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Evaluation Of The Impact Of Clinical, Functional And Social Factors On The Readmission Of Patients With Pluripathologies

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ABSTRACT

PURPOSE: Hospital readmissions of patients with pluripathologies is frequent and costly. This study describes the impact of patients' pluripathologies, functional capacity and social complexity on readmissions during a 12-month period following hospital discharge.

METHODS: A prospective cohort study. Monthly monitoring of 111 patients over 12 months in Hospital of Riotinto. The primary endpoint was readmission rate.

Predictive variables: age, gender, hospitalizations the year before, illnesses that define the pluripathology, medication prescribed on discharge, social situation (Gijón Scale), functional state (Barthel) and cognitive impairment (Pfeiffer).

RESULTS: Readmissions accounted for 21.6% of the patients surveyed. Of those readmitted, the mean age was lower than those who did not return to hospital (75.4 *vs.*79.6) *(p*=0.031*)*, the average amount of medication prescribed greater (10.5 *vs.*8.7) *(p*=0.014*)*, the Barthel score higher (52.5 *vs.*50.6) and the Gijón value lower (13.8 *vs.*14.6), but no results was significant. The mean survival time (without readmission) was 310.9 days (95% CI, 289.4-332.5). Category B (chronic renal disease and vasculitis) and F (diabetes with microangiopathy and artery disease) had a lower average survival time (X^2=7.02; *p*=0.008) (X^2=7.07; *p*=0.008).

The readmission risk was hazard ratio (HR) = 3.13 (95% CI, 1.37-7.14) for category B, and HR = 3.38 (95% CI, 1.37-8.36) for category F.

CONCLUSIONS: There is a high proportion of readmissions among patients with pluripathologies in the year following discharge from hospital. The greater risk occurs in patients with chronic renal insufficiency and diabetes with microvascular complications. Factors that can be modified are polymedication and the proper control of patients' diabetes.

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Introduction:

Hospital readmissions are frequent, expensive and often preventable regardless of the population treated. An analysis of data for 2003-2004 on readmissions of Medicare patients quantified readmissions in the 30 days following discharge at 19.6%, and 34% in the 90 days after leaving hospital, with an estimated cost for non-scheduled readmissions in 2004 of $17.4 million.[1]

Readmission to hospital is very frequent in patients with multiple chronic illnesses. Various patient-related predictive factors have been described, such as the number of readmissions in the previous year, Charlson index scores and certain socio-demographic characteristics such as civil status and access to home help.[2,3] Gender and the severity of the patient's pathologies are also related.[4,5]

The indexes to determine multiple morbidity are highly heterogeneous. Pluripathology and multimorbidity are considered to exist when there are two or more chronic illnesses which produce a special clinical fragility and progressive deterioration in the patient.[6]

This rather simplistic definition is questionable when considering that the majority of elderly people have various pathological processes, suggesting that correlation with social, psychological and quality of life factors be considered.[7]

This study uses Ollero's definition of the multimorbid patient, which designates such a patient as one who presents with illnesses included in two or more clinical categories shown to be related to increased functional limitation, mortality and use of resources.[8]

The prevalence of pluripathological patients among the general population is 1.4% rising to around 5% in those aged 64. In patients attended to by general Internal Medicine services this figure reaches 30%, and is close to 60% in medical services for chronic patients. [9,8]

In primary care, 94% of pluripathological patients are polymedicated, 34% have a Barthel score of less than 60, 37% suffer cognitive impairment and more than 60% need a carer.[10,11]

