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HOSPITAL MANAGEMENT AND THE CREATION OF VALUE THROUGH CLINICAL RESEARCH

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RESUMEN:

La investigación en el ámbito sanitario debería influir en la buena práctica clínica, sin embargo, medir el impacto de la generación de conocimiento en la satisfacción y calidad de vida de la sociedad ha demostrado ser un proceso complejo de abordar.

En este trabajo se pretende analizar el efecto de la actividad investigadora, en un hospital público español, sobre la satisfacción de sus pacientes. Abriendo también la puerta a estudios posteriores que vinculen la generación de conocimiento a los indicadores de rendimiento propios de este tipo de organizaciones.

PALABRAS CLAVE: Gestión Hospitalaria. Indicadores de opinión. Rendimiento. Generación de conocimiento.

SUMMARY:

Healthcare research should have a bearing on good clinical practice, but to measure the impact of knowledge generation on the quality of life of society has been shown to be a complex process to approach.

This article attempts to analyse the effect that research activity has on patient satisfaction in a Spanish public hospital. It also opens the door for further studies that associate knowledge generation with the specific performance indicators of this type of organisation.

KEYWORDS: Hospital management.Opinion indicators. Performance. Knowledge generation.

INTRODUCTION

It is simple and logical to infer that research, particularly in the health field, should have a positive impact on clinical practice and, thus an improvement in the health of the public and in their quality of life. However, recent reviews have demonstrated that the measurement of this impact is a complex subject to tackle. This is because, among other things, the improved health of individuals arises from a combination of elements that make it difficult to associate an immediate and direct effect of the generation of scientific knowledge with the wellbeing of the patients [1-3].

In accordance with Escudero et al[4], the research process has three fundamental phases: knowledge generation, transmission of the knowledge, and the application of the knowledge generated. The time from the first to the last phase is far from being immediate, with there being a considerable time lag in many cases. One example is clinical trials with drugs that require being tested in different phases and over several years before they can be generally circulated and directed at society as a whole.

However, society and governments perceive that biomedical research has a positive effect. A considerable increase in life expectancy of between 20 and 30 years took place during the twentieth century, although unequally distributed between countries, with these inequalities being associated with ignorance and not just to poverty; "the poor die young and a large part of this mortality excess is attributable not directly to poverty but to failure to apply the knowledge, processes and products that are the fruits of research"[5].

Although it is clear that research has contributed to the already mentioned decrease in mortality, this could be due to factors arising from the research activity itself - which provides advice to governments and the public, which is reflected in specific Health Policies, such as prevention and vaccination campaigns or clinical practice guidelines - but also to other different factors, such as the life habits of the individuals or their genetic predisposition[6]. For this reason, those countries who invest more in R+D+I have began to insist on new indicators that can provide reliable information on the positive effect of medical research on society[1-2].

One study worthy of mention is that of Silverstein et al[7] who in 1995 estimated that each dollar invested in biomedical research by National Health Institutes, generated a return of 16 dollars in the United States of America.

This research work aims to link the research activity of different Spanish public hospital departments, formalised through research projects managed by a Foundation, with their daily clinical work.

The intensity of the research activity will be measured with bibliometric parameters (Number of Publications and Impact Factor) and quantitative ones (Number of Research Projects), aiming to determine the effect on the hospital efficiency where these projects take place, which, in turn, will be measured using the appropriate performance indicators of their activity, such as consultations, admissions, or the number of complaints. There are obviously other external results that will not be included, for the moment, in the aim of this work.

In short we will try to determine whether knowledge and innovation generation that arises from formal research, sponsored by the Foundation created for this purpose, leads to the creation of value through the satisfaction of the user due to an increase efficiency of clinical practice.

In a later phase, this research work also attempts to link the changes occurred in the information system attributed to management control with the performance indicators in the preceding and subsequent years. This analysis is essential to give the study rigor. Some previous observations enable the possible existence of interferences in the results to be inferred. Certain changes in the assignment of function of the management accounting system may be determining factors to complement and explain this prior exploratory analysis. It tries to observe whether or not the functions attributed to management accounting, under the perspective proposed by Zimmerman[8] have been modified.

