

# Day-surgery and surgical waiting time

## *Cirurgia de ambulatório e a espera para cirurgia eletiva*

### **Abstract**

Surgical waiting time remains an important issue regarding access to health care provision. It is considered to be excessive in most OEDC countries (over twelve weeks or ninety days). The development of day surgery has been one of the strategies that proved effective in reducing surgical waiting time. This study aims to establish a correlation between surgical waiting time and the percentage of day-surgery cases, in hospitals with surgical services, in the Portuguese National Health Services, during 2006. **Methodology:** An observational, analytical and ecological study was conducted to establish the correlations existing between surgical waiting time and the percentage of day-surgery procedures realized, as well as associations with other variables, through multivariate and correlation analysis. **Results:** A negative, statistically significant Spearman's correlation was observed between the percentage of day-surgery cases and the waiting surgical time for elective procedures.

**Keywords:** Day. Surgery. Time. Waiting. Access. Correlation.

**Paula Maria Caldinhas<sup>I</sup>**

**Paulo Ferrinho<sup>I,II</sup>**

<sup>I</sup>Institute of Hygiene and Tropical Medicine at the New University of Lisbon

<sup>II</sup>WHO Collaborative Center for Health Workforce Policies and Planning

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**Corresponding author:** Paula Maria Caldinhas. Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa. Rua da Junqueira, 100 - Lisboa, Portugal, 1349-008. E-mail: malongane@hotmail.com

## Resumo

O tempo de espera para a cirurgia eletiva constitui uma questão relevante no acesso aos cuidados de saúde, sendo excessivo (superior a doze semanas, ou noventa dias), em vários países da OCDE. O desenvolvimento da cirurgia eletiva em regime ambulatorial tem sido uma das estratégias na redução dos tempos de espera cirúrgicos. Este estudo pretende investigar qual a relação existente entre a percentagem de cirurgia ambulatorial realizada e o tempo de espera para cirurgia eletiva nos hospitais com serviço de cirurgia, do Serviço Nacional de Saúde, em Portugal continental, no ano de 2006. **Material e Métodos:** Realizou-se um estudo observacional, ecológico, analítico. Foram estudadas as associações entre o tempo de espera cirúrgico e a percentagem de cirurgia ambulatorial realizada por hospital, bem como as associações com outras variáveis em estudo, através de uma análise multivariada. **Resultados:** Verificou-se uma correlação negativa, estatisticamente significativa (correlação de Spearman), entre a percentagem de cirurgia ambulatorial realizada e o tempo de espera para cirurgia eletiva.

**Palavras-chave:** Cirurgia. Ambulatório. Tempo. Espera. Acesso. Correlação.

## Introduction

The waiting time for day-surgeries is a relevant issue in the access to health care. It is considered to be excessive (longer than 12 weeks or 90 days) in several countries that are members of the Organization for Economic Co-operation and Development (OECD)<sup>1</sup>. As a consequence of economic, social and demographic changes, with the resulting implications for health care costs, increasing the efficiency and efficacy of health services became relevant to enable their greater profitability<sup>2-4</sup>. The development of day-surgeries in outpatient clinics is one of the strategies that has been found to be efficient in the reduction of surgical waiting time. In general, countries with shorter day-surgery waiting times are also those with higher percentages of day-surgery procedures in outpatient clinics<sup>5-7</sup>. The present study aimed to describe the existing relationship between the percentage of outpatient surgeries performed and surgical waiting time of day-surgeries in hospitals that provide these procedures in the *Serviço Nacional de Saúde* (SNS – National Health Service), in Continental Portugal, in 2006.

### The National Health Service in Portugal

The Portuguese health system has been based on the SNS since 1979 and it is characterized as a public insurance with universal coverage, equality, reduced costs for users receiving services, and funding from regulatory taxes and rates<sup>8-10</sup>. The SNS is complemented by private and voluntary health insurances and by several health sub-systems, usually associated with professional activities. Private health care providers play a role that complements the SNS, rather than representing a comprehensive alternative. Health units can be divided into three types: hospitals, which provide health care services such as surgeries and consultations of several specialties; health centers, which provide consultations with general practitioners and some specialties and nursing care; and, lastly, health units,

which only provide consultations with general practitioners and some nursing care services<sup>11,12</sup>.

Portugal has adopted a gate-keeping system, according to which patients have to seek a general practitioner for an initial evaluation and, if necessary, they are referred to a specialist<sup>13</sup>. Aiming to improve financial sustainability and to provide greater functional and organizational autonomy to hospitals, a new legal regime of management of hospitals covered by the SNS was approved in 2002.

### Outpatient surgeries and waiting times

In 2008, Portugal ranked 26<sup>th</sup> in a classification of health care systems conducted in 31 European countries and promoted in Brussels by the Health Consumer Powerhouse organization, which emphasizes the insufficient access to treatment and long waiting time<sup>15,16</sup>. On an international level, throughout the last decade, several programs were developed with the objective of reducing day-surgery waiting time<sup>17,18</sup>. In Portugal, these programs were initially directed towards the increase in surgical production<sup>11,12</sup>, making available additional funding for this purpose. These programs resulted in the partial reduction in surgical waiting lists and were somewhat efficient, although not achieving the expected results<sup>19-21</sup>. The concept of maximum clinically acceptable waiting time was then introduced, when a maximum waiting time was defined as an indicator of performance and efficiency of health services, according to the clinical status and pathology involved<sup>22,23</sup>. One of the strategies internationally implemented to reduce day-surgery waiting time includes the promotion of outpatient surgeries<sup>5-7,24</sup>. The practice of outpatient surgeries in Portugal began in the 1990s, when certain hospital institutions developed organized programs under this surgical regime. In 1997, the percentage of outpatient surgical interventions remained at 8.9%<sup>24</sup>.