The generic indicators of illness severity can be

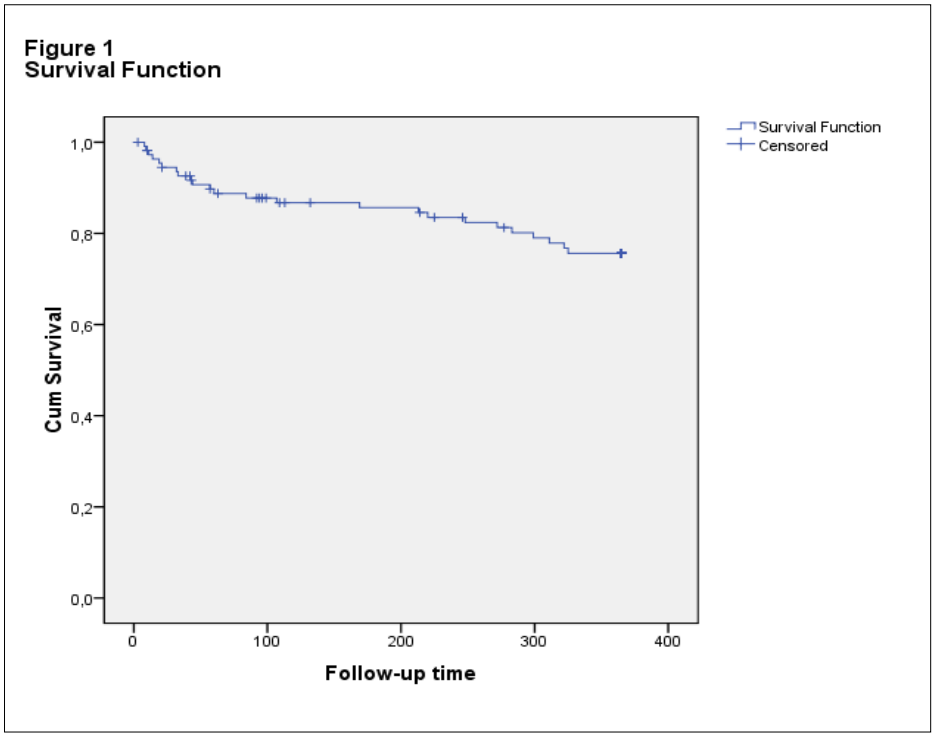

Figure 1: Survival Function

worse predictors of readmission in patients with multimorbidity than when considering each pathology individually or combinations of the same in a particular process. A study of patients with pluripathology based on Ollero's criteria revealed that pluripathology is independently related to readmission when at least three clinical categories are applied.[12]

The factors with greatest predictive capacity for readmission that appear in other studies are age and the use of health services in the last 12 months.[13]

It has recently been determined that mortality rates among pluripathology patients are significantly higher in hospital, regardless of the causes for hospitalization. The factors associated to a negative life prognosis are old age and a worsening functional situation. Patients in this condition also deteriorate further during hospitalization than those who do not present with pluripathology.[14]

The aim of this study is to describe the impact of patients' pluripathology, functional capacity and social complexity on unscheduled readmissions in the year following discharge, and to estimate the probability of surviving time.

Methods

Design, Setting and Patients

This is a prospective cohort study. The participants were recruited between January 2012 and September 2013 in the Internal Medicine service of a tertiary referral hospital in Huelva, Spain. This service has some 1,100 admissions a year most of which occur in patients with chronic illnesses.

Each patient joined the study the day they were discharged following a hospital stay for any of the diagnostic categories related to their pluripathology, and were monitored up to the date of their first unscheduled readmission, or for a maximum of one year after discharge if no readmission occurred.

The patients were recruited if they presented illnesses included in two or more diagnostic pluripathology categories (Table 1). Pluripathologies were diagnosed by objectives measures.

The study did not include scheduled admissions, those patients who belonged to a different health area or who declined to take part.

Consecutive sampling was carried out on all patients admitted during the designated time period and who complied with the inclusion criteria. Two doctors from Internal Medicine and two nurses participated in the study.

Informed consent was sought from all patients to participate in the study.

The Huelva Research Ethics Committee gave its approval for the study.

Outcome Definition and Measurements

The main variable is the first readmission following discharge. Readmission is defined as the first unscheduled admission to the Internal Medicine service, in which the patient is received in Emergencies.

We identified these readmissions from minimum basic data set (MBDS). MBDS consist of a set of clinical and administrative variables which should be collected when discharging in each hospitalization case in all Spanish hospitals.

A follow-up of patients was made every 30 days until the end of the study period by phone calls and visits by the Primary Care nurse who covers the patients' residential area.

During the admission process information is gathered by means of a structured questionnaire that includes variables such as the age of the patient at discharge, gender, number and type of chronic illnesses the patient has at the time of inclusion in the study, the number of admissions due to her/her base pathology in the year prior to inclusion in the study, main diagnosis

Table 1. Pluripathology diagnostic categories based on Ollero's definition of the pluripathological diagnosis categories.