The methodology used is based on the case method. Case study is a useful technique when the phenomenon to investigate is the result of a complex interaction of multiple factors, and their description and subsequent explanation requires endogenous information from multiple primary sources. The use of multiple sources enables qualitative and quantitative data to be combined to achieve a richer understanding of the dynamics of the case and control, to a greater extent, the accuracy of the information.

Theoretical framework

Knowledge, as a source of value creation in organisations, has been extensively analysed by the Positive Agency Theory.

Simon[9] already mentioned that a successful organisation must avoid stagnation of its recourses, by employing people who could provide relevant knowledge to the organisation, or enriching the existing recourses by continuous learning processes.

This is of vital importance in the health care field, where the service is provided to the public by highly qualified staff that also require continuously updating their knowledge. In fact, it is desirable that the activity of health professionals rest on three main pillars, to know, the clinical activity itself (diagnostic and therapeutic) linked to the patient bedside, teaching, and research [3,10].

On the other hand, the greater, more innovative, and higher the quality of the scientific production, the more likely the organisations and the researchers themselves of obtaining effects in clinical practice. It is also reasonable to assume that the

better the resources available, the greater will be the possibilities of generating new and relevant knowledge for clinical practice[4].

According to Jensen and Meckiing[11] and Charreaux[12], knowledge occupies as central position in the Positive Agency Theory, which will serve to focus the theoretical framework of this research, and is attributed a determining role in the genesis of organisational performance. For Professor Azofra Palenzuela[13], when the generation, transfer, and application of knowledge is a substantial part of the exchanges that are made between individuals of an organisation, it leads to long-term relationships within that organisation. Furthermore, the establishment of prolonged contractual relationships fosters investment by the organisation into specific in-house knowledge, being of great value for this.

Positive Agency Theory, and within this the so-called Positive Accounting Theory have, within the New Institutional economy, interesting ramifications for our study, once it is completed, with the aim of examining in detail the role of the In-House Accounting Information Systems concerning the induction of knowledge generation and transmission processes, and in particular the increase in value for the types of organisations that concern us.

A Case analysis

With the aim of approaching the research relative to the work we present, we have opted to use research methodology known as Case Study. This chose is motivated by the fact that the nature of the work, as well as the subjects that we intend to cover, are adequately identified within the sphere of activity that Yin[14] identifies for this research method.

According to Jensen et al[15], case study is a clinical method, based on field work, especially suitable when the knowledge of the phenomenon to investigate requires qualitative and detailed information, being the area of management sciences where this empirical research method has been shown to be especially fruitful.

In short, the case study method is increasingly chosen for the analysis of questions regarding the implementation and functioning of information systems. The reasons that appear to be most relevant for this choice are, in the words of Benbasat et al[16], the following:

> a) The need to study information systems in the environment in which they are developed and in this way, to determine its "state of the art", and
> b) The possibility of understanding the nature and dynamism of the processes that shape them, as well as to grasp its complexity, due in part, to the continuum of changes and innovations to which they are subjected.

From with in the different case study typology, we have opted for the explanatory case design, due to the nature and purpose of our research.

It is our aim to empirically contrast a theory hardly dealt with in the literature, which links organisational design with the creation of value and knowledge, in a very specific context, as is the health field, and its impact on patient satisfaction.

According to the literature, the role of Internal Accounting Information Systems (IAIS) in relation to the processes associated with the creation, transfer and application of knowledge within organisations, has received little attention. Attention is drawn to this incipient "state of the art", since IAIS are one of the most relevant and significant information systems and with an information flow that aspires to be consistent with current needs.

Thus, there is a gap, and the case study that we present here attempts to shed light on how and why real practices developed in the field of IAIS can be coordinated in the stated direction.