However, the interest in the development of such practice only increased in

recent times. According to the National Outpatient Surgery Surveys conducted by the *Associação Portuguesa de Cirurgia de Ambulatório* (APCA – Portuguese Outpatient Surgery Association) in 71 Portuguese public hospitals, in 1999, 2001 and 2003, the percentage of outpatient surgeries in the total number of surgeries corresponded to 5.5%, in 1999, 7.2% in 2001, and nearly 14.6% in 2003<sup>25-27</sup>. As a result of the effort made to increase the development of outpatient surgeries, there was an increase in their percentage between 2004 and 2006, reaching values of nearly 24% of all planned surgeries<sup>28</sup>. A national survey conducted by the *Comissão Nacional para o Desenvolvimento da Cirurgia de Ambulatório* (CNADCA – National Outpatient Surgery Development Committee)<sup>31</sup> in 61 SNS hospitals, in 2008, concluded that the main obstacles to the implementation of outpatient surgeries were the at the level of hospital management and organization (physical conditions of health establishments; top management engagement; human resources, especially anesthesiologists; insufficient infrastructure and organizational difficulties, mainly in the management of teams and units; experiences and acceptance of health professionals; and the difficulties in the post-operative follow-up period) and at the level of patients (population's lack of information about outpatient surgery characteristics, the social conditions of the Portuguese population and the difficulty in users' transportation between their place of residence and the hospital institution)<sup>31</sup>. Currently, after some years of implementation of both additional production programs and outpatient surgery development programs, there was a reduction in the mean waiting time for day surgeries from 6 to 8 months in 2005 and previous years, and from 2.5 to 3.5 months in 2010 (data refer to the first semester of 2010 published by the Health System Management Center). Additionally, there was an increase in the percentage of outpatient surgeries of approximately 50% (data refer to the entire

country in 2010 published by the Health System Management Center)<sup>30</sup>.

The main objective was to study the existing associations between surgical waiting time (dependent variable) and the percentage of day surgeries (independent variable). In addition, the secondary objective was to investigate possible associations with other study variables that were potential determinants<sup>34,35</sup>.

## Material, Population and Methods

### Study design

An observational, ecological and analytical study was performed with health units<sup>32</sup>.

### Population and sample

The study population included all SNS hospital units that provided surgical services in 2006. According to the *Direção Geral da Saúde* (DGS – General Health Management Office)<sup>33</sup>, there were 85 hospitals in Continental Portugal in 2006. This study included 73 hospitals as some were excluded for not having surgical services (psychiatric hospitals, rehabilitation and physiotherapy centers etc.) or due to unavailable data.

### Data source

Data were provided by the *Administração Central de Serviços de Saúde* (ACSS – Health Service Management Center), especially the *Sistema de Informação de Acompanhamento e Contratualização* (SIAC – Contract and Follow-up Information System) and the DGS Department of Statistics, including information about the hospital and hospital management types, performance indicators (occupancy rate, mean stay, discharged patients and discharged patients per bed, number of patients-day), population covered, human resources and existing installations. Data on waiting times and total, conventional and outpatient surgical production for each hospital were obtained

from the *Unidade Central de Gestão de Inscritos para Cirurgia* (UGIC – Central Unit of Management of Patients Listed for Surgery) and mean values for all hospitals were subsequently calculated.

### Statistical analysis

The relative numbers of surgeons and anesthesiologists were given according to specialty for each hospital and their sum was required to obtain the total numbers. Descriptive analysis was performed for numerical variables, with the calculation of the measures of central tendency (mean, mode and median), measures of non-central tendency (quartiles, deciles, percentiles and outlier observations), measures of dispersion (total variation and interquartile amplitude, standard deviation, variation and dispersion coefficients) and comparison of frequencies (ratios, proportions and percentages). Relative and absolute frequencies were used for the nominal and ordinal variables.

The inferential analysis was performed with Spearman's correlation analysis and multiple linear regression (backward stepwise, with a PIN < 0.05 and POUT > 0.1)<sup>35,36</sup>.

A total of 15 sample elements were eliminated in the construction of the linear regression model as they did not have data on some of the variables included in the model. Thus, the sample of the final model includes 58 hospital units. The analysis of the outliers enabled the identification of extreme cases considered to be influential for the models, which will be excluded in the construction of new regression functions. Observations in which the standardized residue had an absolute value higher than 1.96 for a significance level of 5% were considered as outliers. Additionally, observations that disrespected the conditions imposed on residues or that were not within the imposed limits for at least three of the remaining criteria considered were regarded as extreme influential cases. The criteria established enabled the identification of ten outliers in the model, which were excluded

from the analysis model, thus reducing the total number of cases from 58 to 48.

### Description of variables

**Dependent variables:** The dependent variable in the present study is the day surgery waiting time (quantitative variable) in each of the health institutions studied. "Waiting time" is defined as the number of calendar days between the moment when a surgical intervention is indicated by a specialist and the moment when it is performed<sup>55</sup>. A "surgical indication" is the therapeutic proposal in which a surgical intervention is expected to be performed with the resources of planned surgeries<sup>55</sup>. The mean overall waiting time in days was used, regardless of this being associated with a conventional or outpatient surgery. The waiting time calculated from the sum of waiting times of patients listed for surgery, divided by the total number of patients listed and converted to days (multiplied by 30), was used to obtain this variable.