Category A	**A1**: Cardiac insufficiency clinical stability, but has been NYHA Grade II.	**A2:** Ischemic Heart Disease	
Category **B**	**B1**: Vasculitis and autoimmune system diseases.	**B2**: Chronic renal disease defined by creatinine increase (>1.4mg/dl in men; >1.3mg/dl in women), or proteinuria maintained for 3 months.	
Category C Chronic respiratory disease clinically stable, has had MRC Grade II dyspnoea, or FEV1<65% or SaO2<=90%.			
Category D	**D1:** Intestinal inflammation disease.	D2: Chronic hepatopathy with data of hepatocellular insufficiency or portal hypertension.	
Category E	**E1**: Cerebrovascular accident.	E2: Neurological disease with permanent motor deficiency that limits basic daily activities (Barthel index less than 60).	**E3:** Neurological disease with at least a moderate cognitive impairment (Pfeifer score of 5 or more errors).
Category F	**F1:** Symptomatic Periphery Arteriopathy.	**F2:** Diabetes mellitus with proliferative retinopathy or symptomatic neuropathy.	
Category G	G1: Chronic anaemia due to digestive deficiencies or acquired hemopathy not subsidiary to curative treatment that presents Hb<10mg/dl in two tests more than three months apart.	G2: Solid neoplasia or active hematology not subsidiary to curative treatment.	
Category H: Chronic osteoarticular disease that alone puts a limit on basic daily activities (Barthel index less than 60).			

NOTE: MRC= Medical Research Council Breathlessness scale.

on discharge according to the international classification of illnesses (CIE-9-MC), the number of different medications being taken when discharged and the diagnostic category on first readmission.

The degree of social support received by the patient was measured on admission according to the Gijón Socio-Family Evaluation Scale.[15] This is an administration by proxy test that assesses socio-family risk and consists of five items (family, economic, housing and relational situation and social support) each containing five possible categories, ranging from an ideal social situation or lack of problems to the objective determination of a particular circumstance or social problem. With the global score calculated, the cut -off point for the detection of social risk is 16.

The extent of patient dependence on discharge and on first readmission was measured using the Barthel scale16which calculates the degree of patient autonomy in performing basic daily tasks. It can be self-administered or administration by proxy to the patient or the carer. This assessment is based on scores on a scale of 0 to 100 (from total dependence to total independence). The level of cognitive impairment was measured using the Spanish version of the Pfeiffer questionnaire, as validated by Martínez de la Iglesia et al.[17]

Statistical Analysis

The data were analyzed using the SPSS 17.0 statistical package.

The characteristics of the sample were explored by calculating the mean and standard deviation for the quantitative variables, and the absolute and relative frequencies for the qualitative variables.

For the bivariate analysis, we used the Chi squared test for categorical variables, and the Student's t test for comparisons of the means. Before both were applied, we used the Kolmogorov-Smirnov test to check whether the variables followed a normal distribution pattern.

Survival techniques were used in the inferential statistics by considering the time up to first readmission as a dependent variable and the rest of the variables in the study as predictors.

To estimate survival probability an analysis was carried out with the Kaplan-Meier method taking into account the information on the patients who are readmitted to hospital as well as that of those with censored time**,** together with survival by the type of comorbid illnesses that define the pluripathology, the level of patient dependence and their social situation. The confidence interval was calculated at 95%.

The Log Rank test was used to compare the survival curves, and the difference in magnitude between two curves was evaluated with rate ratio.

A multivariate analysis was carried out using the Cox proportional hazards model of those predictive readmission variables that were significant in the stratified analysis.

Results

One hundred and eleven patients who fitted the criteria were included in the study during a period of 21 months, having signed the consent form.

Table 2 shows the socio-demographic characteristics of the study participants, and their clinical, functional and social situation appears in Table 3.

The most frequent diagnoses on discharge were related to the cardivascular system (59.9%), respiratory system (20.8%) and nervous system (4.2%).

A total of 21.6% of patients were readmitted in the first year following discharge and 23.4% died. The rate of readmission was 8.1 for every 10,000 day patients (95%CI, 5.2-12.1). Table 4 shows the bivariate analysis of the predictive readmission factors.

The patients who were readmitted had an

Table 2. Socio-demographic characteristics of the patients enrolled in the study.