Organisational structure of spanish public hospitals

Most of the Spanish public hospitals generally comply with an organisational model set out in regulatory guidelines established in the second half of the 1980's, soon after the approval of the General Health Law. A model that, within the period of time that concerns us in this study, is feasible and has experience few changes. In this sense, three functional areas are configured[17]:

- General Management area: In this area are the supervisory and general coordination functions, the management of resources and services, institutional relationships, strategic planning, and guarantee of the rights of the public.
- Health Care Area. This area groups together the management bodies responsible for the development of the healthcare lines of activity of the Hospital, and are also responsible for general organisational activity functions and coordination between the different in its and departments. In this field, the following management bodies are established:
- Medical Division.
- Nursing Division.
- Medical Sub-Divisions.
- Nursing Sub-Divisions.
- Technical-Administrative and Logistical Support Area: Includes the management bodies of the Management and General Services Division, and the corresponding sub-divisions. Under its responsibility are grouped the functions for supplies, stores management, general logistics, general services management, external contracts management and management of administration staff and subordinates. The General Services Division may be responsible for the planning and management of different alteration works that are done, as well as the planning and management of decentralised investment plans; it will also be concerned with the management of centralised investment plans, etc.

For our study, special emphasis needs to be made on the importance of the Services Control Management (SCG) within public hospitals, given that the surveillance, follow up, regulation and control systems are cornerstones of any organisation responsible for fulfilling the aforementioned objectives and for the monitoring of the activity of the organisation itself.

The Management Control System, according to Capstick and Tarride[18], is conceived in such a way that it goes further than being a simple way to report activity levels in an organisational unit whereby it establishes its performance level of certain activity parameters, but it is also a function that provides the administration of the appropriate hospital organisation with a global and complete vision of its effective viability. In this way, on the MCS being distributed throughout the whole organisation, it helps to integrate each and every one of its levels, and leads to a better use of resources.

In fact, the viability of a system means that its essential variables, in a defined time period, are within a specific range of values considered as normal. It is precisely this Management Control system that provides us with data needed to measure the activity and performance of the hospital.

In terms of our study, it is important to highlight two specific aspects within the hospital structure: Research (Channelled, in this case, through a Management Foundation), and patient satisfaction (Measured by the complaints recorded by the Patient Care Department).

The channelling of research funds through management units has been widely used in the Spanish National Health System. In the specific case that concerns us[19] the foundational purpose and aim is, generically, the promotion of scientific research in the Health field, as well as the development, sharing, dissemination, and support in all matters, works, and studies to this. To fulfil these aims, the Foundation, within its means and in accordance with the Schedules and Programs that its Board approves annually, develops activities such as:

- The awarding of grants to diverse studies and investigations of all classes of material, social, economic and business activities.
- Support for individuals and institutions that are involved in a similar activity.

This role of channelling and uniting research activity provides us with valuable material to make the measurements necessary for the aim of our study as regards the research activity of the hospital and its different departments, as well as its development over time, to later be able to associate it with the parameters that will enable us to determine its impact on the results of the health organisation analysed.

To do this, we also turn to the Patient Care department that is responsible for managing aspects related to the processing of suggestions and complaints received from patients and/or their relatives, being an efficient way when "taking the pulse" of the running of the organisation. The number of complaints per department, suitably weighted using the number of professionals per department, will give us a measure of the satisfaction of the patient.

Model formula, hypothesis and variables.

Hypothesis:

Based on the aforementioned studies up to now, in order to attempt to determine whether research activity can have an effect on professional clinical activity and, thus, on the patient, we propose the following working hypotheses:

H1: The increase in work load per clinical department negatively influences patient satisfaction measured by the number of complaints.

H2: The generation of knowledge through basic and clinical research and its dissemination positively affects patient satisfaction measured by the number of complaints.

Variables:

We have obtained information on two departments in a Spanish public hospital, which has a Foundation that acts as a research management body, for a period of the six years between 2006 and 2011.

The data selected for the study of workloads per department has been provided by the Management Control department of the hospital.

The data as regards the generation of knowledge and the research activity of the centre has been provided by the Management Foundation.

The complaints per department were obtained from the Patient Care department.