**Independent variables:** The independent variables are those that theoretically predict the dependent variables<sup>52</sup>. The percentage of outpatient surgical procedures performed in each hospital was the independent variable of this study. An "outpatient surgery" is understood as a planned surgical intervention carried out under general, loco-regional or local anesthesia, usually during hospitalization, which can be safely performed in adequate facilities, according to the existing *lege artis*, following admission and subsequent discharge within 24 hours and not including minor surgeries<sup>55</sup>. The calculation of this percentage is based on the number of outpatient surgeries as a numerator and the number of outpatients surgeries added to the number of conventional surgeries as the denominator.

**Interfering or potentially confounding variables:** Confounding variables are an important type of independent variables for this investigation. The expression

"confounding" appears when the result is not true, because it is confounded or masked by another variable<sup>52</sup>. Confounding can appear when an interfering variable, in this case known as confounder, distorts the association between the exposure variable (independent) and the response variable (dependent), changing its strength or even its meaning<sup>52</sup>. The following were considered as potentially confounding variables in this study:

- Total surgical production in each hospital, i.e. the total number of (conventional and outpatient) surgical interventions. "Surgical intervention" is understood as the operative action or actions performed by one or more surgeons in an operating room, in the same session. A day or planned surgery is that performed in the surgical ward according to a previous appointment, excluding minor surgeries<sup>55</sup>;
- Bed capacity, defined by the total number of surgical hospitalization beds per hospital<sup>33</sup>;
- Occupancy rate, given by the ratio between the number of hospitalization days in a certain period (January 1<sup>st</sup> to December 31<sup>st</sup>) and the hospitalization capacity (hospital or service bed capacity) multiplied by 365 days;
- Mean waiting time, defined by the mean number of hospitalization days for all patients discharged from a certain hospital for 365 days<sup>33</sup>;
- Hospital management type, i.e. health units with an EPE (Company Public Hospitals) management model, defined as public establishments that have their own legal personality; administrative, financial and patrimonial autonomy; and company nature, and health units with an SPA (Public Administrative Sector) management model, defined as public establishments that have their own administrative and financial autonomy, with or without patrimonial autonomy<sup>53</sup>. The management model of SNS hospitals can have any of the following legal personalities:

- SPA (Public Administrative Sector) hospitals: public hospitals with a legal personality, administrative and financial autonomy, with or without patrimonial autonomy. In Portugal, this model included the great majority of SNS hospitals, which, despite their autonomy, greatly depended on the Ministry of Health in terms of funding, management and recruiting of human resources;
- *Hospitais EPE* (EPE – Company public hospitals) – public hospitals with a legal personality; administrative, financial and patrimonial autonomy; and a company nature. This is a model that has been increasingly used in all SNS hospitals;
- Profit or non-profit private organizations, with which contracts are made;
- SNS institutions and services managed by other public or private organizations through management contracts;
- *Hospitais SA* (Anonymous society hospitals) – anonymous societies with exclusive public funding, based on a relationship where this funding is in accordance with objectives and incentives and the achievement of such.

The “management type” dichotomous nominal variable was made functional in the following way: EPE management type and SA management type, as these were the most frequent existing management types.

- Number of surgeons existing per hospital;
- Number of anesthesiologists existing in each hospital;
- Total number of physicians existing in each hospital;
- Number of conventional ward and outpatient nurses, i.e. the number of nurses present in the conventional surgical ward or outpatient clinic or both, existing in each hospital;
- Number of operating rooms (conventional and outpatient surgeries), i.e. the number of operating areas aimed at outpatient and/or conventional surgeries;
- Number of hospitalization days, defined

by the total number of days used by all hospitalized patients in several services of a hospital, except on their days of discharge in 365 days<sup>33</sup>;

- Number of released patients, defined by the total number of patients who did not remain in the hospital, as they were discharged, deceased or transferred to another hospital, in 365 days, and those released per bed, i.e. the rate of patients discharged from hospitalization, and the total number of beds<sup>33</sup>;
- Population covered by each hospital, i.e. the total population living in a certain geographic area served by a certain hospital;
- Hospital type, described as central, district or level 1 district hospital<sup>56</sup>. In the perspective of the classification used in the present study<sup>13,14</sup>, it should be clarified that the Central Hospital is considered to be that one whose area of geographic intervention determines a hospital area of influence or part of it, and it is characterized by the existence of a great number of specialties. The number of existing specialties depends on whether the institution is a General Hospital, with a great number of existing specialties, or a Specialized Hospital, with a limited number of specialties. The Central Hospital corresponds to the most sophisticated and distinct level of care and is capable of providing care for all clinical situations, except for exceptional cases that can only be treated in a different Central Hospital. Apart from the health care function, this hospital type includes scientific research and it may have a teaching function and be associated with universities (University Hospital). District Hospitals are those whose geographic intervention area corresponds to a district or part of it and which can be classified according to the their levels of difference or specialties: basic district hospital, intermediate level district hospital or distinct level district hospital<sup>13</sup>. Level 1 district hospitals, also known as level 1 hospitals, are



those whose hospitalization is usually limited to more basic specialties: Internal Medicine, General Surgery, Obstetrics, Gynecology and Pediatrics, apart from Orthopedics, which can be included in some cases<sup>14</sup>. Aiming to statistically treat or analyze the data, the operationalization of this variable was performed in the following way: 1. Central Hospital, 2. District Hospital, and 3. Level 1 District Hospital.

