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FINANCE AND PERFORMANCE OF PORTUGUESE HOSPITALS

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Abstract

This study analyses the impact of changing systems of finance on the performance of hospitals in Portugal, specifically in terms of costs per admission and per patient day, average length of stay and the number of admissions. The study is based on panel data (36 hospitals over a ten-year period), used to estimate cost functions. It is concluded that costs per admission decreased over the period in question, principally due to declining length of stay.

KEYWORDS – DRG, financing systems, hospital, Portugal, prospective payment.

1. Introduction

The rising costs of health care have been a source of concern for governments in all industrialised countries. In Portugal throughout the 1970s, the proportion of gross domestic product devoted to health care more than doubled [OECD, 2000 #16]. This rapid growth prompted an interest in the possibilities offered by alternative forms of financing hospital services and, as a consequence, the financial environment of Portuguese hospitals became the subject of reform. In 1981, hospital finance moved away from the earlier system of direct reimbursement, based on pre-determined schedules and costs incurred, towards prospective payment, entailing the implementation of hospital budgets based on hospital output (average cost by specialty and individual services provided). In 1990, a new process of allocating the budgets, based on a less heterogeneous measure of output, was gradually introduced. In essence, this was a diagnosis-related-group (DRG) system, of the form pioneered in private health care systems, such as that of the USA. This development was defended on the grounds both of leading to a more equitable distribution of funds across providers and of improving the efficiency of the public sector hospitals, where a lack of incentives for resource-saving had been recognized.

Although the DRG reform was criticised on the grounds of ineffectiveness and inadequacy [Costa, 1994 #1], there was relatively little empirical analysis at the time to inform a judgement [Paiva, 1992 #3; Dismuke, 1994 #2]. This paper undertakes a retrospective evaluation of the Portuguese financial initiatives.

2. Portuguese hospital finance

Until the end of the 1970s, hospitals providing care were reimbursed from a variety of funding sources. These included patients or their families and the counties, for care provided to the poor. For hospital care provided to patients under social security schemes, the central government reimbursed on a per diem basis, according to pre-determined schedules. The principal funding source, however, remained the public health care budget. Since hospitals were at liberty to determine the number of patient days and the services provided, there appeared to be little incentive to improve efficiency. Except for care funded by the social security scheme, hospitals were paid according to the costs they incurred.

In 1981, a new financing structure was implemented [Ministério da Saúde, 1985 #4]. Hospital prices (in effect, fees for service) were defined according to the average costs of two different groups of hospitals (Central and District). Within each group, prices were based on the average cost of each medical speciality, adjusted for average length of stay and occupancy rate, variations being permitted within pre-determined limits. Outpatient consultations, emergency admissions and ancillary services were reimbursed according to prices set annually, again on the basis of average costs. Average in the first two of the above was based on the number of patients attending, whilst ancillary services were costed on the basis of number of clinical procedures performed. The hospitals' "hotel" services were similarly priced on the basis of average costs and reimbursed by number of inpatient days per case. Using the above criteria and based on past activity levels, annual prospective hospital budgets were elaborated, although a secondary financial budget was also established to take account unplanned breaking of constraints in the initial budgets [Mantas, 1989 #5].

Whilst it appeared to exert a positive impact on the number of hospital admissions, length of stay and occupancy rates, this budget allocation process still appeared less than satisfactory [Ministério da Saúde, 1989 #6]. Basing reimbursement on costs by medical speciality enabled a high degree of heterogeneity to remain in the financial structure. No rewards for efficiency were built in to the funding model; indeed, funding the ancillary services by fee-for-service induced over-consumption and the substitution of more expensive for cheaper diagnostic tests. Over time, the 1981 reform led to significant differences in the cost of treating individual cases across Portuguese hospitals.

