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Article information:

To cite this document:

Angelos Pantouvakis Panagiotis Mpogiatzidis, (2013), "Measuring clinical department efficiency – the impact of clinical leadership job satisfaction", *Benchmarking: An International Journal*, Vol. 20 Iss 3 pp. 305 - 321

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Measuring clinical department efficiency – the impact of clinical leadership job satisfaction

Clinical
department
efficiency

An application to public hospitals

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Received 19 August 2011
Revised 16 October 2011
Accepted 16 October 2011

Abstract

Purpose – The purpose of this paper is to evaluate clinical departments' performance per clinical sector in the context of the Greek public hospital care system.

Design/methodology/approach – The sample consisted of 96 internal pathology and surgical clinical departments in 15 hospitals in Greece and their technical efficiency was assessed by the use of data envelopment analysis. The proposed model used the number of nursing staff, medical specialists and department beds, pharmaceutical expenditure and clinical leadership job satisfaction as inputs while the number of hospitalized patients was selected as an output. Clinical leadership job satisfaction was captured by the use of a specialized questionnaire. The methodology applied investigated variations in technical efficiency in the presence or absence of job satisfaction. The model proposed an efficiency improvement through the possible reduction of inputs (input oriented) variable returns to scale.

Findings – Processing the results revealed variations in the way clinical leadership job satisfaction affects efficiency assessments per clinical sector. The impact of job satisfaction is verified for the surgical sector and rejected marginally for the pathology sector. Applied methodology results proposed reductions in pharmaceutical expenditure, human resources and available beds. These are indications towards implementing rational economic and human resources management and productive factors development.

Originality/value – This research effort uses job satisfaction as a quantitative variable to assess efficiency, focusing on clinical efficiency per clinical sector. In all efforts to restrain health expenditure, measuring clinical department efficiency is critical for health policy makers.

Keywords Greece, Hospitals, Leadership, Job satisfaction, Clinical governance, Efficiency, Data envelopment analysis, Clinical department, Clinical sector

Paper type Research paper

1. Introduction

According to the economic theory, available resources (and therefore health resources) are always insufficient compared to human needs and even more so to human desires. In addition, those resources often have competitive alternative uses. Finding the optimal use of health resources is never easy due to specificities of health as a commodity and health sector diversities compared to other economy sectors (Tountas, 2003).

Over the past decades in most Western countries health care expenditure increased significantly and this is a trend expected to continue. According to OECD data, during the last 40 years, health expenditure rose up to 150 percent, from 4 percent of GDP in 1960 to



Benchmarking: An International
Journal
Vol. 20 No. 3, 2013
pp. 305-321

© Emerald Group Publishing Limited
1463-5771
DOI 10.1108/14635771311318108

10 percent on average nowadays. Continuous population aging, rapid development and use of technologies, universal population insurance coverage, increased society demands for expanded health coverage and improved health services quality and induced demands from health services suppliers among others, are some of the factors that enhance this trend (ESDY, 2010).

Thus, in this context, measuring health services' efficiency is one of the first and fundamental steps in providing quality health services. Both cost and efficiency are dominant parameters shaping the future of health services while expanding, improving or developing health systems requires a scientific approach in planning, assessment and evaluation (Murray and Frenk, 2000). In recent years all health systems have developed policies aiming to improve the efficiency of health care services provided and control health expenditure growth (Mossialos and Le Grand, 1999; Drummond and Jöhnsson, 2003). At the same time, the necessity to restrain rising health expenditure highlights the need to evaluate the efficiency of medical practices and health services. This is reflected in the increasing number of empirical studies appearing in this field in the literature (Cunningham, 2001).

This study expands previous research on hospital care efficiency measures and contributes to the literature as follows. For the first time clinical leadership job satisfaction was used as quantitative variable to evaluate the technical efficiency of clinical departments in hospital care system. We have also investigated whether job satisfaction affects the estimation of technical efficiency whereas it is the first time in the Greek public hospital care system the introduced attempt to categorize inpatient cases using pharmaceutical expenditure as a criterion.

