

# Reduction of the average length of stay in internal medicine: difficult, but not impossible

*Disminución de la estancia media en medicina interna: difícil, pero no imposible*

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## Abstract

**Objective:** To analyze the variables that influence the average length of stay (LOS), mortality and readmissions in an Internal Medicine Department (IMD) of a tertiary University Hospital.

**Method:** Retrospective observational study of all patients admitted to an IMD from 2017 to 2019. The LOS, number of occupied beds, total number of admissions, urgent admissions, destination of the patient at discharge, hospital mortality, and early readmissions were analyzed. The age of the physicians, hours on call, work in the University and involvement in the plan of the multi-pathological patients (MPP) and the average delay of the diagnostic imaging procedures were collected. A descriptive analysis of the data was carried out.

**Results:** 18,129 patients (mean age: 81 years) were studied. There was a progressive decrease in the LOS (8.6 days in 2017 and 6.4 in 2019; 26% reduction) and in overall mortality (12.9% in 2017 and 11.3% in 2019). The rate of early readmissions was maintained (around 15%). In the clinical wards, differences were observed in the LOS, related to the profile of the internists with respect to both the mean age, as well as the monthly number of hours on call, and participation in the MPP.

**Conclusion:** We here present our experience in reducing LOS in an IMD. LOS is a key indicator to optimize hospital beds in periods of peak occupancy.

**Keywords:** Internal Medicine, hospitalization, hospital mortality.

## Resumen

**Objetivo:** Analizar las variables que influyen en la estancia media (EM), mortalidad y reingresos en un Servicio de Medicina Interna (SMI) de un Hospital Universitario de tercer nivel.

**Método:** Estudio observacional retrospectivo de todos los pacientes ingresados en un SMI durante 2017 a 2019. Se analizó la EM, número de camas ocupadas, número total de ingresos, ingresos urgentes, destino del paciente al alta, mortalidad hospitalaria y reingresos precoces. Se recogió la edad de los facultativos, horas de guardia, vinculación con la universidad e implicación en el plan del paciente pluripatológico (MPP) y la demora media de las pruebas complementarias. Se realizó un análisis descriptivo de los datos.

**Resultados:** Se estudiaron 18.129 pacientes (media de edad: 81 años). Se observó una disminución progresiva de la EM (8,6 días en 2017 y 6,4 en 2019; reducción del 26%) y de la mortalidad global, (12,9% en 2017 y 11,3% en 2019). La tasa de reingresos precoces se mantuvo (alrededor del 15%). En las diferentes plantas, se observaron diferencias en la EM relacionadas con el perfil de los internistas respecto tanto a la media de la edad, como al número mensual de horas de guardia, y a la participación en el MPP.

**Conclusión:** Presentamos nuestra experiencia en la reducción de la EM en un SMI. La EM es un indicador clave para optimizar el uso de las camas hospitalarias, principalmente en periodos de máxima ocupación.

**Palabras clave:** Medicina Interna, hospitalización, mortalidad hospitalaria.

## Introduction

The average length of stay (LOS) is an indicator that reflects the time that elapses from the time a patient is admitted to hospital until he or she recovers sufficient health to be able to receive care in his or her usual environment<sup>1,2</sup>. It therefore represents the speed with which the diagnosis and treatment of diseases and conditions in hospitalized patients is carried out, i.e., it is linked to effective and appropriate use of available resources<sup>3,4</sup>.

The aim of the present study was to analyze the variables that influence the decrease in the LOS, mortality and readmissions in the different hospitalization wards belonging to the same Internal Medicine Department of a tertiary care University Hospital.

## Methods

Retrospective observational study of all patients admitted to the Internal Medicine Department (IMD) of the Marqués de Valdecilla University Hospital of Santander (HUMV). This is a hospital with a capacity of 700 beds and covers a population of about 350,000 inhabitants in the Autonomous Community of Cantabria. The study period runs from June 1, 2017 to December 31, 2019. The IMD is distributed over three hospitalization floors (floor A, floor B and floor C), each with 42 functional beds, staffed by 5 internists on staff and a similar number of resident physicians on each floor. The structure of the nursing teams is the same on all three floors and consists of a nursing supervisor, 4 nurses and 5 auxiliary nurses per floor on the morning shift.

Patients are admitted to the IMD, mostly from the Emergency Department and, to a lesser extent, from outpatient consultations or are transferred from other medical or surgical services. There is no prior selection of patients admitted from the Emergency Department, since it is the physician from that department who indicates the admission, and the Admitting Service staff assigns the

hospitalization bed, indistinctly, to any of the three floors of the IMD.