Age years, Mean (SD); (IR)	78.7(8.5); (73.5-83.5)
Gender, men (%)	56.8%
Medication at discharge, Mean (SD)	9.1(3.1)
Length of stay, Mean (SD)	11.4(5.9)
Barthel index, Mean (SD)	51(29.5)
Gijón index, Mean (SD)	14.4(2.9)
Pluripathology diagnosis categories, Mean(SD)	2.4(0.6)

Abbreviations: SD-Standard deviation; IR-Interquartile range

average age of 75.4 years compared to 79.6 years (p=0.031) for those who did not return to hospital. The mean number of drugs consumed was greater in patients who were readmitted than in those who were not, 10.5 vs. 8.7 (p=0.014).

The average score on the Barthel index was greater in patients who were readmitted (52.5 *vs.* 50.6) and less on the Gijón scale (13.8 *vs.* 14.6) although the differences were not significant.

The average survival time (without readmission) was 310.9 days (95%CI, 289.4-332.5).

The subjects in this study population had a 75.6% possibility of not being readmitted in the 325 days following discharge.

The patients with cognitive impairment were 7.7% more likely to be readmitted during the follow-up year. The survival rate (the proportion of patients who do not return to hospital) was lower in the group with cognitive impairment than in the group without this condition although the differences were not significant (X^2=0.254; p=0.614).

The patients in diagnosis categories B and F had a lower level of survival (X^2=7.02; p=0.008) (X^2=7.07; p=0.008).

During follow-up, the patients with diagnosis category B had a 25.7% probability of readmission and those in category F had a 27.1%.

The risk of readmission multiplied by 0.96 (95% CI, 0.91-0.99) with each yearly increase in age.

The Cox regression model was used to carry out a multivariate analysis (Table 5). The predictors most closely associated to readmission were clinical categories B and F, and the number of drugs being administered on discharge.

DISCUSSION

This study reveals a high percentage of readmissions among pluripathology patients.

The study of readmissions in Medicare patients1 showed that 19.6% returned to hospital in the 30 days following discharge although the risk of readmission persisted throughout the 365-day monitoring period.

Readmissions during the first year are associated to the diagnosis categories that define the pluripathology, in particular categories B and F, together with age and the number of drugs being taken at the moment of discharge. No link was found to functional situation or social risk.

S. López-Aguilá [18] developed a model for readmissions that occur six months after discharge which

Table 3. Clinical, functional and social situation of the patients enrolled in the study

Clinical situation (Pluripathology diagnosis categories) n (%)	A1: 37 (33.3)	A2: 34 (30.6)	
	B1: 1 (0.9)	B2: 35 (31.5)	
	C: 38 (34.2)		
	D1: 1 (0.9)	D2: 6 (5.4)	
	E1: 23 (20.7)	E2: 8 (7.2)	E3: 11 (9.9)
	F1: 11 (9.9)	F2: 16 (14.4)	
	G1: 8 (7.2)	G2: 10 (9)	
	H: 28 (25.2)		
Functional situation (Barthel index) n (%)			
Independent	7 (6.3)		
Moderate dependence	35 (31.5)		
Severe dependence	47 (42.3)		
Total dependence	22 (19.8)		
Social risk (Gijón index) n (%)			
Social problem	61 (56.5)		
Social risk	38 (35.2)		
Good social situation	9 (8.3)		
Cognitive impairment (Pfeiffer) n (%)			
No impairment	69 (62.2)		
Cognitive impairment established	41 (36.9)		