## Results

### Descriptive analysis

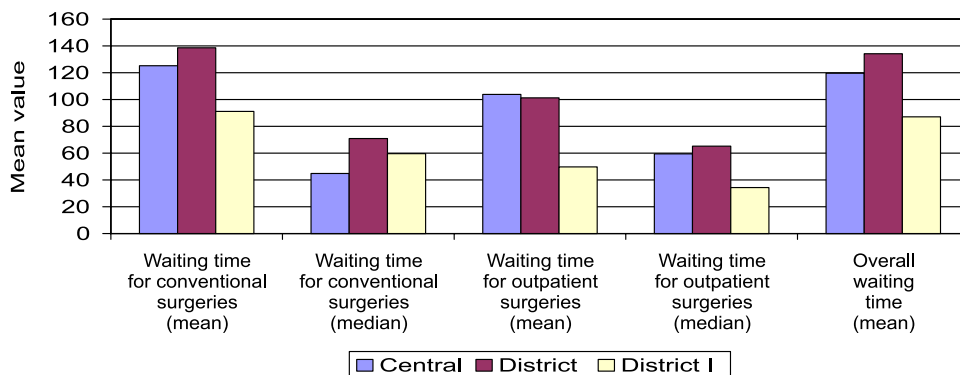
The sample was comprised of 47% district hospitals, 28% of central hospitals and 25% of level 1 hospitals. A total of 56% of hospitals with company management or *Entidade Pública Empresarial* (EPE – Public Company Institution) and 44% with *Setor Público Administrativo* (SPA – Public Administrative Sector) management were observed. In 2006, there was a mean surgical bed occupancy of 160 beds, a mean of 7,282 discharged patients and 47 discharged patients per bed, a mean of 42,147 patients-day, a mean stay of 5.6 days and a mean occupancy rate of 67%.

The mean population served by the hospitals was 433,791 users, with a mean of 5,922 surgical procedures performed (conventional and outpatient surgeries), including a mean of conventional surgeries

of 4,399 and a mean of outpatient surgeries of 1,524, which corresponds to a mean percentage of outpatient surgeries of 24% (median of 23%) for the sample. Additionally, a mean of 38 nurses per conventional surgical ward and six nurses per outpatient surgical ward were found. The mean of conventional surgical wards was six, while that of outpatient surgical wards was one for the entire sample. The mean overall waiting time was 116 days, reflecting an improvement in waiting time values when compared to previous years. However, there is a great variation in the overall waiting time among different health units, ranging from 15 to 274 days. In the analysis of waiting time per type of surgery, the mean waiting time for conventional surgeries was 121 days and that for outpatient surgeries was 88 days. Moreover, in the analysis of waiting time per hospital type, the overall waiting time was higher among district hospitals (134 days), followed by central hospitals (119 days) and type 1 hospitals (87 days) and these differences were statistically significant (Figure 1). The overall waiting time was identical for both the EPE and SPA types of management (Figure 2).

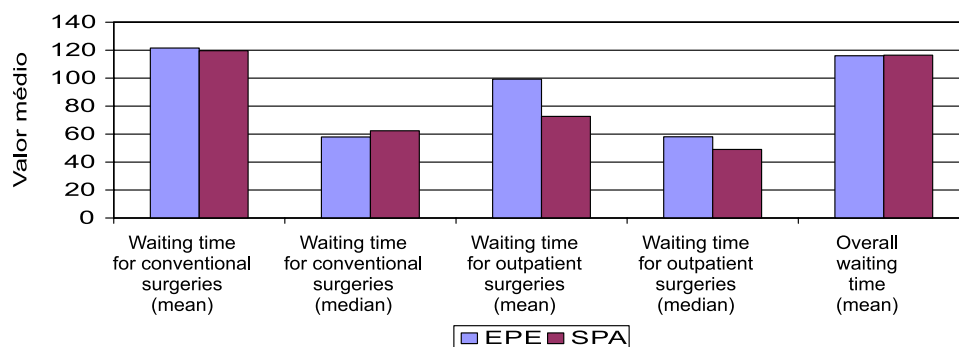
### Inferential analysis

There was a statistically significant inverse relation between the percentage of outpatient surgeries and overall waiting time for the entire sample, using Spearman's correlation (Table 1).



**Figure 1** - Waiting time in days and hospital classification (all health units), 2006.

**Figura 1** - Tempo de espera em dias e tipo de hospital (todas as unidades de saúde), 2006.



**Figure 2** - Waiting time and administration regime (all health units), 2006.

**Figura 2** - Tempo de espera e tipo de gestão (todas as unidades de saúde), 2006.

### Multiple linear regression analysis

The regression model initially included all independent variables of the study. Using a systematic analysis process of the importance of each variable in the developed models, those that were not relevant were eliminated step by step, according to the criteria of significance analysis of independent variables and those of maximization of the adjusted determination coefficient, through the Backward Stepwise procedure<sup>35</sup>. Subsequently, the analysis of outliers and refining of the model through exclusion of these outliers was performed. An outlier was considered as an observation in which the standard residue had an absolute value higher than 1.96 for a significance level of 5%. The estimates of coefficients of significant independent variables included in

the model indicate the following (Tables 2 and 3):

- The increase of 1% in the percentage of outpatient surgeries is associated with the reduction in the mean waiting time of 2.32 days, while the other variables remained constant;
- The district hospital type is associated with the increase in the mean waiting time of 27.18 days, while the other variables remained constant;
- The SPA management type is associated with the increase in the mean waiting time of 36.34 days, when compared to the EPE management type, while the other variables remained constant;
- The increase of one unit in surgical bed occupancy is associated with the increase in mean waiting time of 2.66 days, while the other variables remained constant;

**Table 1** - Day-surgery x waiting time (all health units), 2006.

**Tabela 1** - Cirurgia de ambulatório x Tempo de espera (todas unidades de saúde), 2006.

		Spearman's correlation test				
		Waiting time for conventional surgeries (mean)	Waiting time for conventional surgeries (median)	Waiting time for outpatient surgeries (mean)	Waiting time for outpatient surgeries (median)	Overall waiting time (mean)
Percentage of outpatient surgeries	Correlation coefficient	-0.214	-0.160	0.116	0.082	-0.247(*)
	P-value	<b>0.083</b>	<b>0.196</b>	<b>0.348</b>	<b>0.512</b>	<b>0.044</b>
	N	67	67	67	67	67

\* Normal correlation for a significance level of 0.05 / \*Correlação normal, para um nível de significância de 0.05



**Table 2** - Initial linear regression model: dependent variable – overall waiting time, 2006.**Tabela 2** - Modelo de regressão linear inicial: Variável dependente - tempo de espera geral, 2006.