The working day of IMD physicians is from Monday to Friday, from 8:00 am to 3:00 pm. All the physicians on floor A are linked to the IMD's Pluripathological Patient Plan (MPP) and, in addition to the on-call duties of the IM, they perform a specific duty where, in addition to the patients of the service, patients included in the MPP are attended from 3 to 10 p.m. from Monday to Friday and from 9 a.m. to 3 p.m. on Saturdays.

Data collection was carried out by means of a structured questionnaire in a computerized database. The variables analyzed in the present study were average stay, number of occupied beds, total number of admissions, number of emergency admissions and those of average stay less than 48 hours, patient destination at discharge, mortality during admission, and early readmissions (in the first 30 days after discharge) to the different hospitalization wards. These data were provided by the hospital's Admissions and Clinical Documentation Service. In addition, the mean age of the staff physicians, their monthly number of on-call hours, their link to the university and their direct involvement in the MPP were collected. Finally, data were collected on the mean delay of the main complementary tests performed in hospital wards (endoscopy, computed tomography -CT- and echocardiography).

Given the type of study, informed consent was not required. A descriptive analysis of the data was performed. Quantitative variables were expressed as mean  $\pm$  standard deviation and qualitative variables as numbers and percentages.

## Results

The results of the care variables are shown in **table I**. The number of patients hospitalized in IMD increased progressively during the study period and most of them (approximately 90%) came from the Emergency

**Table I:** Mean annual stay and other indicators in the different hospitalization wards of the Internal Medicine Department.

INDICATOR	Plant A			Plant B			Plant C			Total		
	2017	2018	2019	2017	2018	2019	2017	2018	2019	2017	2018	2019
Occupied beds	33	32	31	32	34	33	33	35	34	133	118	110
Total Admissions	1081	2263	2378	736	1598	1722	728	1363	1420	2545	6153	6277
Urgent Admissions	952	2112	2224	684	1478	1627	675	1276	1340	2311	5559	5799
Admissions < 48h	206	587	800	88	263	319	65	124	149	359	1165	1460
Average stay (days)	6	5,1	4,7	9,5	7,8	6,9	9,8	9,5	8,7	8,6	7	6,4
Total discharges	1034	2265	2382	728	1598	1724	716	1365	1423	2478	6172	6296
Discharges at home	812	1788	1890	545	1222	1365	579	1095	1029	1445	4828	4970
Discharges due to service transfer	73	155	172	37	104	87	38	67	61	148	431	417
Discharges due to hospital transfer	24	61	84	20	44	29	14	34	25	58	164	179
Exitus	125	255	234	125	226	240	85	166	165	335	737	708
Mortality / 100 admissions (%)	11,6	11,3	9,8	17,1	14,1	13,9	11,4	12,2	12,9	12,9	12,0	11,3
Early readmissions < 30 days (%)	15,8	14,3	16,5	14,8	15,3	16,0	17,0	17,4	14,7	15,8	15,3	15,8

Data are expressed as numbers or percentages.

Department. During the year prior to the start of the study the IMD beds were 131, with a total of 4844 patients discharged from hospital. The respective figures in the years 2017, 2018 and 2019 were 133, 118 and 110 occupied beds in the IMD and 5661, 6172 and 6296 discharged patients (a 10% increase during the study period).

The mean patient age was  $80.8 \pm 3.2$  years and remained stable throughout the study (mean age 81.1 years in 2017, 80.5 in 2018 and 81 in 2019). A significant percentage of these patients were older than 90 years, specifically 22.5% in 2017, 21.5% in 2018 and 24% in 2019.

There was a progressive decrease in average stay (8.6 days in 2017, 7 days in 2018 and 6.4 days in 2019; an overall reduction of 26%) and overall mortality, which decreased from 12.9% in 2017 to 11.3% in 2019. However, the rate of early readmissions has remained stable (around 15%).

Analyzed separately the three hospitalization wards of the IMD, ward A had a shorter average stay and lower mortality than wards B and C, with an average annual stay of 4.7 days in 2019. The number of discharges due to hospital transfer (mainly to a chronic hospital) or service transfer, from this floor was slightly higher than in the other floors. There were no differences in age and percentage of nonagenarians among the three wards.

**Table II** shows the characteristics of the medical staff on the three floors of the IMD. It can be seen that there are differences in the profile of internists with respect to mean age, monthly number of on-call hours, participation in the MPP and affiliation with the University of Cantabria.