Our analysis includes the following parameters for each of the departments and the years covered by our analysis:

- **Number of patient visits as the sum of the first and successive consultations and admissions.**
- **Number of clinicians.**
- **Number of complaints.**
- **Number of publications.**
- **Impact factor of the publications.**
- **Number of projects.**

Model:

To contrast the first hypothesis, we have constructed a Cobb-Douglas model based on that developed by Griliches[20-21], with three productive factors:

$$R_i = T_i^{\alpha} I_i^{\beta} \qquad (1)$$

Where R denotes the patient complaints per department, T is the number of patients per clinical department in each year, and I is the scientific production measured by the number of publications, the impact factor, and projects each year. The superscripts, α, β, are the elasticity coefficients of the complaints as regards workload and research, respectively. The subscript i identifies each department.

The elasticity coefficients measure the response of the complaints to changes made in the factors, work and generation of knowledge.

If $\alpha + \beta = 1$ signifies that the function has a constant returns to scale, that is to say, if the work and generation of knowledge is increased by a percentage, the complaints should be seen to increase by this same percentage. However, if $\alpha + \beta$ is < 1 the returns to scale of the function is decreasing, and if $\alpha + \beta$ is > 1 it is increasing.

The usual procedure to solve this type of equation is by linearization using a logarithmic transformation[1], which gives rise to the following equation:

$$Ln(R_i) = \alpha Ln(T_i) + \beta Ln(I_i) \qquad (2)$$

To introduce the data obtained from two different departments into the model, we have standardised the data using the first year as a baseline.

Table 1. Standardised Complaints data (R), patients per clinical department (T), and knowledge generation (I) for department 1.

Department 1			
Year	R	T	I
2006	100.000	100.000	100.000
2007	143.243	102.825	47.642
2008	127.928	102.344	190.567
2009	35.135	94.988	47.642
2010	45.045	92.441	190.567
2011	18.919	95.062	370.176

Table 2. Standardised Complaints data (R), patients per clinical department (T), and knowledge generation (I) for department 2

Department 2			
Year	R	T	I
2006	100.000	100.000	100.000
2007	76.190	99.204	158.755
2008	76.190	116.554	267.101
2009	19.048	103.113	389.564
2010	23.810	114.788	415.722
2011	38.095	117.910	537.503

Finally, we used a multiple linear regression model to find the elasticity constants.

RESULTS

Department 1:

Table 3. Adjusted results for department 1.

T		I	
Value	Standard Error	Value	Standard Error
1.363	0.42611	-0.44289	0.40268

Adj. R-Square 0.96695

$$R_1 = T_1^{1,363} I_1^{-0,44289} \qquad (3)$$

The result of from the multiple linear regression model show that the elasticity coefficient ? that corresponds to the number of patients seen by each clinical department will increase the number of complaints. On the other hand, it also shows that the

elasticity coefficient of the generation of knowledge β is negative, which implies that an increase in publications and projects decrease the number of complaints, as shown by equation 3.

The classic Cobb-Douglas model uses the partial derivative of the production function to find the marginal productivity as regards capital or labour, thus it is possible to determine the variation rate in the number of complaints depending on the number of patients per clinical department for a constant value of research activity. It is also valid to determine the variation rate in the number of complaints depending on the research activity for a ratio of patients per constant clinical department.

For example, equation 4 corresponds to the partial derivative of the number of complaints as regards the number of patients per clinical department.

$$\frac{\partial R_1}{\partial T_1} = 1.363\, T_1^{0.363}\, I_1^{-0.44289} \qquad (4)$$

The variation of the complaints has been calculated for a ratio of patients per clinical department increase, fixing the percentage of research activity at three different values, 1%, 5% and 10% above the baseline of our study, as shown in Figure 1. It is observed that a higher research activity lowers the increase in complaints for a progressive increase in the workload.

