Accepted Manuscript

Title: Rural vs Urban hospital performance in a 'competitive' public health service

Authors: Javier Garcia-Lacalle, Emilio Martin

PII: S0277-9536(10)00461-2

DOI: 10.1016/j.socscimed.2010.05.043

Reference: SSM 7435

To appear in: *Social Science & Medicine*

Received Date: 24 July 2009

Revised Date: 29 March 2010

Accepted Date: 28 May 2010

Please cite this article as: Garcia-Lacalle, J., Martin, E. Rural vs Urban hospital performance in a 'competitive' public health service, Social Science & Medicine (2010), doi: 10.1016/j.socscimed.2010.05.043

Details for Manuscript Number: SSM-D-09-01587 R2
"RURAL vs URBAN HOSPITAL PERFORMANCE IN A 'COMPETITIVE' PUBLIC HEALTH SERVICE"

Corresponding Author:	Javier Garcia-Lacalle, University of Zaragoza Zaragoza, SPAIN [Proxy]
Corresponding Author E-Mail:	jlacalle@unizar.es;javierglacalle@yahoo.es
Author Comments:	
This study has been carried out with the financial support of the Spanish National R&D Plan through the research project SEJ2007-62215-ECON-FEDER.	
Other Authors:	Emilio Martin
Keywords:	Spain; Servicio Andaluz de Salud; healthcare reforms; hospital performance; efficiency; patient satisfaction; urban; rural; hospitals; markets

ABSTRACT

In some western countries, market-driven reforms to improve efficiency and quality have harmed the performance of some hospitals, occasionally leading to their closure, mostly in rural areas. This paper seeks to explore whether these reforms affect urban and rural hospitals differently in a European health service. Rural and urban hospital performance is compared taking into account their efficiency and perceived quality. The study is focused on the Andalusian Health Service (SAS) in Spain, which has implemented a freedom of hospital choice policy and a reimbursement system based on hospital performance. Data Envelopment Analysis, the Mann-Whitney U test and Multidimensional Scaling techniques are conducted for two years, 2003 and 2006. The results show that rural and urban hospitals perform similarly in the efficiency dimension, whereas rural hospitals perform significantly better than urban hospitals in the patient satisfaction dimension. When the two dimensions are considered jointly, some rural hospitals are found to be the best performers. As such, market-driven reforms do not necessary result in a difference in the performance of rural and urban hospitals.

Main Text

Introduction

European public healthcare systems are implementing market-driven reforms to improve the efficiency and quality of the services they provide. These reforms include managerial decentralisation, the separation of purchasers and providers, the use of prospective payment systems, mostly performance-based, and the implementation of policies that allow patients to choose their hospital (Botten, Grepperud & Nerland, 2004; Allen, 2009). The main objective of these measures is to introduce some kind of competition into healthcare systems. It is expected that patients will choose the hospitals with the best quality or, at least, will try to avoid 'bad' hospitals, and that 'good' hospitals will be rewarded with more resources.

However, the importance of healthcare services in welfare policies and their specific characteristics, such as the information asymmetries that exist between the different actors involved, make the implementation of 'market mechanisms' a controversial issue that does not always produce the desired effects in terms of efficiency and quality improvements (Woolhandler & Himmelstein, 2007; Propper, Burgess & Gossage, 2008). Braithwaite (1997) argues that a market runs the risk of failing to provide healthcare services equitably in publicly funded systems. The introduction of market-driven reforms has resulted in the closure of hospitals, especially in rural areas, in the US (GAO, 1990; Adams, Porrell & Robbins, 1996) Korea (see Noh, Lee, Yun, Lee, Lee & Khang, 2006), Canada (see James, 1999; Lepnurm &Lepnurm, 2001) and New Zealand (see Healy, 2002). However, in Western Europe, the restructuring of acute care has meant a reduction in the number of acute beds in hospitals (Kroneman & Siegers, 2004) but, only rarely has it led to the closure of hospitals (Healy & Mckee, 2002).

This paper carries out a comparative analysis of the performance of rural and urban hospitals belonging to the *Servicio Andaluz de Salud* (SAS), the Health Service in Andalusia,

which has implemented key market-driven reforms. The introduction of market-driven mechanisms raises questions over the efficiency and financial viability of rural hospitals (Rosko & Mutter, 2010), and might be detrimental for hospitals in rural areas because it is argued that sometimes they are justified for social equity reasons rather than for economic reasons. The objective is to determine whether rural hospitals are performing worse than their urban counterparts in order to evaluate whether the provision of hospital services in rural areas is justified according to different performance criteria. In our analysis of hospital performance, we focus on efficiency in the use of the resources and on patient satisfaction. Clinical quality considerations are beyond the scope of this paper.