In consequence, a second reform was introduced from 1990. This new scheme used an homogeneous measure of hospital output, based on DRGs. Under this system, patients were to be classified, according to diagnosis, into one of 477 DRG categories. Classification is based on multiple characteristics, for example, the anatomical system affected, whether surgery was performed, the principal diagnosis, the age of the patient, secondary conditions prevalent and discharge status. In theory, cases within in each diagnostic category will have similar hospital lengths of stay and similar intensities of resource consumption. By implication, the treatment costs for all patients within each group will be similar. Under the DRG reimbursement mechanism, therefore, prices are set for the entire inpatient episode and not individually for each input used during the episode (e.g., bed days, pharmaceuticals, and X-rays).

Implementing a DRG-based financing model requires that every case be assigned to a specific DRG and reimbursed on the basis of an average cost computed for the whole health care system. In reality, however, implementation cannot ignore the structural consequences of the earlier models of financing. Prior to 1990, significant differences in treatment costs amongst Portuguese hospitals had emerged. A rapid application of the DRG model would have had a considerable impact, in that some hospitals would have experienced large and sudden decreases in funding, while others would have experienced abrupt increases. It was established that the move to DRG financing would have to be protracted and, each year, hospital appropriations would embody a decreasing component of payment based on hospital-specific costs. In the first year, this proportion would be 90 per cent, with only 10 per cent of the resources allocated for inpatient care on the basis of national average cost.

It is worth commenting that, since the publication of the DRG plan, the financing of hospitals has not been the subject of open debate. The Central Financing Department has operated with a degree of secrecy and it is accordingly difficult to make reasoned judgements about the course of the reform and its future. Possibly political reasons explain the lack of dissemination of financial information concerning the funding of hospitals. To the best of our knowledge, only data enabling the comparison of lengths of stay in each DRG between hospitals has been formally published. Even so, an increasing part of hospital revenue has been regulated directly by DRG schedules since 1990.

The majority of empirical studies of the impact of rate-setting legislation on hospital costs were conducted in the USA, contemporaneously with the introduction of DRGs in that country. These typically used the state or the county as the unit of analysis and found that replacing retrospective payment systems with prospective ones was effective in restraining costs and utilisation [Melnick, 1981 #7; Coelen, 1981 #8; Rosko, 1984 #9; Rosko, 1987 #10]. Our study attempts a similar analysis in the Portuguese context, with a slight modification. In the Portuguese case, it is clearly the pre-1980 financing model which is the closest approximation to retrospective payment, whereas the two schemes of the 1980s and 1990s are both variants of prospective payment. As data prior to 1985 are unavailable, it proved impossible to compare the pre-1980 period with the following two periods of reform. Our study thus analyses hospital performance over the period 1985-1994 and compares the two prospective payment periods, before and after the introduction of DRGs.

3. Analysis

Our analysis of the impact of prospective payment on hospital performance relied on the general model:

$$P_{it} = \alpha + \beta X_{it} + \gamma D_t + \delta H_i + \varepsilon_{it}$$

where i = 1,…,36 denotes the thirty six individual hospitals and t = 1,…,10 denotes annual time periods. P_{it} is the measure of performance of the i^{th} hospital during the t^{th} year and X_{it} a vector of control variables representing demand and supply factors. D_t a vector of dummy variables for years and H_i a vector of dummy variables for the hospitals. As conventionally, ε_{it} is the error term, α the model intercept, and β, γ, and δ vectors of estimated parameters. A linear functional form was used in the estimation of separate regression models for four different measures of hospital performance – cost per case, cost per patient day, average length of stay and number of admissions.

To properly identify the specific impact of the financing system on hospital performance, several control variables were included in the model. Thus, the estimated coefficients of variables such as population age, local income and local infant mortality capture the impact of demographic and economic characteristics, as well as the health status, of the population resident in the district in which each of the hospitals is operating. The coefficients of size, input prices and staff levels estimate the effect of hospital characteristics on unit costs, length of stay and cases treated. The coefficients of the hospital binary variables measure the impact of omitted, hospital specific variables, which are assumed invariant over time. In turn, the regression coefficients of the year binary variables measure the effects of changes in the payment system, assumed to exert a constant effect across hospitals.