This study provides health policy makers and public sector reformers with a useful tool for assessing performance in the public hospital care system.

2. Conceptual background

2.1 Job satisfaction

Job satisfaction has been a subject of research at least since the Western Electric Hawthorne plant studies conducted by Roethlisberger and Dickson (1939). This study concluded that the interaction between the individual and the social organization of its workplace determined employee adjustment.

In the past 80 years job satisfaction has been heavily researched but suffers from many meanings or interpretations and the lack of a universal definition of the concept. Churchill *et al.* (1974, p. 255) defined job satisfaction for sales people as "all characteristics of the job itself and the work environment which salesmen find rewarding, fulfilling and satisfying, or frustrating and unsatisfying". Locke (1976, p. 1300) contended that job satisfaction is a "pleasurable or positive emotional state, resulting from the appraisal of one's job experiences" while Spector (1997) suggested that job satisfaction is the extent to which people like or dislike their jobs.

The factors shaping job satisfaction in different work environments have also been widely investigated in the literature. Churchill *et al.* (1974) identified seven factors defining job satisfaction the job itself, fellow workers, supervision, company policy and office support, pay and company benefits, promotion and advancement and finally the behavior of the customers.

Hoy and Miskel (1996) describe three types of characteristics that interact to shape job satisfaction namely individual, job and organizational variables:

- (1) individual (i.e. age, gender, education, motivation, ability);
- (2) characteristics of the job tasks (i.e. autonomy, pay and other benefits, significance, challenge, variety); and
- (3) characteristics of the work organization (i.e. centralization, professionalism, supervision, feedback, culture).

According to Rowden and Conire (2005) there are two perspectives under which organizations treat the concept of job satisfaction: the humanitarian and the utilitarian. The first involves employees treated fairly and with respect and considers job satisfaction as a reflection of good treatment while the second considers job satisfaction as a cause to an employee behavior affecting and reflecting on organizational functioning. Those two equally important perspectives force organizations to treat job satisfaction as an important aspect of their function.

2.2 Organizations' and employees' performance

All kinds of organizations simulate social systems where human resources are the most important factor for their effectiveness and efficiency (Mosadeghrad *et al.*, 2008). Organizational success is inextricably linked with employee efforts and commitment. In this equation, employees as internal customers in an organization and employee satisfaction appear to be variables that directly affect job performance and thus organizational success. On the other hand, employee performance as a dimension is also complex and is considered to be the result of one's personal characteristics, work effort and organizational support (Blumberg and Pringle, 1982). Lee (1988) also considers performance as a multidimensional composition, as an outcome measure, a range of important performance categories including financial performance, customer and employee satisfaction.

In the current literature, research is attempting to link job satisfaction to the concept of performance (Hartline and Ferrell, 1996; Arnold and Davey, 1999; Herrington, 1999; Judge *et al.*, 2001), but also to investigate the causal relationship between these two concepts.

Drawing on evidence from the available literature a clear controversy arises whether job satisfaction results in performance or vice versa. High performance leads to rewards, which in turn lead to satisfaction (Porter and Lawler, 1968), while on the other hand job satisfaction can cause high organizational performance (Spector, 1985; Wood *et al.*, 1998). Lee (1988) argues that job satisfaction is key factor in achieving efficiency while Balzer *et al.* (1990) noted that a satisfied employee can be more effective and efficient in fulfilling tasks assigned.

Determining factors that affect the relationship between job satisfaction and organizational performance and determining each factor's contribution in this relationship are of particular interest. Riggio (2003) considers the type of work, while Lok and Crawford (2003) consider loyalty to the organization-employer as the most important determinants of organizational effectiveness. The employee-work environment relationship is considered to be a key factor in shaping a positive framework for enhancing performance. Hence, work environments that facilitate employee satisfaction lead to increased efficiency (Kieffer *et al.*, 2004). Using a quantitative approach Patterson and Spreng (1997) studied the factors that mostly affect organizational performance (in terms of overall productivity and profits per employee) and concluded that 5 percent of profit and 16 percent of productivity variation among organizations is attributed to different levels

of employee satisfaction. Kennedy *et al.* (2002) studied both profits and organizational goals in relation to employee satisfaction.