Figure 1. Graph of the partial derivative of the percentage of complaints as regards the number of patients per clinical department, for three different research activity values, 1%, 5% and 10%.
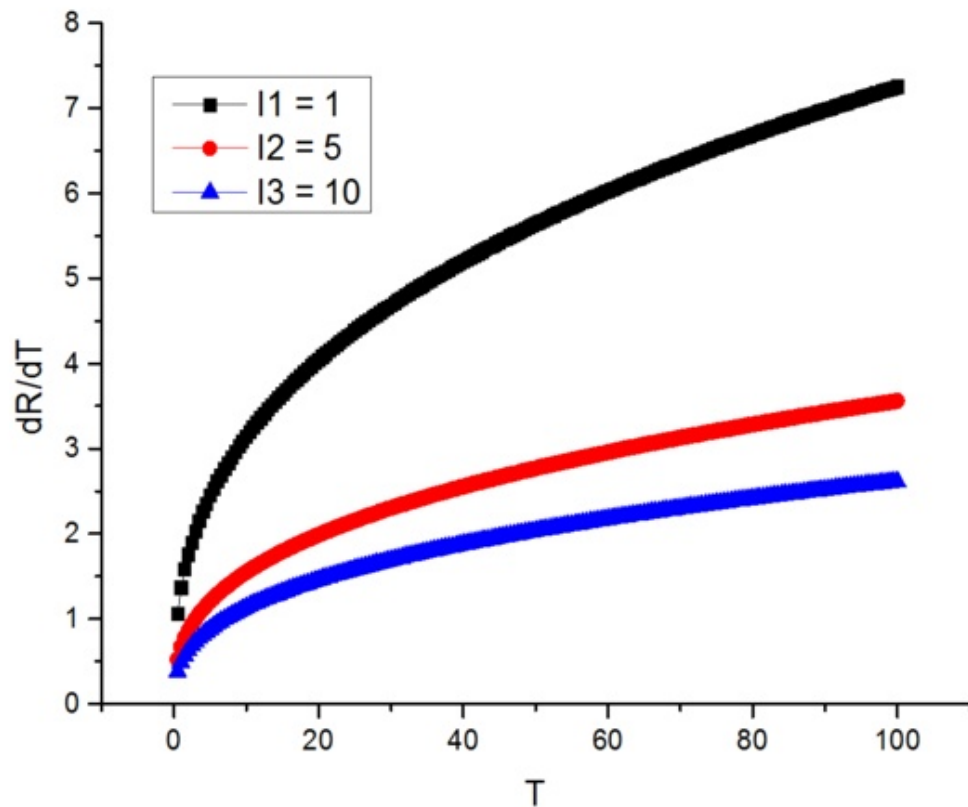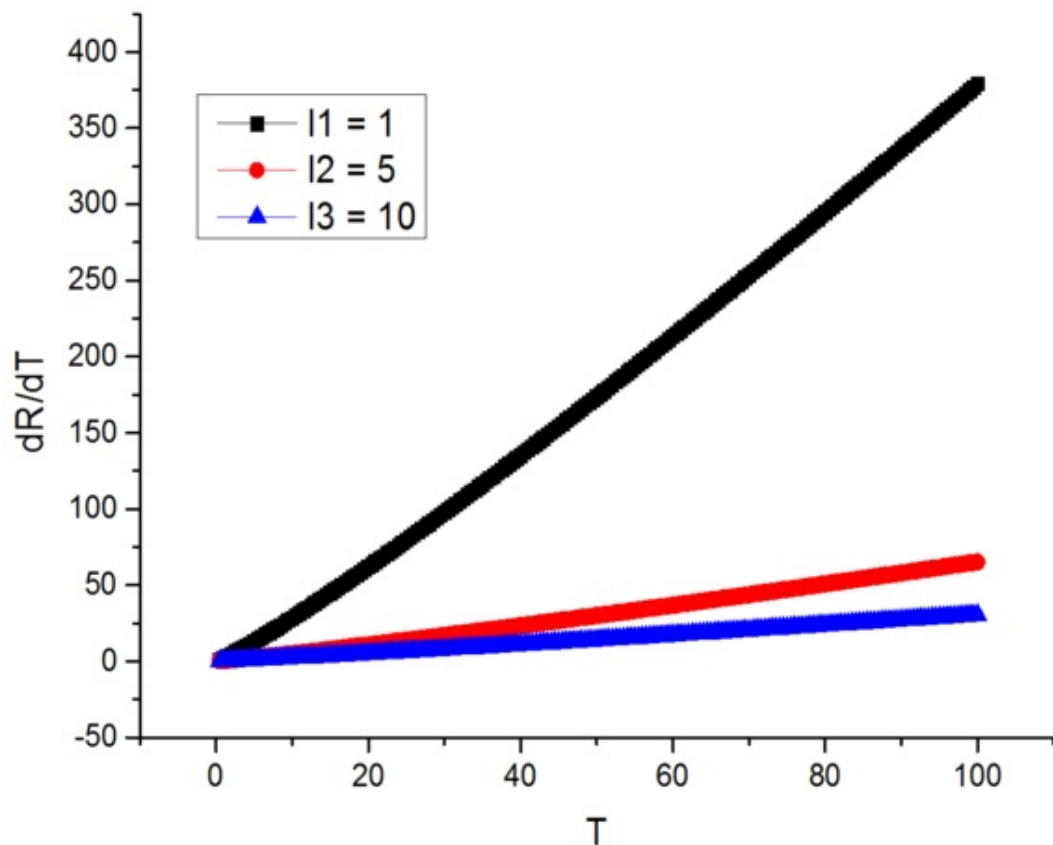