The average delay for non-urgent digestive endoscopies, went from an average of about 9 days in 2016 (the year before the start of the study) to less than 72 hours in 2019. The respective numbers for CT and echocardiogram went from 6.5 and 7.5 days in 2016 to 4 and 3 days in 2019.

## Discussion

The decrease in the LOS of the HUMV IMD has been constant and progressive over the last three years in the different hospitalization wards, going from 8.6 days

in 2017 to 6.4 days in 2019. And this, despite the fact that the average age of patients seen in our IMD, during the period 2017-2019, was about 81 years, 5 years older than that published in the RECALMIN 2019 study, in Internal Medicine units of similar hospital<sup>5</sup>. One reason is that, in these last three years, the percentage of nonagenarian patients admitted to our units has increased. In fact, it is well known that a prolonged stay of very elderly patients does not necessarily result in an improvement in their health<sup>6</sup>.

Coinciding with the improvement in the LOS in our IMD, a slight decrease in overall mortality was also observed, which is lower than that reported in the RECALMIN study 2019<sup>5</sup>. However, the percentage of early readmissions to the service has remained at similar level, although also somewhat lower than that described in the RECALMIN study, in hospitals of the same level of complexity<sup>6</sup>.

There are several reasons that could explain the constant and progressive decrease in the LOS over the last three years. In this sense, several factors common to the entire IMD could have had an influence, such as the clear decrease in the delay in the main diagnostic tests requested during admission, the decrease in the number of beds per physician, due to a reduction in the number of occupied beds in the IMD, but which led to a progressive increase in the number of discharges (a 10% increase during the 3 years of the study) and access to the patient's electronic history from the home of the responsible physician, through a VPN connection.

However, there are a number of differences between the IMD wards that may have influenced the reduction in average stay and are worth commenting on. Thus, the average stay on floor A is lower than on the other two floors, and we were able to note that this shorter length of stay was not associated with an increase in mortality or early readmissions, compared to the data for the other floors. Floor A was opened in June 2017, after the completion of the reconstruction works of our hospital. The physicians who make up this team had been part of an IMD unit that had had to move to a hospital that primarily cared for elderly and multi-pathological patients. The stay in this center allowed them to gain experience in the specific care of these patients, both for the physicians and the nursing teams. In addition, the mean age of the

**Table II:** Differences in faculty staffing on the three hospitalization floors of the Internal Medicine Department.

	Plant A	Plant B	Plant C
Mean age of the physicians (years), mean $\pm$ SD	45.6 $\pm$ 4.8*	55.6 $\pm$ 8.2	58.4 $\pm$ 4.7
Physicians on duty, n (%)	5 (100)	3 (60)	2 (40)
On-call hours per physician per month, mean $\pm$ SD	51.2 $\pm$ 2.9**	22.5 $\pm$ 19.5	12.3 $\pm$ 16.9
Total on-call hours per floor per month, mean $\pm$ SD	256	112	62
Professors linked to the University, n (%)	2 (40)	3 (60)	2 (40)
Physicians linked to the MPP, n (%)	5 (100)	1 (20)	0 (0)

MPP: Care Plan for the Pluripathologic Patient. \*p=0.046 vs. plant B y p=0.003 vs. plant C. \*\* p=0.03 vs. plant B y p=0.007 vs. plant C.

IMD physicians was 53 years, higher than that described in the RECALMIN study (47 years)<sup>5</sup>.

In plant A, however, the average age of the physicians is more than 10 years younger than in the other two plants. In this regard, studies analyzing the association between age and employee productivity have yielded contradictory results. In general, workers' skills tend to increase up to a certain age and then begin to decrease, although older workers tend to develop a greater ability to plan, supervise and react to day-to-day problems<sup>7,8</sup>.

Motivation is an internal state that activates, directs and maintains behavior<sup>9</sup>. Motivation and job satisfaction are aspects that complement each other within the business structure, and even more so in the healthcare setting<sup>10</sup>. It is a fundamental characteristic for the achievement of objectives and difficult to quantify in work teams<sup>11</sup>. The team on floor A had undergone various organizational changes that finally led to a high degree of motivation, especially focused on achieving high healthcare performance. Some changes, but of lesser intensity, arose on floor B linked to the renewal of the staff, which implied a rejuvenation and increase in the degree of motivation of the physicians on this floor. However, on floor C, where there was no organizational change, the older age of the team physicians may have influenced the degree of their motivation. However, the opening of floor A and the improvement of its care indicators has had a motivational "knock-on" effect on the other floors of the IMD, also reactivated, in part, by a change in the Head of Service during the first year of the study period. Finally, the fact that the different hospitalization units have been able to be located in the same building, following the completion of the reconstruction work on our hospital, may also have played a role.