Considering job satisfaction as the cause of high performance, research efforts have incorporated employee satisfaction in models estimating organizational efficiency using the data envelopment analysis (DEA) method (Rucci *et al.*, 1998; Koys, 2001; Reynolds and Biel, 2007).

During the past three decades, various methodologies have been developed and implemented in evaluating the performance of both hospitals and health services. Most of these methods focus on measuring productivity and efficiency in order to explore the relationship between hospitals and their environment.

Hollingsworth (2008) reviewed 317 studies on efficiency in health services conducted between 1980 and 2006. This review revealed that 80 percent of the studies used the non-parametric DEA method, while in the majority of the remaining 20 percent used the parametric stochastic frontier analysis (SFA).

3. Research hypothesis

It has been argued that job satisfaction of health care employees affects health services quality, effectiveness and efficiency while at the same time has an impact on the cost of their provision. A number of studies however, accepts, that job satisfaction of health care employees reflects on patients and the healthcare system overall, while at the same time is directly linked to implementing an organizational culture on hospital care units (Pousette and Hanse, 2002; Visser *et al.*, 2003; McManus *et al.*, 2004).

Negative effects at both personal and organizational level emanating from job dissatisfaction in health care organizations, have created the need to further investigate employee satisfaction as a variable of organizational success. Due to the unique nature of the medical profession and the increased demands of a hospital as a work place, studies in the available literature incorporate a variety of factors shaping job satisfaction in this context. Stress, apathy and burnout are important determinants of employees' health and welfare, affecting job satisfaction (Miljković, 2007). Reviewing the available literature we come across a large number of studies investigating factors that affect job satisfaction among medical professionals (Bogue *et al.*, 2006; Van Ham *et al.*, 2006; Janus *et al.*, 2008). This is expected since physicians job satisfaction is directly related to the quality of services provided by them (Bodur, 2002; Landon *et al.*, 2007; Qian and Lim, 2008).

It has been argued that factors regarding both the nature and the conditions of the medical practice are related to medical professionals' job satisfaction (Akroyd *et al.*, 1994; Bergin *et al.*, 2004; Bogue *et al.*, 2006). One of these factors is medical specialty and various studies consider it as an important factor affecting physicians' job satisfaction (Nylenna *et al.*, 2005; Scheurer *et al.*, 2009). According to Leigh *et al.* (2009) using a sample of 6,590 US doctors of the ten specialties associated with higher satisfaction, six were internal pathology specialties while of the 11 specialties associated with less satisfaction, five were surgical specialties.

At the same time contemporary research reveals a distinct need to clarify what leadership in a clinical environment consists of, taking into consideration that there is a difference between a traditional working environment and a clinical one (Edmonstone and Western, 2002). Millward and Bryan (2005) support that clinical leadership is all about front line effective health care and is considered to be a necessary prerequisite in designing service provision and individualizing patient needs in the health services market.

Ham (2003) supports that this role is decisive in improving clinical practice, clinical management decision-making processes, as well as decisions involving all clinical patients. Measures and policies aiming to improve safety and clinical treatment efficiency cannot be materialized without the immediate participation of clinical managers both in their original design and their completion (Badrick and Preston, 2000).

In addition to their operational framework as described above, clinical leaders also function as agents while the hospital administration, representing often the ministry or the government, as the principals according to the principal-agent theory. The agency theory in the complex environment of health care creates a variety of principal-agent contracts namely physician-patient, medical staff-hospital administration, clinical leaders-hospital administration, etc. (Scott and Vick, 1999; Golden and Martin, 2004). Jensen (1998) developed a set of important arguments to address common principal-agent problems that bedevil all complex organizations, including those in the health sector. In this sector most of the problems arise mainly because healthcare professionals are socialized to care and put patients first.