The observational unit for our analysis was thus the individual hospital. The data set consisted of a pooled sample of cross-section and time series observations covering 36 acute district hospitals, for 10 years (1985-1994), a total of 360 observations. The primary data source was the Ministry of Health's hospital statistics. These annual surveys provide patient numbers, number of hospital beds, hospital expenditures, personnel and cost estimates for outpatient and emergency visits. Data for the demand variables and price indices were obtained from annual surveys published by the Instituto Nacional de Estatística. A listing of the variables used in the analysis appears as an Appendix to this paper.

As noted above, our analysis comprises four regression models, with cost, output and utilisation as dependent variables. Two proxies - the ratio of total hospital inpatient expenditures (adjusted by the public expenditure deflator) to the number of patients admitted yearly and number of patient days - measure the two cost- determining variables. Capital expenditures were subtracted from total hospital expenditures, as capital goods are financed independently of the recurrent budget. Other items subtracted from the total were expenditures on medicines prescribed during outpatient consultations (which were paid by the Regional Health Authorities pre-1990) and costs on outpatient and emergency visits. Both cost per case and cost per day are reported, because it was conjectured that the two payment systems under consideration (speciality and DRG) might have different effects on specific cost components. Were both payment systems to affect primarily the length of stay, a substantial impact would be expected on cost per case and a negligible or even opposite effect on cost per day.

Exogenous variables in all regressions included four demand variables, describing factors that mirror need for health care, the inducement of consumer demand by health care professionals and the ability to pay for health care. Portuguese public hospitals are obliged to treat all patients in their area of referral and the four variables thus capture the impact of health, demographic and economic characteristics of the population living in the district where the hospital is located. The proportion of district population aged 65 years and over (POP>65) reflects the significance of population groups who tend both to consume a disproportionate amount of health care and to be admitted to hospital more often. USA studies reported patient age to be a significant determinant of hospital costs and utilisation

[Melnick, 1981 #7; Sloan, 1980 #11] and we therefore hypothesised a positive regression coefficient for this variable in all four regressions.

The standardised mortality rate - a commonly-used proxy for population health status and need for care - has been shown to be positively related to the standardised hospital episode ratio [Estelle, 1994 #12]. However, as the variability of district infant mortality was larger than that of standardised mortality, we have adopted the former variable (IMRate) in our model. Again, a positive coefficient of this variable would be predicted for every model estimated. The number of inhabitants per general practitioner (POPGP) was included as a measure of the impact on the demand for inpatient care induced by the number of GPs in the district. In other studies, the number of active physicians per capita has been found to be positively related to hospital expenditures per inpatient day and per admission [Coelen, 1981 #8]. Positive elasticities between the number of physicians per capita and total costs, and between the former and the number of admissions per capita, have been reported [Ashby, 1984 #13]. The purchasing power index (PPIndex) is a measure of the income for the average consumer in each district and thus proxies the ability to pay for health care. We hypothesised that this variable might have a positive impact on unit costs, as well as on admissions and utilisation.

Four independent variables are included to control for the impact of hospital characteristics on performance. Hospital size was measured as the total number of inpatient beds (BEDS). USA evidence suggests that larger hospitals are more likely to attract a complex case mix and to have higher unit costs [Pauly, 1970 #14; Rosko, 1984 #9]. Thus, this variable should have a positive coefficient. The unit cost of labour (LPrice) and of supplies (OPrice) were included to account for possible differences in input prices across hospitals. Hospital spending, and hence unit costs, is expected to rise with each of these two variables, although their impact on admissions and length of stay seems unpredictable.

Hospital personnel per available bed (STAFF) is a crude measure of the intensity of services provided by the hospital. Therefore, this variable should be positively related to unit costs, admissions and length of stay, as has been discovered before [Rosko, 1984 #9]. Ideally, case-mix and managerial skill differences require controlling in the analysis. As case-mix data were unavailable, binary dummy variables for each hospital were used to isolate the impact of otherwise-unmeasured hospital-specific characteristics.

4. Results

A two-way fixed effects regression analysis was undertaken for each of the four specifications of performance. Thereafter, the estimation of the degree of cost-containment was undertaken for three separate cost measures (total, labour and overheads), on a per admission and per diem basis. The results for total cost equations are displayed in Table 1.