Coefficient of determination: $r^2 = 0.802$		SS	g.l.	MS	F	Valor prova
Adjusted coefficient of determination: $r_a^2 = 0.247$	Regression	96602.631	21	4600.125	1.626	0.146
Estimate of standard deviation: $\sqrt{MSE} = 53.19$	Residues	53750.729	19	2828.986		
F = 1.626 $\Rightarrow$ Significance F = 0.146	Total	150353.360	40			

d.f – degrees of freedom; SS and MS – square sum and mean square sum / g.l. – graus de liberdade; SS e MS – somatório e média do somatório dos quadrados.

	Bi	s(bi)	T	P-value
(Constant)	194.624	171.960	1.132	0.272
Hospital type (1-Central)	21.238	58.269	0.364	0.720
Hospital type (2-District)	46.961	36.501	1.287	0.214
Type of management	9.191	28.082	0.327	0.747
Bed occupancy (surgical)	1.666	1.374	1.212	0.240
Discharged patients	0.005	0.017	0.285	0.779
Hospitalization days	-0.004	0.005	-0.914	0.372
Bed occupancy rate	4.807	3.653	1.316	0.204
Mean waiting time	-38.747	32.053	-1.209	0.242
Discharged patients/bed	-3.937	4.689	-0.840	0.412
Conventional surgical ward nurses	-0.985	0.858	-1.148	0.265
Outpatient surgical ward nurses	2.346	1.175	1.995	0.061
Conventional BO	7.617	8.799	0.866	0.398
Outpatient BO	-8.830	22.515	-0.392	0.699
Number of conventional surgeries	-0.013	0.018	-0.727	0.476
Number of outpatient surgeries	0.016	0.020	0.806	0.430
Percentage of outpatient surgeries	-158.212	94.139	-1.681	0.109
Population covered	-9.84E-006	0.000	-0.368	0.717
Anesthesiologists	1.641	1.965	0.835	0.414
Surgeons	-2.379	1.528	-1.557	0.136
Total number of physicians	0.193	0.644	0.299	0.768
Total number of nurses	-0.101	0.329	-0.307	0.762

bi and s(bi) – estimates of coefficient and its standard deviation for the i variable. / bi e s(bi) – estimativas do coeficiente e do seu desvio padrão para a variável i. t – Student's t test statistics. P-value – significance level of Student's t test. / t – Estatística do teste t de Student. Valor de prova – nível de significância do teste t de Student.

- The increase of one thousand units in hospitalization days is associated with the increase in mean waiting time of 6.3 days, while the other variables remained constant;
- The increase in bed occupancy rate of 1% is associated with the increase in mean waiting time of 8.27 days, while the other variables remained constant;
- The increase in mean stay in a unit is associated with the reduction in mean waiting time of 84.51 days, while the other variables remained constant;
- The increase in the discharged patients/bed ratio in a unit is associated with the reduction in mean waiting time of 7.41 days, while the other variables remained constant;
- The increase of one nurse in the conventional surgical ward is associated with the reduction in mean waiting time of 1.13 days, while the other variables

**Table 3** - Final linear regression model: dependent variable – overall waiting time, 2006.**Tabela 3** - Modelo de regressão linear final: Variável dependente - Tempo espera geral, 2006.

Coefficient of determination: $r^2 = 0.757$		SS	d.f.	MS	F	P-value
Adjusted coefficient of determination: $r_a^2 = 0.598$	Regression	57659.955	13	4435.381	5.035	<b>.001</b>
Estimate of standard deviation: $\sqrt{MSE} = 29.70$	Residues	18498.399	21	880.876		
F = 5.035 $\Rightarrow$ Significance F = 0.001	Total	76158.355	34			

d.f. – degrees of freedom; SS and MS – square sum and mean square sum / g.l. – graus de liberdade; SS e MS – somatório e média do somatório dos quadrados.

	Bi	s(bi)	T	P-value
(Constant)	339.000	80.789	4.196	.000
Hospital type (2-District)	27.179	14.749	1.843	.080
Management type	36.340	15.301	2.375	.027
Bed occupancy (surgical)	2.660	.711	3.742	.001
Hospitalization days	-.006	.002	-2.647	.015
Bed occupancy rate	8.272	1.886	4.387	.000
Mean waiting time	-84.511	17.926	-4.715	.000
Discharged patients/bed	-7.407	1.846	-4.013	.001
Conventional surgical ward nurses	-1.131	.471	-2.399	.026
Conventional BO	18.120	5.408	3.351	.003
Number of conventional surgeries	-.015	.006	-2.548	.019
Number of outpatient surgeries	.033	.010	3.458	.002
Percentage of outpatient surgeries	-231.534	57.290	-4.041	.001
Surgeons	-2.832	.752	-3.768	.001

bi and s(bi) – estimates of coefficient and its standard deviation for the i variable. / bi e s(bi) – estimativas do coeficiente e do seu desvio padrão para a variável i.  
t – Student's t text statistics. P-value – significance level of Student's t test. / t – Estatística do teste t de Student. Valor de prova – nível de significância do teste t de Student.

remained constant;

- The increase of one conventional surgical ward is associated with the increase in mean waiting time of 18.12 days, while the other variables remained constant;
- The increase in one unit in the number of conventional surgeries is associated with the reduction in mean waiting time of 0.015 days, while the other variables remained constant;
- The increase of one unit in the number of outpatient surgeries is associated with the increase in mean waiting time of 0.033 days, while the other variables remained constant;
- The increase of one surgeon is associated with the reduction in mean waiting time of 2.83 days, while the other variables remained constant.