This often results in a misalignment of agents and principals goals. In the clinical leader-hospital administration contract this misalignment is often described as dilemmas that emanate not only from information management but also from knowledge management, and in particular the existence of specific knowledge. This is true for all organizations, but particularly in professionalized healthcare organizations (Golden and Martin, 2004). The way that this principal-agent contract between clinical leaders and the hospital administration affects job satisfaction can be crucial to this study.

The structure of public hospital care in Greece is organized in three major clinical sectors namely the internal pathology, surgical and psychiatric sector. Hospital clinical departments belong to one of these three sectors. Assessing department efficiency within such an operational framework requires an evaluation in line with their corresponding clinical sector which greatly determines the nature of clinical work produced. Clinical leaders although selected by scientific background and experience criteria do not mandatory have managerial expertise. Since task performance groups are not included in the structure of Greek public hospital care, clinical leaders are also responsible for performing such duties.

To our knowledge, the way job satisfaction affects the efficiency of clinical departments in Greek hospitals has not been investigated to date.

Combining the impact of job satisfaction and medical specialty on clinical department operation within a certain operational framework, the research hypothesis was formed as follows:

- H1.* The estimated efficiency of clinical departments per sector is affected from clinical leader's job satisfaction.

4. Materials and research methodology

The sample used for the efficiency assessment consisted of functional data of 96 clinical – pathological and surgical – departments in 15 Greek general hospital during 2007. University and small hospitals (under 100 beds) data were excluded. Those departments were consistent regarding operational indicators and results. In further processing, clinical departments presenting marginal deviations were excluded and this resulted in an outlier free sample. The number of clinical departments per sector and specialty are presented in Table I.

In order to estimate the degree of efficiency in a health unit, data on patient turnover regarding inputs and outputs are required. Hospitals are unique organizations producing a variety of services such as patient hospitalization, outpatient services, educational work, etc. At the same time their productive process involves a large number of inputs such as human resources, material and technical infrastructures, etc. Challenges in measuring hospital outputs are due to the nature and variety of services provided (Lee, 1991; Fare *et al.*, 1992; Butler, 1995).

So far measuring the final output is not practically feasible since difficulties in quantifying the “health status” of hospitalized patients exist, while a patients’ health improvement rate due to hospitalization cannot be accurately measured. However, in the process of achieving the final output, namely to improve patients’ health, hospitals produce a number of intermediate outputs, directly related to the therapeutical process, as the number of hospitalized patients, days of hospitalization, medical actions, etc. Hence, in this study to assess hospital operation efficiency the measurement of intermediate outputs was employed.

The number of hospitalized patients was the variable chosen as the departments’ output, adopting a widely used method in Greece (Katharaki, 2007; Maniadakis *et al.*, 2008). However, by using this sole variable, the actual output of clinical operations cannot be reflected since data on the case mix, the severity and complexity of cases treated is not available. Up till now in Greece no available methods or data exist to monitor and record both the case mix and the indicators of the quality of the therapeutical work produced (Aletras *et al.*, 2007; Maniadakis *et al.*, 2008; Dimas *et al.*, 2010).

As an alternative, a case-mix index (CMI), using a modification of the approach of Dimas *et al.* (2010) was used. The sample of departments was divided into two groups one containing large hospitals departments (>300 beds) and another containing medium and smaller hospitals departments (<300, >100 beds). We consider the average pharmaceutical cost per patient in each clinical department related to the total patient pharmaceutical costs in clinical departments of the same sector (surgical-pathological) in the same group and then multiply it by the average length of hospitalization of the patients in this group. The result shows the average share of pharmaceutical patient cost in each department, in each department group for the period of hospitalization. In this way the variation of pharmaceutical costs is accounted for and therefore associated with the complexity of the case mix:

$$CMI_i = (APC_{ij}/TPC_j) \times ALOS_j$$

Table I.
List of departments
per sector and specialty
that provided data for
the analysis

<i>Internal pathology sector</i>	
Cardiological	15
Pathological	15
Pediatrics	12
<i>Surgical sector</i>	
Obstetrics/gynaecology	15
Orthopedics	14
Urological	9
Surgical	16

where:

CMI_i = case mix index in clinical department i .