The impact of prospective payment on hospital performance is captured by the coefficients for the individual year dummy variables. Specifically in relation to the costs per admission, the results suggest that, after accounting for the effect of other explanatory variables, the deviations of the time dummy coefficients from the base year (1985) range from 8 contos in 1986 to 212 contos in 1994. The costs per patient day are around 2 contos lower in 1986 and 20 contos in 1994. With regards to the number of admissions, there is a positive trend throughout the period, whilst length of stay steadily declined. In the unit cost and length of stay equations, the estimated coefficients of the control variables have the expected sign. The coefficients in the admission equation, however, appear perverse in this respect, for example, the negative sign associated with population age.

Based on the Table 1 results, Table 2 displays the annual and cumulative savings in cost per case and cost per day for both specialty-based and DRG financing periods. The DRG cumulative effect is estimated from the difference between the coefficient for the last year before the implementation of DRGs (1989) and the coefficient for 1994. The specialties cumulative effect is obtained from the difference between 1986 and 1989. In both cases, the level of statistical significance of the estimated cost savings was assessed using a t-test at the conventional statistical levels. The results for individual year estimates follow a similar pattern for both cost per case and cost per day, with 1989 (the year before the implementation of the DRG scheme) being associated with the highest cost-saving effect.

The cumulative savings expressed as a percentage of average costs during the two schemes are presented in Table 3. It is evident that the negative effect on both components of total inpatient unit costs during the specialty scheme is quite different in terms of magnitude. Labour expenditures are twice as large on a per admission basis and relatively higher on a per patient day basis. However, the contribution of other overhead expenditures to the total inpatient estimated savings is larger than labour expenditures when both cumulative savings, as a percentage of average costs in 1989, are compared. The reasons for these divergent patterns are not clear. It is possible that the smaller percentage attributed to the labour costs could be associated with changes in the structure of professional careers at the time. Under the DRG scheme, the contribution of labour to cost containment was about eight times higher than other overhead expenditures. However, the results suggest that the contribution of labour to total inpatient estimated savings is now higher than overhead expenditures, when the cumulative savings, as a percentage of average unit costs in 1994, are compared. The lower contribution of other expenditures to cumulative cost savings in percentage terms could be explained by the fact that hospitals began contracting privately for catering, cleaning, security, hotel and other services. Under both schemes, cost per day declined less than did cost per admission. As hospitals were remunerated and budgets allocated per patient admitted, it seems plausible to argue that the incentive effect to reduce costs per admission was operating.

Table 4 displays estimated changes in length of stay and admissions attributed to both payment schemes. With regard to the average length of stay, only in 1994 does there appear to be an increase, although this effect is not significant. Once again, 1989 seems to have experienced the greatest annual reduction. This result helps to explain the significant yearly cost savings already found for this year. Table 5 displays the cumulative changes in both the number of patients admitted in the hospital and in the average length of stay, expressed as a percentage of the average levels of these variables in 1989 and 1994. The impact on the number of admissions during the specialty scheme period is more than twice as large as during the DRG scheme. The impact on the length of stay appears to be similar under both schemes, possibly because there will be technical constraints to length-of-stay reductions independent of systems of finance.

5. Discussion

Our results suggest that significant cost reduction occurred over the period of analysis, achieved by the reduction in the average length of stay. As a result of shorter stays in hospital, there were opportunities to increase admissions. The evidence that the number of hospital admissions rose also suggests that the occupancy rate increased, given stability in the stock of beds. This finding would support an increase in the efficiency in the provision of care, in that there is an opportunity to distribute fixed costs across more patients. The significant cumulative cost reductions per inpatient day suggests either that district hospitals were treating less complex, and hence less costly, cases or that they are treating the same cases with less resources (i.e. more efficiently). Given the evidence that hospitals were reducing length of stay, costs per day would be expected to increase, unless there had been significant declines either in the provision of labour and ancillary services and/or in input prices.