Department 2:

Table 4. Adjusted results for department 2.

T		I	
Value	Standard Error	Value	Standard Error
2.12555	0.33969	- 1.09435	0.28316
Adj. R-Square 0.99123			

$$R_2 = T_2^{2,12555} I_2^{-1,09435} \qquad (5)$$

$$\frac{\partial R_2}{\partial T_2} = 2.1255\, T_2^{1.12555} I_2^{-1.09435} \qquad (6)$$

Figure 2. Graph of the partial derivative of the percentage of complaints as regards patients per clinical department, for three different research activity values, 1%, 5% and 10%

In the same way, the variation of complaints for an increasing ratio of patients per clinical department is represented, fixing the percentage of research activity at three different values, 1%, 5% and 10% above the considered, as shown in Figure 2. As in the case of department 1, it can be observed that a higher research activity slows the growth of complaints for a progressive increase in workload. This department appears to be more sensitive to increases in workload for a very low research activity. For example, an increase of 100% in healthcare load, in the case of little or no research activity, shows increases of around 380% in complaints; however, when the scientific activity increases, this increase in complaints is fixed around 30%.

DISCUSSION

The same trend is seen in both departments, the higher the workload per clinical department, the number of complaints in the department increases, while a higher research activity leads to a decrease in the number of complaints.

The positive effect of research in decreasing the number of complaints per patient could basically have its origin in the motivation and satisfaction of the clinical department, as well as the updating of its knowledge arising from research projects.

On the other hand, a high workload could assume an excess in pressure in the clinical department and a stress factor. All the aforementioned influences its treatment of the patient and their satisfaction.

Although the model shows a correlation between research activity and productivity, it is important to find a balance between healthcare pressure and research. This opens the door to future research on the motivational effect of research, both at a personal and economic level.

However, this analysis is incomplete without approaching other aspects, such as the performance indicators of the hospital itself. In a subsequent phase, it is essential to analyse how management systems affect daily clinical practice in order to obtain a complete view, and identify and analyse the functioning of this type of organisation.

After our review of the literature we have not found any similar and previous work.

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Comment of the reviewer Alberto Enrique D'Ottavio PhD Professor and Researcher, Faculty of Medical Sciences, Rosario National University, Rosario. Argentina.

This article focuses its analysis a hospital management as well as in the creation of value through research. Considering the coherence of its different issues, it may be considered acceptable for publication in the Electronic Journal of Biomedicine.

Comment of the reviewer Larisa Ivón Carrera PhD Professor, Researcher and Dean, Faculty of Medical Sciences, Litoral National University, Santa Fe. Argentina.

As said by the authors in the Summary "*this article attempts to analyse the effect that research activity has on patient satisfaction in a Spanish public hospital. It also opens the door for further studies that associate knowledge generation with the specific performance indicators of this type of organisation*". In this regard and taking into account its suitable development. I think that it results acceptable for publication.