APC_{ij} = average patient pharmaceutical cost in department i of group j .

TPC_j = total patient pharmaceutical cost of group j .

$ALOS_j$ = average length of stay of group j .

The value of the adjusted variable-output (number of patients and length of stay) for the case mix of each department results from multiplying the corresponding case mix index and the actual output value. However, the proposed approach may be deficient (due to data limitations), since the results are not properly adjusted regarding case severity and this may lead to an underestimation of corresponding performances.

Inputs identified as variables to assess the efficiency of clinical departments included: the number of employed medical specialists and nurses, the number of department beds, the cost of pharmaceutical expenditure and the quantified qualitative variable of job satisfaction. Although the cost of labor is considered to be an alternative measure of resources used (Giokas, 2001), the number of employed medical specialists and nurses was selected instead, since total rewards do not burden the hospital's budget (salaries, various subsidies), vary among hospitals (e.g. special subsidies) and their disaggregation per clinical department was extremely difficult.

The total fixed hospital capital may be expressed by the number of deployed beds (Aletras *et al.*, 2007). Considering the number of beds in each department we assume that hospitals invest about the same amount of capital on each bed they maintain in clinical departments. The variable of treatment pharmaceutical expenditure indicates resources used by hospital units in the productive process of patients' health rehabilitation (Zere *et al.*, 2001).

The special role of clinical department management includes primary responsibility for organizational, functional and scientific issues and directly determines the application of therapeutical methods to face department patients' problems. Simultaneously, the decisions of managers to implement measures and practices including guidelines, protocols-lists and control-reevaluation procedures in pharmaceutical treatments, define the productive process in clinical departments affecting their performance (Maynard and Kare, 2003). Using the quantified qualitative variable of clinical leaderships job satisfaction, we attempt to incorporate qualitative characteristics in the process of investigating the productive procedure. The DEA model used is of variable returns to scale (VRS), input oriented and the PIM-DEA Version 3 software was used for the extraction of indexes.

The choice of a VRS model aims to eliminate the bias of clinical department size in the assessment of technical efficiency so that its definition will be scale efficiency free. At the same time an input-oriented choice is in line with the design philosophy of hospital care delivery systems in which productive forces using limited available resources are expected to meet a given demand of hospital care.

To investigate physicians' satisfaction, a questionnaire intended to collect primary data was constructed. According to Saunders *et al.* (2003) in causal surveys a questionnaire is the most appropriate way of collecting primary data. Saane *et al.* (2003) analyzed 29 psychometric tools measuring job satisfaction of hospital employees and concluded that only seven of those meet qualitative criteria for reliability and validity. Among these "job satisfaction survey" (JSS) is characterized as a multidimensional tool

and according to Spector (1985), although it can be used in most fields, in principle it was developed exclusively for the public sector, especially for social services and nonprofit organizations. For that reason it has been used in surveys to measure physicians' job satisfaction (Nyllena *et al.*, 2005; Sharaf *et al.*, 2008; Aasland *et al.*, 2010). This survey employed this tool to investigate job satisfaction using initially ten questions that were answered in a seven-point Likert scale (extremely dissatisfied-extremely satisfied) based on Nyllena's *et al.* (2005) research in a sample of 509 hospital doctors. After the initial controls and tests job satisfaction questionnaire reliability was examined using Cronbach's α coefficient. After removing four variables using "Alpha if item removed" method, the questionnaire reliability was identified as high (0.885) thus demonstrating a very good measuring tool classification (Nunnally, 1978). The remaining six questions were: to what extend are you satisfied:

- (1) with potentials and opportunities for skills and competence advancement;
- (2) with recognition regarding work contribution;
- (3) with physical work conditions;
- (4) with your benefits;
- (5) with your relationships with your colleagues and other hospital employees; and
- (6) overall with your practice.