During the specialty period, overhead expenditures emerged as the main determinant of cost savings. Under the DRG scheme, however, it was the labour component fulfilling this role, suggesting that hospitals were substituting expenditures on services contracted privately for labour. Regarding the cumulative changes in admissions and length of inpatient stay, it was found that, under the specialty period, the number of admissions was higher and the average length of stay slightly lower, in percentage terms, than under the DRG period.

6. Conclusion

As noted at the outset, with health care expenditures rising at a rapid pace in Portugal, several attempts have been made to reform the health care system. The hospital sector, consuming around fifty-two percent of public funds, has been subject to changes in the process of allocating the public health budget. This study represents the first attempt to analyse the impact of changing systems of finance on the performance of hospitals in Portugal.

Our analysis reveals that significant cost reduction occurred over the 10 years' (1985-1994) period of study, achieved by the reduction in the average length of stay. The empirical results also suggest that Portuguese district hospitals have been providing hospital services more efficiently, in that higher occupancy rates mean opportunity to distribute fixed costs across more patients and that decreasing costs per day the possibility of treating the same cases with less resources.

This study also concluded that, unlike the specialty scheme period, under the DRG scheme the main component contributing to cost savings was labour, suggesting that hospitals were substituting expenditures on services contracted privately for labour.

The above findings have implications for the evaluation of the DRG system as a budget setting tool and as a payment mechanism in Portugal. Lately, the Ministry of Health, to keep pace with the need of extra health care funds, is questioning the financing criteria adopted. However, it is particularly pertinent to note that the DRG system was not yet adopted in full and, despite the schedule fixed by the Ministry of Health, in 1999 only 30 percent of the budget was allocated according to the DRG pricing scheme. Therefore, a longer time period and larger percentages of payment based on DRGs are needed to infer whether changes in hospital financing will actually reduce hospital costs without adversely affecting quality of care, access to hospital care and patient health status.

APPENDIX

Variable	Definition	Mean	SD
Dependents			
Cost per case	Ratio of total inpatient expense (net of capital expenditures and ambulatory expenditures) to admissions, expressed in 1991 constant contos.	165.4	48.9
Cost per day	Ratio of total inpatient expense to patient days, expressed in 1991 constant contos.	20.6	6.1
ALOS	Ratio of total inpatient days to admissions	8.1	1.5
CASES	Total admissions to the hospital	8052.1	3688.5
Demand			
POPGP	Number of inhabitants per GP, in the district where the hospital is located	1454.0	225.2
POP>65	Population aged 65 and over, in district where the hospital is located (%)	14.8	3.8
IMRate	Infant mortality rate, in the district where the hospital is located (%)	12.0	4.2
PPIndex	Purchasing power index, in the district where the hospital is located	63.7	20.8
Supply			
BEDS	Total inpatient beds	244.6	112.8
Oprice	Overhead expenditure per day	1202.2	1095.5
Lprice	Ratio of expenditures on labour to number of personal	1787.9	752.6
STAFF	Ratio of number of personnel to beds	2.3	0.8
Dummy			
YR85,...,YR94	Binary variable, =1 in year indicated		
Hosp02,...Hosp36	Binary variables, =1 for hospital indicated		

Table 1 – Two-way fixed effects regression model results

Independent variable	Cost per admission	Cost per patient day	Average length of stay	Admissions
POPGP	-0.0171**	-0.00131	-0.00081	0.08174
POP>65	7.7926***	0.60104*	0.1972**	-251.49***
IMRate	0.07457	0.0204	-0.001777	-3.4715
PPIndex	-0.3504	-0.0807	0.0226	12.496***
BEDS	0.16632***	-0.00391	0.05621***	8.2006
Oprice	0.01131***	0.00299***	-0.000347***	1.0113***
Lprice	0.0665***	0.00743***	-0.000616*	-0.50267
STAFF	54.444***	6.272***	0.3047**	-145.42
YR86	-8.264	-0.67026	-0.28854	182.67
YR87	-23.694***	-1.5175*	-0.77631***	536.55***
YR88	-57.975***	-4.8375***	-1.1822***	998.83***
YR89	-100.82***	-8.8460***	-1.9468***	1 542.4***
YR90	-124.59***	-11.697***	-2.1651***	1 669.7***
YR91	-161.31***	-14.742***	-2.9116***	1 705.7***
YR92	-180.73***	-16.844***	-3.3263***	2 388.7***
YR93	-210.45***	-19.583***	-3.6815***	2 756***
YR94	-212.10***	-19.957***	-3.6776***	2 376***
Lag.Mult. test	224.6	178.3	491.9	537.9
Hausman test	0.0001	0.0001	0.0	0.0
R^2	0.76	0.79	0.76	0.95

