorbidity in the older patients which principally determines the high cost of the management of the disease.

The hospitalisation rate for over 65's with COPD is particularly high. There could be many reasons for this, on the one hand there is the normal increase in care costs for older people with chronic diseases, but on the other hand there is the lack of complete programmes for the management

Table 6. - Distribution of secondary diagnoses in relation to the principal diagnosis reported on the discharge records. In-patients

Diagnosis	491.20 - Obstructive chronic bronchitis without mention f acute exacerbation		491.21 - Obstructive chronic bronchitis with acute exacerbation		518.81 - Respiratory failure		Totals	
	N°	%	N°	%	N°	%	N°	%
491 - Chronic bronchitis	3385	5.0%	3384	3.6%	16651	18.8%	24648	8.5%
402 - Hypertensive heart disease	5013	7.4%	9148	9.7%	4689	5.3%	20733	7.2%
401 - Essential hypertension	6324	9.3%	7170	7.6%	3635	4.1%	19930	6.9%
250 - Diabetes mellitus	5244	7.7%	7027	7.5%	5214	5.9%	19632	6.8%
414 - Ischemic heart disease	4628	6.8%	6303	6.7%	4298	4.9%	16966	5.9%
427 - Cardiac dysrhytmias	2568	3.8%	4271	4.5%	3584	4.1%	11388	3.9%
278 - Obesity and other hyperalimentation	1524	2.3%	1980	2.1%	2436	2.8%	7006	2.4%
416 - Chronic pulmonary heart disease	1754	2.6%	1607	1.7%	2986	3.4%	6720	2.3%
571 - Chronic liver disease and cirrhosis	1867	2.8%	2760	2.9%	938	1.1%	6503	2.3%
518 - Other diseases of lung	1617	2.4%	2825	3.0%	1167	1.3%	6346	2.2%
429 - Ill-defined descriptions and complications of heart disease	1988	2.9%	2092	2.2%	1506	1.7%	6297	2.2%
428 - Heart failure	835	1.2%	1251	1.3%	2305	2.6%	4686	1.6%
780 - general symptoms (syncope)	590	0.9%	705	0.7%	2662	3.0%	4250	1.5%
585 - Chronic renal failure	827	1.2%	1706	1.8%	1159	1.3%	4021	1.4%
Others	29539	43.6%	41982	44.6%	35243	39.8%	129686	44.9%
Totals	67703	100.0%	94211	100.0%	88473	100.0%	288812	100.0%

Table 7. - Distribution of secondary diagnoses in relation to the principal diagnosis reported on the discharge records. Day-hospital

Diagnosis	491.20 - Obstructive chronic bronchitis without mention f acute exacerbation		491.21 - Obstructive chronic bronchitis with acute exacerbation		518.81 - Respiratory failure		Totals	
	N°	%	N°	%	N°	%	N°	%
491 - Chronic bronchitis	142	6.1%	161	11.9%	18	4.4%	321	7.9%
402 - Hypertensive heart disease	201	8.7%	66	4.9%	22	5.4%	289	7.1%
401 - Essential hypertension	152	6.6%	95	7.0%	3	0.7%	250	6.1%
250 - Diabetes mellitus	110	4.8%	83	6.1%	24	5.9%	217	5.3%
414 - Ischemic heart disease	119	5.1%	57	4.2%	23	5.6%	199	4.9%
427 - Cardiac dysrhytmias	5	0.2%	185	13.7%		0.0%	190	4.7%
278 - Obesity and other hyperalimentation	139	6.0%	26	1.9%	7	1.7%	172	4.2%
416 - Chronic pulmonary heart disease	16	0.7%	2	0.1%	115	28.2%	133	3.3%
571 - Chronic liver disease and cirrhosis	58	2.5%	25	1.8%	28	6.9%	111	2.7%
518 - Other diseases of lung	84	3.6%	24	1.8%	1	0.2%	109	2.7%
429 - Ill-defined descriptions and complications of heart disease	52	2.3%	21	1.6%	5	1.2%	78	1.9%
428 - Heart failure	48	2.1%	12	0.9%	11	2.7%	71	1.7%
780 - general symptoms (syncope)	21	0.9%	46	3.4%	2	0.5%	69	1.7%
585 - Chronic renal failure	42	1.8%	25	1.8%	1	0.2%	68	1.7%
Others	1122	48.6%	525	38.8%	148	36.3%	1795	44.1%
Totals	2311	100.0%	1353	100.0%	408	100.0%	4072	100.0%