The qualitative questionnaires were collected via post from 1 September 2007 to 30 November 2007. The collection of quantitative resources data held from 15 January 2008 to 30 May 2008. All hospitals responded and answered either using special electronic registration forms designed specifically for this research or handwritten.

5. Results

Processing demographics revealed that the majority of the participants in our sample are male, 83 percent of the sample under investigation. 64.2 percent of the respondents are between 56 and 65 years of age, while 31.7 percent are between 46 and 55. The high average age of the participants reflects to some extent the profile of leadership chosen in recent years in Greece. Regarding prior experience of the participants in responsibility positions, 76.4 percent have not exceeded ten years in a managerial position while 23.6 percent have performed managerial duties for over ten years. This percentage combined with the average age of department heads reveals the slow progression rate of doctors within the NHS in positions of responsibility. The consequences of such choices on systemic functionality are yet to be investigated. Only 22 percent of the respondents held a managerial position in another hospital.

Implementing exploratory factor analysis (EFA) through principal component analysis (PCA) method we found that Kaiser-Meyer-Olkin (K-M-O) coefficient for the qualitative survey data was 0.915. According to Hutcheson and Sofroniou (1999), coefficients over 0.9 give almost perfect results. This process also revealed the existence of one factor explaining 70.8 percent of the total variance. This factors score, representing job satisfaction, was used as an input to the efficiency estimation model.

5.1 Assessments incorporating job satisfaction

The application of the DEA methodology on the model, using the qualitative variable of job satisfaction estimated the average technical efficiency to 87.54 percent for

internal pathology sector departments and 88.36 percent for surgical sector departments (Table II). The estimate for the pathology sector suggests that if all the departments in this sector have adopted best practices (as followed by 100 percent efficient departments), in their productive process then their achieved output could have been achieved by reducing the inputs used at 12.46 percent on average. Similarly for the surgical sector this input reduction was estimated at 11.64 percent.

According to the classification of clinical departments (Table III) based on their estimated technical efficiency 38.10 percent of the pathology sector departments were estimated as 100 percent efficient while the corresponding percentage in the surgical sector was 38.89 percent.

Further analysis of the methodology results revealed the extent of the incorrect use of inputs. In Table IV the proposed reductions of the available inputs for the entire sample and for each sector are presented. Regarding the optimal use of the number of beds available, a reduction of 20.47 percent in the internal pathology sector and 17.69 percent in the surgical sector is proposed. A reduction regarding nursing and medical staff of 19.51 and 18.55 percent, respectively, in the internal pathology sector is also indicated. The corresponding figures for the surgical sector are 19.97 and 28.39 percent. The reduction proposed regarding the cost of pharmaceutical expenditure is 20.60 percent in the internal pathology sector and 21.07 percent in the surgical sector.

An average reduction of 13.71 and 12.34 percent in job satisfaction in the pathology and surgical sector, respectively, is also proposed by the model. This can be associated with the reverse effect of a highly increased level of personal satisfaction recorded for some department heads, on department efficiency which often results in a lack of motivation in achieving new organizational goals, etc.

Nevertheless, a possibility of increasing services provided in some clinical departments per sector arises, improving technical efficiency. The methodology in this

Efficiency	Including job satisfaction variable		Without job satisfaction variable	
	Pathology	Surgical	Pathology	Surgical
Mean	87.54	88.36	81.02	77.03
Median	91.45	90.71	83.75	76.96
SD	13.73	12.25	16.96	19.43
Minimum	50.11	50.7	45.74	38.93
Maximum	100	100	100	100