## Discussion

It could be concluded that there was an increase in the percentage of outpatient surgeries in 2006, compared to previous years, although with great variability among different health units, regardless of their geographic location or dimension (assessed in terms of surgical production), ranging between 0% and 75%. The analysis of human resources and materials found a greater amount of resources for conventional surgical wards, reflecting a clear numerical disadvantage of outpatient surgical wards in terms of facilities and health professionals specialized in this practice, which could be one of the reasons for their performance being lower than what was expected<sup>38-42</sup>.

The analysis of waiting time per hospital

type showed that the waiting time for conventional surgeries (mean and median) and outpatient surgeries (mean and median) is higher in district hospitals than central hospitals, with statistically significant differences<sup>34</sup>. The reasons for the poorer performance of district hospitals are associated with user-related factors (longer distance between the user's home and the hospital, greater difficulty in transportation), which are out the scope of this study<sup>31,41,42</sup> (Figures 1 and 2).

Spearman's correlation analysis (Table 1) for the entire sample (73 health units with surgical services) confirms the hypothesis that the percentage of outpatient surgeries performed is associated with waiting time, so that the higher the percentage of outpatient surgeries, the shorter the mean overall waiting time. Thus, the multiple linear regression analysis confirmed the "percentage of outpatient surgeries" as a determinant variable of waiting time. Thus, the increase of 1% in the percentage of outpatient surgeries is associated with the decrease in overall waiting time of 2.32 days, while the other variables remained constant. Other variables directly associated with waiting time were "district hospital type" and "SPA management type". "Percentage of outpatient surgeries", "number of surgeons" and "number of nurses in the conventional surgical ward" were variables inversely associated with waiting time<sup>46-48</sup> (Tables 2 and 3). The association with hospital management type – with the best performance being observed among the EPE hospitals – is encouraging in view of the reality experienced by Portugal, as it moves from the SPA model to the EPE model<sup>12,13</sup>. The results of the regression analysis were in agreement with those found in other studies<sup>1,22-27,31</sup>, in terms of determining factors: infrastructure (number of wards available for surgery), human resources (number of surgeons and nurses available), hospital type, and hospital management type. The number of anesthesiologists was not found to be a determining factor of waiting time, although

its number was lower (nearly half) than that of surgeons and although the lack of anesthesiologists had been considered as a relevant factor in other studies<sup>31,34,35</sup>.

With regard to the model used in the multiple regression analysis, it should be emphasized that the hypothesis of "absence of multicollinearity"<sup>35,36</sup> was not observed in the linear regression model constructed, probably due to the small dimension of the sample with regard to the number of variables. The fact that this hypothesis was not confirmed hinders the use of this model to predict waiting times, although this was not the main objective of the present study.

## Conclusion

Despite the limitations of this type of study, the results obtained from the multivariate analysis showed that ambulatory surgery appears to be associated with shorter waiting time for elective surgeries<sup>42-44</sup>. Thus, it could be concluded that their development should be promoted as a strategy to improve access to health services<sup>46-48</sup>. Additionally, other potentially determining factors of waiting time for day surgeries could be identified and "hospital management type" and "number of surgical theatres available" were those that apparently had the greatest influence and are useful for the work of health authorities.

The present results must be interpreted according to the limitations of this study and a more in-depth analysis may be required in the future.

Conflicts of interest: authors declared no conflicts of interest.

Ethical approval: The present study was approved by the Research Ethics Committee of the Institute of Hygiene and Tropical Medicine (IHMT) at the New University of Lisbon.

Acknowledgements: Authors would like to thank Professor Paulo Pereira for his support in the statistical data treatment.