Note: Models with pooled data for 36 hospitals, over the period 1985-1994. Hospital dummies not shown.*** Significant at the 1% level **Significant at the 5% level * Significant at the 10% level (two-tailed test)

Table 2 - Estimated savings attributed to the prospective payment schemes for inpatient cost per admission and inpatient cost per day *(1991 constant escudos)*

	Year	Cost per case (contos)	Cost per day (contos)
	1987	-15.429**	-0.847
	1988	-34.263***	-3.32***
	1989	-42.863***	-4.008***
	1990	-23.77***	-2.851***
	1991	-36.72***	-3.045***
	1992	-19.42***	-2.102***
	1993	-29.72***	-2.739***
	1994	-1.65	-0.37
Cumulative Savings			
Specialty scheme		92.55***	-8.175***
DRG scheme		-111.28***	-11.111***

Note: *** Significant at the 1% level **Significant at the 5% level * Significant at the 10% level (two-tailed test)

Table 3 - Cumulative cost savings attributable to financing schemes

	Cumulative cost effect	Cost level at end of period *(b)*	Cumulative effect as a percentage of end-year cost level
Speciality scheme (1985-1989)			
Total inpatient costs	-251 174 c *(a)*		
Total inpatient costs per admission	-100.82 c	143.66 c	70.17
Labour inpatient costs per admission	-56.26 c	125.5 c	44.91
Other inpatient costs per admission	-28.58 c	37.93 c	75.34
Total inpatient costs per patient day	-8.84 c	17.93 c	49.30
Labour inpatient costs per patient day	-3.77 c	15.76 c	23.92
Other inpatient costs per patient day	-2.5 c	4.74 c	52.74
DGR scheme (1989-1994)			
Total inpatient costs	-622 593 c *(a)*		
Total inpatient costs per admission	-100.28 c	175.16 c	63.53
Labour inpatient costs per admission	-83.13 c	130.43 c	63.73
Other inpatient costs per admission	-10.56 c	76.54 c	13.79
Total inpatient costs per patient day	-11.11 c	25.24 c	44.01
Labour inpatient costs per patient day	-7.59 c	18.84 c	40.28
Other inpatient costs per patient day	-0.22 c	11.02 c	1.99

Note: *(a)* This figure represents the cumulative cost saving of total inpatient costs obtained from the dummy coefficients of the two-way fixed effects model, run for total inpatient costs.
(b) Figures in this column are unit costs computed for the sample mean in end-period year.

Table 4 - Estimated changes in average length of stay and number of admissions attributed to the DRG scheme

	Year	Average length of stay (days)	Admissions
	1987	-0.4875***	353.88*
	1988	-0.4061**	462.28**
	1989	-0.7646***	543.57***
	1990	-0.2183	127.3
	1991	-0.7465***	36
	1992	-0.4147**	683***
	1993	-0.3552**	367.3***
	1994	0.0039	-380***
Cumulative Savings			
Specialty scheme		-1.6582***	1 359***
DRG scheme		-1.7308***	833.6

Note: *** Significant at the 1% level **Significant at the 5% level * Significant at the 10% level (two-tailed test)

Table 5 - Cumulative changes in admissions and average length of stay

	Cumulative effect	Average level *(a)*	Cumulative effect as a percentage of average
1985-1989			
Admissions	1 542.36	7 960.5	19.37
Average Length of Stay	-1.95	8.02	24.31
1989-1994			
Admissions	833.6	9 866.6	8.44
Average Length of Stay	-1.73	6.98	24.78

Note: *(a)* Figures in this column are ALOS computed for the sample mean in 1989 and 1994.

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