Table II.
Statistical data
on technical efficiency
per sector

Efficiency	Including job satisfaction variable				Without job satisfaction variable			
	Pathology		Surgical		Pathology		Surgical	
	Dep.	%	Dep.	%	Dep.	%	Dep.	%
100	16	38.10	21	38.89	10	23.81	16	29.63
90-99.9	7	16.47	6	11.11	8	19.05	3	5.56
80-89.9	6	14.29	11	20.37	5	11.9	4	7.41
70-79.9	8	19.05	13	24.07	4	9.52	9	16.67
60-69.9	4	9.52	2	3.7	10	23.81	7	12.96
< 60	1	2.38	1	1.85	5	11.9	15	27.78

Table III.
Department classification
according to technical
efficiency

Table IV.
Suggested input-output
reductions

	Including job satisfaction			Without job satisfaction variable		
	Existing	Pathology DEA	Surgical %	Existing	Pathology %	Surgical %
Number of beds	1,099	874.02	-20.47	1,426	1,173.66	-17.69
Number of nursing staff	724	582.69	-19.51	940	752.21	-19.97
Number of medical staff	205	166.96	-18.55	236	168.99	-28.39
Pharmaceutical expenditure	11,557,675	9,176,028	-20.60	10,252,052	8,091,490	-21.07
Adjusted number of inpatients	39,946.49	39,989.34	0.1	56,050.57	57,611.63	2.78
Job satisfaction	1,226	1,057.9	-13.71	1,566	1,372.75	-12.34
				Existing	DEA	Existing
				1,426	818.29	-25.54
				940	532.92	-26.39
				236	158.37	-22.75
				11,557,675	7,783,742.4	-32.65
				10,252,052	7,767,897	-24.23
				39,946.49	39,946.49	0.00
				56,050.57	56,050.57	0.00
				1,566	1,459.6	-38.15

model proposes changes in the number of hospitalized patients. In the surgical sector an increase in inpatients of 2.78 percent is proposed while in the pathology sector the proposed rate is negligible (0.10 percent).

5.2 Assessments without the input of job satisfaction

Implementing the model without the input of job satisfaction, an average technical efficiency of 81.02 percent for the pathology sector departments and 77.03 percent for the surgical sector departments (Table II) was estimated.

The estimate for the pathology sector suggests that if all the departments in this sector have adopted best practices, followed by 100 percent efficient departments, in their productive process then their achieved output could have resulted by reducing the inputs used at 18.98 percent. Respectively for the surgical sector this reduction is estimated at 22.97 percent.

According to the classification of clinical departments (Table III) based on their estimated technical efficiency 23.81 percent of the pathology sector departments were estimated as 100 percent efficient while the corresponding percentage in the surgical sector was 29.63 percent.

Further analysis of the data revealed the extent of the incorrect use of inputs. In Table IV the proposed reductions of the available inputs for the entire sample and for each sector are presented. Regarding the optimal use of the number of beds available, a reduction of 25.54 percent in the internal pathology sector and 27.0 percent in the surgical sector is proposed. A reduction regarding nursing and medical staff of 26.39 and 22.75 percent, respectively, in the internal pathology sector is also indicated. The corresponding figures for the surgical sector are 27.08 and 38.15 percent. The reduction proposed regarding the cost of pharmaceutical expenditure is 32.65 percent in the internal pathology sector and 24.23 percent in the surgical sector.

Using this approach no changes in the number of hospitalized patients are proposed by the methodology.

5.3 Hypothesis control

To test the research hypothesis, the non-parametric U test of Mann-Whitney was applied. Testing methodology application to the technical efficiency assessment of the pathology sector, we found that the averages equality hypothesis for both approaches (with and without job satisfaction) is not marginally rejected ($U = 675.5$, $N1 = 42$, $N2 = 42$, two-tailed $p = 0.061$). The same hypothesis for the surgical sector is rejected ($U = 976.5$, $N1 = 54$, $N2 = 54$, two-tailed $p = 0.003$) for both approaches.

Therefore, the research hypothesis that “the estimated efficiency of clinical departments per sector is affected from clinical leader’s job satisfaction” is verified for the surgical sector and rejected marginally for the pathology sector.