## References

1. OECD. *Towards High Performing Health Systems: the OECD Health Project* (versão eletrônica); 2004. Disponível em [www.oecd.org/dataoecd/](http://www.oecd.org/dataoecd/) (Acessado em 10 de novembro de 2007).
2. Hurst J, Siciliani L. *Explaining waiting times variations for elective surgery across OECD countries*. OECD Health Working Papers; 2003. Disponível em [www.oecd.org/dataoecd/](http://www.oecd.org/dataoecd/) (Acessado em 10 de novembro de 2007).
3. Barkun, Barkun JS. Waiting lists for surgery. *Can J Surg* 2002; 45(5). (versão eletrônica). Disponível em [www.ncbi.nlm.nih.gov/pubmed/](http://www.ncbi.nlm.nih.gov/pubmed/) (Acessado em 30 de novembro de 2007).
4. Waddell JP, MD. Wait times and health care resources. *Can J Surg* 2003; 47(6). (versão eletrônica). Disponível em [www.ncbi.nlm.nih.gov/pubmed/](http://www.ncbi.nlm.nih.gov/pubmed/) (Acessado em 27 de novembro de 2007).
5. Oudhoff JP, Timmermans DRM, Knol DL, Bijnen AB, Wal G. (2007) *Waiting for elective general surgery: impact on health quality of life and psychosocial consequences*, doi:10.1186/1471-2458-7-164 (versão eletrônica). Disponível em [www.pubmedcentral.nih.gov/](http://www.pubmedcentral.nih.gov/) (Acessado em 27 de fevereiro de 2008).
6. Davis K, Schoen C, Schoenbaum SC et al. Mirror, mirror on the wall: an update on the quality of American health through the patient's lens (versão eletrônica). The Commonwealth Fund, 2006. Disponível em [www.commonwealthfund.org/publications/](http://www.commonwealthfund.org/publications/) (Acessado em 03 de novembro de 2007).
7. Willcox S, Seddon M, Dunn S et al, Measuring and reducing waiting times: A cross-national comparison of strategies. (versão eletrônica) *Health Affairs* 2007; 26 (4): 1078-1087. Disponível em [www.commonwealthfund.org/usr\\_doc/](http://www.commonwealthfund.org/usr_doc/). (Acessado em 3 de novembro de 2007).
8. Biscaia AR, Ferrinho P et al. *Cuidados de Saúde Primários em Portugal – Reformar para Novos Sucessos*. Lisboa: Padrões Culturais Editora; 2006
9. Campos CD, Simões J. *O Percurso da Saúde: Portugal na Europa*. Lisboa: Almedina; 2011.
10. Simões J. *Retrato Político da Saúde – Dependência do Percurso e Inovação em Saúde: da Ideologia ao Desempenho*. Lisboa: Almedina; 2009.
11. OPSS. *Relatório de Primavera 2006 – Um ano de governação em Saúde*. Observatório Português de Sistemas de Saúde; 2006.
12. OPSS. *Relatório de Primavera 2008*. Observatório Português de Sistemas de Saúde; 2006.
13. Santos R. *Tipos de Hospitais 1989*. Disponível em <http://portalcodgdh.minsauade.pt/index.php> (Acessado em 2009 e 2012).
14. Instituto Nacional de Estatística (INE), 2002. Disponível em [www.ine.pt](http://www.ine.pt). (Acessado em março de 2012).
15. Health Consumer Powerhouse. Disponível em [www.healthpowerhouse.com](http://www.healthpowerhouse.com). (Acessado em 20 de março de 2009).
16. Hurst J, Siciliani L. *Tackling excessive waiting times for elective surgery: a comparison of policies in twelve OECD countries*. (versão eletrônica) OECD Health Working Paper; 2003. Disponível em [www.oecd.org/dataoecd/](http://www.oecd.org/dataoecd/) (Acessado em 8 de novembro de 2007).
17. Zalmanov M. *As US outpatient surgery rates soar, ambulatory surgical centers shown to be safer than doctor's offices or hospitals for same-day procedures*. Disponível em [www.prweb.com/releases/2007/09](http://www.prweb.com/releases/2007/09). (Acessado em 5 de novembro de 2007).
18. Westert GP. Geographical variations in surgery: outpatients versus inpatient treatment. (versão eletrônica). *Revue Medicale de l'Assurance Maladie* 2002; 33(1). Disponível em [www.ameli.fr/fileadmin/](http://www.ameli.fr/fileadmin/) (Acessado em 22 de outubro de 2007).
19. Tribunal de Contas. *Auditoria ao acesso aos cuidados de saúde do SNS*. 2007. Disponível em [www.tcontas.pt](http://www.tcontas.pt). (Acessado em 5 de novembro de 2007).
20. Francisco AP. *Avaliação de Desempenho – Hospitais SA*. DGS; 2005.
21. Lemos P. Indicações e Vantagens da Cirurgia de Ambulatório. *Revista da SPA* 1998; 9: 104-13
22. Lemos P. *A cirurgia em regime de ambulatório no HGSA – uma década de experiência*. GICCA – HGSA 1998-2005.
23. Lemos P. *Enquadramento nacional e internacional de cirurgia do ambulatório*. Hospitais SA – Unidade de Missão; 2003 (versão eletrônica). Disponível em [www.hospitalsepe.min-saude.pt/](http://www.hospitalsepe.min-saude.pt/) (Acessado em 12 de novembro de 2007).
24. Natário A et al. *Cirurgia de Ambulatório: recomendações para o seu desenvolvimento*. DGS, Direcção de Serviços e Planeamento; 2001 (versão eletrônica). Disponível em [www.srsdocs.com/parcerias/publicacoes/](http://www.srsdocs.com/parcerias/publicacoes/) (Acessado em 29 de novembro de 2007).
25. Associação Portuguesa de Cirurgia de Ambulatório – APCA. *I Inquérito Nacional de Cirurgia de Ambulatório*; 1999.
26. Associação Portuguesa de Cirurgia de Ambulatório – APCA. *II Inquérito Nacional de Cirurgia de Ambulatório*; 2001.
27. Associação Portuguesa de Cirurgia de Ambulatório – APCA. *III Inquérito Nacional de Cirurgia de Ambulatório*; 2003.