Table 4. Bivariate analysis of predictive readmission factors

	Readmission	Discharge	
Gender, (men) n (%)	15 (23.8)	48 (76.2)	X^2= 0.41 (p=0.52)
Diagnosis categories n (%)			
Cat A(A1, A2)	14 (20.6)	54 (79.4)	X^2=0.1 (p=0.74)
Cat B (B1, B2)	13 (36.1)	23 (63.9)	X^2= 6.6 (p=0.01)
Cat C	7 (18.4)	31 (81.6)	X^2=0.5 (p=0.55)
Cat D (D1,D2)	3 (42.9)	4 (57.1)	X^2=1.9 (p=0.16)
Cat E (E1,E2,E3)	6 (15.4)	33 (84.6)	X^2=1.3 (p=0.24)
Cat F (F1,F2)	10 (37)	17 (63)	X^2= 5 (p=0.025)
Cat G (G1,G2)	5 (27.8)	13 (72.2)	X^2=0.4 (p=0.49)
Cat H	3 (10.7)	25 (89.3)	X^2=2.6 (p=0.1)
Functional situation n (%)			X^2=2.1 (p=0.55)
Independence	1 (14.3)	6 (85.7)	
Moderate dependence	7 (20)	28 (80)	
Severe dependence	13 (27.7)	34 (72.3)	
Total dependence	3 (13.6)	19 (86.4)	
Social situation n (%)			X^2= 1.6 (p=0.44)
Good situation	3 (33.3)	6 (66,7)	
Social problem	11 (18)	50 (82)	
Social risk	10 (26.3)	28 (73.7)	
Cognitive impairment n (%)	7 (17.1)	34 (82.9)	X^2=0.86 (p=0.35)
Age (Mean, SD)	75.4 (8.2)	79.6 (8.3)	t=2.18 (p=0.03)
Nº drugs on discharge (Mean, SD)	10.5(2.1)	8.7 (3.2)	t=-2.5 (p=0.014)
Nº admission days (Mean, SD)	12.7(5.7)	11 (5.9)	t= 0.4 (p=0.21)

NOTE: X^2= Pearson Chi Square t= T-test

contained predictive factors such as age (the greater risk being in patients over 65), the use of more than four

Table 5. Cox regression of predictive readmission factors

	Hazard Ratio (95% IC)	*p*
Diagnosis category B	3.13 (1.37-7.14)	0.007
Diagnosis category F	3.38 (1.37-8.36)	0.008
Functional situation (Barthel)	0.76 (0.46-1.26)	0.29
Social situation (Gijón)	0.87 (0.44-1.71)	0.68
Cognitive impairment (Pffeifer)	1.09 (0.41-2.85)	0.88

Category B= Vasculitis and autoimmune system diseases AND/ OR Chronic renal disease.

Category F= Symptomatic Periphery Arteriopathy AND/ OR Diabetes mellitus with proliferative retinopathy or symptomatic neuropathy.

drugs, and pathologies associated to cardiac insufficiency and chronic obstructive pulmonary disease (COPD). These data are consistent with those found in our study since, although there is an inverse relation to age, 92.8% of patients in our study are 65 or over.

The presence of chronic illnesses is also described as a predictive factor. In the study by A.M. Mudge[19] comorbidity is associated with readmissions at six months after discharge, mainly renal disease, cardiac insufficiency and diabetes. In our study, the greatest risk associated to readmission is chronic renal disease, autoimmune illnesses and diabetic retinopathy and neuropathy.

The association between diabetes and readmissions has been described in other studies[20,21] as well studies on previous hospital readmission, but this study found no association with this particular variable.

Some researchers analysing social risk have found a relation to low socio-economic status, poor housing and the lack of social support.[22] Most patients in our study were financially stable, their housing presented some but not many inconveniences in terms of architectural design, they did not go out but could receive visits and they received care on a permanent basis. The homogenous distribution of social risk in the sample could explain why this variable is not associated to readmission.

Functional situation has been described as a readmission risk factor at 30 days after discharge. In a study by A. Morandi[23] a score in the Barthel index of 56 points or less is associated to greater risk. In our study, the Barthel index is on average 1.9 points greater in patients who are readmitted. The interquartile range in the Barthel index is from 30 to 78.7 in those who return to hospital and from 30 to 80 in those who do not, indicating that there are hardly any differences between the two groups, which could explain the lack of association.

One of the main limitations of this study is the sample size nevertheless there were few ones lost to follow-up. It has reduced the probability of selection bias. The highly homogenous distribution of some variables can be explained because the sample recruited from admissions to a hospital serving an area whose residents are mainly elderly people with high comorbidity.

CONCLUSIONS

There is a high proportion of readmissions in the 12 months following discharge in patients with pluripathology. The biggest risk is in patients with chronic renal insufficiency and those with diabetes and microvascular complications. Among the factors that can be modified are the number of drugs being taken on discharge. No relation to the social or functional variables was found.

Diabetes control programs aimed at delaying the appearance of complications, and measures for reducing and controlling polymedication in chronic patients can be effective in reducing readmissions.

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Conflict of Interest.

The authors declare that they have no conflict of interest.

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