6. Discussion

During the last decades, quantifying overall hospital efficiency is an important issue for both researchers and health policy makers. Most of the surveys in the field use the DEA method to assess hospital efficiency. At the same time defining the causal relationship between job satisfaction and efficiency is an ongoing subject among practitioners and academics. All the factors influencing this relationship are continuously explored and evaluated.

The scope of this research study was to evaluate clinical departments' technical efficiency in the Greek NHS, classifying clinical departments per clinical sector. Our research focuses on a clinical department level, since clinical departments are the productive units of hospital care system and are placed in the hard core of any effort to improve the quality of services provided and increase hospital efficiency. In this study clinical department efficiency is assessed through the input of job satisfaction on a clinical leadership level taking under consideration important factors such as workplace conditions and medical specialty as reflected on clinical sectors. We also attempt to access clinical leaders' job satisfaction by investigating their relationship with the hospital administration considering this relationship as a principal-agent contract.

This study is conducted in the context of the Greek public sector which according to OECD data is large and inefficient. The World Economic Forum ranked Greece extremely low in public sector outcomes. Low outcomes combined with high public sector expenditure, indicate the underperformance of the Greek public sector (Schwab, 2011). Even if this is the case in general, the Greek health care system is credited with better results. The efficiency of the Greek health care system is similar to that of the OECD average according to a recent OECD empirical study (Journard *et al.*, 2008) while Afonso *et al.* (2003) ranked Greece sixth out of 23 OECD countries for the efficiency of the health care system. In alignment with this data the average estimated efficiency of the clinical departments under investigation was high.

In this study a model oriented on input reduction was used. Implementing the methodology on this model, a reduction on pharmaceutical expenditure was proposed as necessary. This is an indication for the implementation of measures enhancing a more rational and cost effective management in clinical units. Such choices on a clinical department management level as well as on hospital administration level are a prerequisite, combined with new and modern methods of management such as task performance groups. The use of integrated information management systems in hospitals, the implementation of control procedures and prescribing norms are measures that can contribute to a more efficient department operation.

The proposed reduction of available beds in clinical departments is indicative of the perverse use of available beds, which is supported by data on reduced bed occupancy in a significant number of clinical departments. The reduction of nursing and medical staff proposed by the methodology is an indication of poor human resources management and inefficient use of employees' potential. A health map redeployment including clinical departments or even hospital mergers can ensure the efficient use of hospital care available resources that burden heavily both state and insurance agencies budgets.

The model methodology with the input of the qualitative variable of job satisfaction on a leadership level, proposed changes in the number of hospitalized patients in order to increase technical efficiency. The proposed increase in clinical work produced, highlights the potential of clinical work reorganization since this proposed increase in the number of hospitalized patients indicates the degree of unexploited productive factors.

The verification of the research hypothesis for surgical sector departments, attributes estimated efficiency variations on the effect of clinical leaderships' job satisfaction, a finding that marginally does not apply for the pathology sector. This is not consistent with the higher degree of job satisfaction among physicians with internal pathology specialties as recorded in the literature but can be attributed to a better alignment between the goals

of surgical department leaders and hospital administrations. The marginally rejected result regarding the pathology sector can be an indication towards the realignment of the principal-agent contract in these departments.

7. Future research-limitations

The sample in our study was limited to a specific number of hospitals where it was possible to record inputs and outputs of their productive process. This was the result of the lack of a unified integrated information system in the Greek NHS providing functional data on public hospital units. Future research could incorporate a larger number of hospital units, allocated to more geographical and health regions.

In the process of measuring and analyzing hospital efficiency and productivity, the accuracy of recording financial management and case mix immunological data in their clinical departments is critical. The quality and availability of data in research models estimates could lead to safer conclusions and help formulating more effective policies.

Finally, introducing more qualitative variables in medical units efficiency studies, such as patients satisfaction, all hospital care level employees satisfaction (nurses and doctors of all levels) could be the direction for future research.

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