28. Direção Geral de Saúde. *O desenvolvimento da Cirurgia de Ambulatório como objectivo estratégico do hospital*. DGS; 2005.
29. Barros P. *As listas de espera para intervenção cirúrgica em Portugal*. Ipris; 2008.
30. Indicadores do SNS – UGIC. *1 Semestre de 2010*. Disponível em [www.acss.min-saude.pt](http://www.acss.min-saude.pt) (Acessado em 01 de março de 2012).
31. Ministério da Saúde. *Cirurgia de Ambulatório: um modelo de qualidade centrada no utente – Relatório Final*. Comissão Nacional para o Desenvolvimento da Cirurgia de Ambulatório. Outubro de 2008.
32. Rothman KJ, Greenland S. *Modern Epidemiology*. 2<sup>nd</sup> edition, Philadelphia: Lippincott, Williams & Wilkins; 1998.
33. DGS/DSIA/Divisão de Estatística; 2006. *Centros de Saúde e Hospitais: Recursos e Produção do SNS-2005*. Disponível em [www.dgsaude.pt](http://www.dgsaude.pt) (Acessado em 25 de março de 2008).
34. Murteira JF. *Análise Exploratória de Dados – Estatística Descritiva*. Lisboa: Editora McGraw-Hill; 1993.
35. Harrell Jr. FE. *Regression Modeling Strategies*. New York; Ed. Springer-Verlag; 2001.
36. Henriques A, Neves C, Pesquita I. *Estudos correlacionais e estudos causal-comparativos. Metodologia da Investigação I*. DEFCUL; 2004. (versão eletrônica). Disponível em [www.educ.fc.ul.pt/docentes/](http://www.educ.fc.ul.pt/docentes/) (Acessado em 27 de fevereiro de 2008).
37. Martí J. *Management of surgical waiting lists by health centers and health professionals*. Hospital de Traumatologia y Rehabilitación Vall d'Hebron, Barcelona. Disponível em [www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov) (Acessado em 27 de fevereiro de 2008).
38. Department of Human Services, State Government of Victoria, Australia; 2007. *Extended day surgery: Guidelines for the implementation and evaluation of 23-hour service models in Victoria*. (versão electrónica). Disponível em [www.health.vic.gov.au/eletivesurgery](http://www.health.vic.gov.au/eletivesurgery) (Acessado em 12 de novembro de 2007).
39. Canadian Institute for Health Information; 2007. *Surgical volume trends within and beyond wait times priority areas*. (versão eletrônica). Disponível em [www.cihi.ca](http://www.cihi.ca) (Acessado em 27 de outubro de 2007).
40. Taylor MC, Hadorn DC. Developing priority criteria for general surgery: results from the Western Canada Waiting List Project. *Can J Surg* 2002; 45(5): 351-7. (versão eletrônica). Disponível em [www.ncbi.nlm.nih.gov/pubmed/](http://www.ncbi.nlm.nih.gov/pubmed/) (Acessado em 26 de fevereiro de 2008).
41. The Australian Institute of Health and Welfare. *Epidemiology and Health Information Branch*; 1996.
42. Department of Health. NHS. UK; 2002. *Day surgery: Operational guide – waiting, booking and choice*. (versão eletrônica). Disponível em [www.dh.gov.uk/en/Publicationsandstatistics/](http://www.dh.gov.uk/en/Publicationsandstatistics/) (Acessado em 29 de novembro de 2007).
43. Department of Human Services. State Government of Victoria. Australia; 2007. *Extended day surgery: Guidelines for the implementation and evaluation of 23-hour service models in Victoria*. (versão eletrônica). Disponível em [www.health.vic.gov.au/eletivesurgery](http://www.health.vic.gov.au/eletivesurgery) (Acessado em 12 de novembro de 2007).
44. Americano M. *Recomendações para Programas de Cirurgia de Ambulatório*. Direção Geral de Saúde, Lisboa: DGS; 2001.
45. Department of Human Services. Victoria. Australia; 2004. *Review of elective surgery waiting lists – Findings and Recommendations*. (versão eletrônica). Disponível em [www.dhs.vic.gov.au/ahs/archive/waitlist/4.htm](http://www.dhs.vic.gov.au/ahs/archive/waitlist/4.htm) (Acessado em 05 de novembro de 2007).
46. Martin S, Jacobs R, Rice N, Smith P. *Waiting times for elective surgery: a hospital – based approach*. University of York Centre for Health Economics, Department of Economics; 2003. (versão eletrônica). Disponível em [www.york.ac.uk/media/che/documents/reports/wait2.pdf](http://www.york.ac.uk/media/che/documents/reports/wait2.pdf) (Acessado em 05 de novembro de 2007).
47. McIntosh T, Fafard P et al. *The taming of the queue IV: New frontiers of wait time measurement, monitoring, and management*. Canadian Policy Research networks; 2007. (versão eletrônica). Disponível em [www.cprn.org/](http://www.cprn.org/) (Acessado em 06 de novembro de 2007).
48. Bosch X. Spain cuts waiting times for surgery. *Br Med J* 1999; 318: 71817181, 419; 93;117. (versão eletrônica). Disponível em [www.bmj.com/bmjournals.com](http://www.bmj.com/bmjournals.com) (Acessado em 26 de fevereiro de 2008).
49. Bian J, Morrissey M. HMO Penetration, Hospital Competition, and Growth of Ambulatory Surgery Centers. *Health Care Financ Rev* 2006; 27(4): 111-112.
50. Oudhoff JP, Timmermans DRM et al. *The acceptability of waiting times for elective general surgery: the appropriateness of prioritising patients*. doi:10.1186/1472-6963-7-32; 2007. (versão eletrônica). Disponível em [www.pubmedcentral.nih.gov/](http://www.pubmedcentral.nih.gov/) (Acessado em 25 de fevereiro de 2008).
51. NHS, August 2002. *Day Surgery: Operational guide, waiting, booking and choice - Departement of Health*.
52. Aguiar P. *Guia Prático de Estatística em Investigação Epidemiológica: SPSS*. 1<sup>st</sup> edition, Lisboa: Climepsi Editores; 2007.

53. Harfouche AP. Hospitais Transformados em Empresas- Análise do Impacto na Eficiência: Estudo Comparativo. Lisboa, ISCPS; 2008.
54. Pina AP. *Investigação e Estatística com o EpiInfo*, 2005. (versão electrónica). Disponível em [www.saudepublica.web.pt](http://www.saudepublica.web.pt) (Acessado em 12 de outubro de 2008).
55. Regulamento do SIGIC. Portaria 45/2008 de 15 de janeiro.
56. Diario da Republica n. 54, I, serie B, Ministerio da Saude, Portaria 281/2005 de 17 de Marco, acedido em <http://www.dre.pt/cgi/dr>.

Received: 05/05/11  
Final version: 11/01/13  
Approved: 05/02/13