The organizational structure of public hospitals generally allows for few logistic adjustments in hospitalization wards, where work is usually carried out from Monday to Friday, from 8 am to 3 pm, with the rest of the day covered by on-call teams. This means that there is little care activity during weekends and holidays, which has been one of the reasons behind the creation of short-stay or high-resolution units<sup>12,13</sup>. In this regard, a key factor in the reduction of average stay has been the implementation of a MPP on-call schedule, from 15:00 to 22:00 hours from Monday to Friday and from 9:00 to 15:00 hours on Saturdays. Although this on-call service was initially aimed at the care of MPP patients, the physician also performed care activities on his floor, which may have had an impact on the reduction of average stay. On floor A, all the physicians were on call and the average number of hours on call per attending was higher compared to the internists assigned to the other hospitalization floors (**see table II**). The link to the MPP is vital in improving the length of stays, since it allows better interpretation of the needs of these types of patients and more effective coordination

of care with Primary Care Services<sup>16</sup>. In this regard, it was observed that on floor A there was a greater number of discharges due to transfer to another hospital (mainly for chronic patients) or transfer to other services, doubling the number of discharges for this reason on the other floors. However, the number of discharges for this reason does not reach 10% and does not have a significant weight in the improvement of average stay.

On the other hand, it has been suggested that, in university hospitals, the link between the medical staff and the university may lead to a longer average stay, both because of the complexity of the patients attended in this type of center and because of the more teaching-oriented approach<sup>14,15</sup>. However, in all the wards of our IMD the medical staff was linked to the university and there were no differences in the teaching given, so this factor does not seem to play a relevant role in our study.

Regarding the role of the nursing teams, the IMD wards had a similar structure, in terms of patient/nurse ratio (10/1), to the average for hospitals in Spain, according to data from the RECALMIN study<sup>5</sup>. However, the nursing team on Floor A had acquired greater experience in the care of the very elderly patient during their stay in the satellite hospital of the central hospital and that applied in daily care may possibly have played a role in the lower average stay on this floor.

Therefore, we believe that the main factors that have influenced a shorter stay on floor A have been: the younger age of the physicians, a higher degree of motivation, the application of geriatric care measures in very elderly patients, a greater presence on the hospitalization floor (due to the implementation of the afternoon and Saturday shift), which allowed for better discharge planning and participation in the MPP plan.

On the other hand, it has been shown that the decrease in the LOS of a ward had a beneficial effect on the overall average stay of the IMD, which has been decreasing over the last few years to around 6 days at present. This has been beneficial both for the patients, with fewer days of hospitalization, and for the hospital, avoiding the collapse of services such as the Emergency Department, especially in winter periods, and increasing the number of beds available for surgery programs.

With respect to the limitations of the study, we found several. An analysis by degree of severity of the patients admitted to the different wards was not carried out, since this information was not available. However, admission to the different wards was decided by the Admission Service, maintaining homogeneous distribution criteria. Likewise, the patients integrated in the MPP were also admitted indistinctly to the 3 floors, with a similar distribution. Another limitation is the lack of a tool to quantify the degree of motivation among the different physicians.

## Conclusion

It should be noted that this improvement in the average stay of the IMD has been achieved with minimal changes in the organization and without these entailing a significant increase in costs. In addition to the improvement in MS, there has also been an improvement in in-hospital mortality, with the percentage of early readmissions remaining stable during this period. The hours of on-call duty, when not excessive in number, can be an economic incentive and at the same time an activity enhancer that has repercussions on better health care results. The maintenance over time of this efficiency of care has meant that, during 2020, in the midst of the SARS-CoV-2 pandemic, our hospital has not been overwhelmed with the care of patients affected by COVID-19, who have been attended mainly by internists.

## Authorship contributions

D. Nan: conception, study design, data collection and drafting of the original version of the manuscript. M. Fernández Ayala, G. Martínez de las Cuevas and E. Canga: study conception, data collection and analysis, and critical

revision of the paper. J.M. Olmos: conception of the study, data analysis and critical revision of the manuscript. J.L. Hernández: conception and design of the study, analysis of the data, critical revision of the manuscript and writing of the final version of the manuscript. All authors approved the final version of the manuscript.

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## Conflict of interest

None.

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