Table 8. - Diagnostic procedure reported on the discharge database with a principal diagnosis of Chronic Obstructive Pulmonary Disease or respiratory failure

Diagnosis	In-patients					Day-hospital				
	Total N° discharge records	Spirometry		ABG		Total N° discharge records	Spirometry		ABG	
		n°	%	n°	%		n°	%	n°	%
491.0 - Simple chronic bronchitis	1505	106	7.0%	129	8.6%	591	81	13.7%	70	11.8%
491.1 - Mucopurulent chronic bronchitis	2698	164	6.1%	464	17.2%	89	9	10.1%	14	15.7%
491.20 - Obstructive chronic bronchitis without mention of acute exacerbation	23723	1555	6.6%	3257	13.7%	2626	440	16.8%	378	14.4%
491.21 - Obstructive chronic bronchitis with acute exacerbation	50409	1037	2.1%	2618	5.2%	1362	209	15.3%	291	21.4%
491.8 - Other chronic bronchitis	1187	55	4.6%	129	10.9%	190	18	9.5%	12	6.3%
491.9 - Uspecified chronic bronchitis	2121	24	1.1%	59	2.8%	113	2	1.8%	3	2.7%
492 - Emphysema	955	44	4.6%	149	15.6%	109	24	22.0%	24	22.0%
493 - Asthma	13888	774	5.6%	500	3.6%	3671	832	22.7%	221	6.0%
518.81 - Respiratory failure	38548	573	1.5%	3040	7.9%	229	29	12.7%	67	29.3%
Total	135034	4332	3.2%	10345	7.7%	8980	1644	18.3%	1080	12.0%

However the upward trend in the hospitalisation rate for COPD with and without acute exacerbation is increasing over time. The modifications in hospital management such as payment for performance and the encouragement of out-patient treatment have led to more efficiency, obtained as a result of increasing performance without increasing resources and through, in the case of in-patients, reducing the number of bed occupancy days, with the risk of causing a readmission, above all in cases of chronic illnesses.

This could lead to an increase in admissions for some cases which would explain the increase in the hospitalisation rate, even if we cannot completely exclude that the increase could be linked to a increase in the incidence of the disease in the territory.

The use of management and health databases, with particular reference to the discharge database, is a limitation both due to the necessity for a correct definition of a case and because of observational bias. According to Mannino [18, 20] the choice of the codes to define a case can lead to very different conclusions on the incidence and prevalence for age and sex. In fact to include diagnoses of emphysema and chronic bronchitis in the analysis of chronic respiratory diseases can lead to a high prevalence among young people with respect to older people. He also affirms that the use of spirometry for screening could improve the quality of determining incidence and prevalence. The appropriate diagnosis should be based on an objective reduction of FEV_1, but often the discharge record does not hold the details to should show that the diagnostic procedure has been carried out, meaning that any estimate of COPD would be unreliable if based of diagnostic procedures. We could perhaps think that the diagnosis

was based only on the clinical aspects without the use of instrument based diagnostic procedures. In any case the discharge database does not permit the recording of the outcome of the spirometry. The possibility of ascertaining the gravity of the disease would allow a more precise care/cost estimate insomuch as the more serious cases, which use more resources, could be better evaluated. Administrative databases are inadequate in evaluating the distribution of the gravity of the disease so the socio-economic cost of a disease could be under or over estimated.

As with many other hospital statistics the number of admissions for males is higher than that of females. This data is different to that seen in other countries (e.g. USA). Through the use of questionnaires to determine the prevalence of COPD among the public based on their replies, from 1987 the questionnaires have shown that the rate of incidence of the disease is higher among females than among males, and that in the period 1980-96 the rate has not varied in males but that there is an upward trend for females. The NHANES studies, based on spirometry examinations, have shown that the prevalence rate among women has progressively grown and that increasing age increases the rate for both males and females [20].

One of the causes for this increase in females could be explained by an increased exposure to risk factors, for example smoking has increased among women, though it has not yet reached the level seen in men. Although smoking is a major risk factor, it is still difficult to determine what weight to give to the reduction in smoking in general and what to give to the occupational and environmental factors that seem to play a negative role especially in countries of low and medium socio-economic status. Currently there is evidence to

show that the improvement of these conditions has reduced the frequency of acute respiratory infections that can act as predisposing factors for the development of chronic respiratory diseases [18].

The geographic distribution, different between rural areas, high population density cities with industry and towns distant from industrial areas, can be correlated to aetiopathogenetic causes, insofar as they suggest the responsibility of environmental factors in influencing the frequency of the disease and consequently a greater need for hospitalisation. The higher rate of hospitalisation in cities and their surrounding areas could be explained either by the easier access to hospitals and to more specialised care, or by the role played by the environmental pollutants in the onset and development of the disease. Those pollutants studied most are the combustion oxides and particulate matter that have a role not only outdoor but also indoor due to contamination from outside and production at home and at work [22-28].

The repeated admissions are an important factor in the costs of the National Health Service and a more detailed analysis could bring out ideas to better manage the costs [29]. From a superficial analysis of the tables herein it could be concluded that the diagnosis of COPD without acute exacerbation leads to re-admission in that 40% of the patients have at least two admissions (in-patients and day hospital together). The analysis of re-admission reveals that, at least in the period under examination, the reason for the re-admission is generally the same as the previous admission (i.e. same diagnosis) and so there is no worsening of the condition that could justify the re-admission. In these cases it is important to investigate how it would be possible to avoid such re-admissions, or one must presume that still today 10 years after the introduction of the discharge database and the diagnosis codes, there is an inappropriate use of the ICD9-CM codes.

An aspect worthy of comment is the elevated percentage of re-admission for patients affected by respiratory failure at first admission. This is what shows that the most advanced phase of the disease takes the most resources. It should be considered that the frequency of repeated admissions could be controlled by improving the patient compliance to treatment, experimenting with alternatives to in-patient treatment and reinforcing out-patient services.

An assessment of the periodicity of the acute exacerbations could perhaps show an association between admissions with a principal diagnosis of respiratory failure or COPD with acute exacerbation any previous admissions with other acute diseases of the respiratory system (influenza, bronchitis, pneumonia, etc.) [30-32].

The acute exacerbations greatly impact the quality of life of the patient and the evolution of the disease. They also create the need for frequent care [33].

They can appear in many different forms and seriousness from slight and fleeting worsening of symptoms, managed directly by an aware patient, to very serious conditions which require hospitalisation in intensive care [34]. The reasons for admission are numerous and must be evaluated individually for each case [35].

Kinnunen has shown that the rate hospitalisation in advanced age is rather high and that the more serious cases, followed by death within the year, show frequent periods in hospital in the last months of life [36]. The advanced age of the patient, as seen in this study and numerous others, helps explain the high frequency of acute exacerbations and repeated need for hospital care; the comorbidities shown in the Puglia discharge records allow us to define the patient's compromising clinical picture, the seriousness of the prognosis and the need for a higher costly level of care for patients in advanced age.

The decision of whether to admit a patient with COPD with acute exacerbation can significantly influence both the prognosis and the quality of life of the patient. It is however extremely difficult to define guidelines for what to do as the decision is strongly influenced not only by the clinical condition of the patient but also by the financial resources of both the family and the hospital [37].
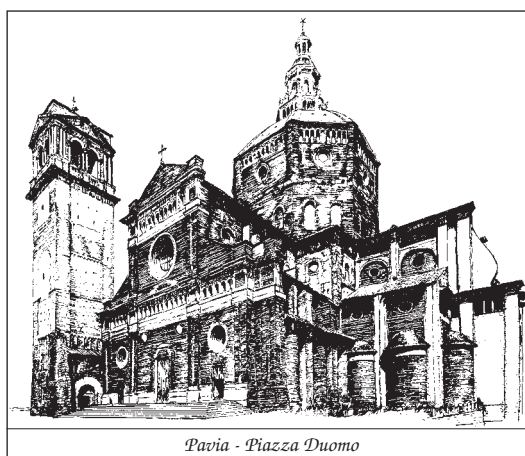
In any case the decision as to whether to go into hospital or not is, today, a great problem from both a socio-political and management viewpoint [38].

The availability of epidemiological data must be, for the disease under consideration, the only factor that should be considered when deciding on regional health policies, the distribution of resources, the organisational structure and the giving of care. Chronic respiratory disease can also become an example for the application of innovative management models based on a just integration between the hospital and the community geared towards the activation of home care plans and the organisation long-stay wards. The choices, shown in Health Plans, should be the base for coherent and uniform action regionally and nationally with the objective to reduce the social-health impact of the disease and produce the maximum benefit for the patients.

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