The paper is structured as follows. We briefly present the most significant market-driven reforms implemented in the healthcare sector, particularly in hospitals. We review the literature about the performance of rural and urban hospitals in the two hospital dimensions studied in this paper: hospital efficiency and perceived quality. We describe the main features of the SAS. We introduce the methodology used for the analyses and present the results. Finally, the paper closes with a discussion and conclusions section, including some policy recommendations.

Market-driven reforms in healthcare

All over Europe, there has been a tendency to applaud the decentralisation of health services in recent years (Allen, 2006). It is expected that public services will be more responsive and efficient if decision making is undertaken at lower levels. The introduction of hospital Foundation Trusts (FTs) in the English National Health Service (NHS) is the most important decentralisation initiative in Europe. FTs have freedom to spend their income, do not need to break even, can keep any surplus generated and can borrow money from whom

they wish (Allen, 2006). The initiative also tries to involve local communities in decisions about public services (Ferlie & Fitzgerald, 2002). Citizens belonging to the FT and FT staff have the right to become members and vote for a board of governors and FTs are no longer directly accountable to the Secretary of State for Health.

The idea of decentralisation is closely linked to the introduction of reimbursement mechanisms that promote efficiency and quality improvements in hospitals. Because prospective payment systems (PPS) introduce incentives to economic performance improvements, they have substituted retrospective payments. Providers are encouraged not to spend more than they are paid, so they have a clear stimulus to contain costs and improve efficiency (Jegers, Kesteloot, De Graeve & Gilles, 2002). However, in order to avoid deficits, providers have incentives to develop 'strategic responses' which may result in a reduction in the number of services provided and/or in their quality (Newhouse, 1996; Ellis 1998; Jegers et al., 2002; Ankjær-Jensen, Rosling & Bilde, 2006).

The most cited strategic responses are often described as 'risk-selection' practices, that is, providers try to select patients who will be 'profitable' for them and try to avoid those who will not. Providers can select patients using *cream skimming* and *dumping* practices (Ellis & McGuire, 1996; Ellis, 1998). These practices consist of attracting and retaining healthy patients or patients with health conditions which make it probable that the cost of their treatment will be lower than its payment and/or systematically avoiding high-cost patients because treating them significantly increases costs. Other undesirable provider responses to PPS are *codification* practices and *moral hazard* effects. Codification practices consist of classifying cases into groups which maximise revenues. As most per case codification uses the Diagnostic Related Group (DRG) classification, this practice is known as 'DRG-creep'.

The 'moral hazard' response to PPS is the under-provision of services to patients with expensive treatments, also known as *skimping.*

The implementation of policies that give patients the right to choose their hospital is a common initiative in Europe. According to the standard economic theory of markets, it is expected that consumer choice will lead to provider responsiveness, quality, innovation and efficiency because consumers choose among competing providers on the basis of price and/or quality (Thomson & Dixon, 2006; Vrangbæck & Østergren, 2006). In 'free at the point of service' systems, patient choice may lead to quality improvements, since hospitals only compete on the basis of quality. An important political motive behind the introduction of patient choice is to empower the patient (Vrangbæk & Østergren, 2006). Scandinavian countries introduced hospital choice initiatives at the beginning of the 1990s (Vrangbæck, Østergren, Birk & Winblad, 2007). In England, since 2008, the possibility of hospital choice for many types of care includes all NHS hospitals and independent sector hospitals which meet NHS standards (DoH, 2004). This encourages competition because it means that patients have a wider choice of hospitals.

The potential benefits of choice depend on a number of assumptions, including the willingness and ability of most patients to evaluate treatment options and act accordingly. Choice relies on the skill of the patients to understand and choose between options, but people are not always the best judges of their own welfare, the choices they make may not be the ones they might have made if they had been better informed and they do not always behave rationally (Appleby, Harrison & Devlin, 2003; Thomson & Dixon, 2006). Amyx, Mowen & Hamm (2000) cast doubts about whether patients really want more choice and whether they are always more satisfied when they have a choice. Dent & Haslam (2006) state that the inability to treat all the English NHS patients in the best hospitals due to high bed occupancy

rates in the best-performing hospitals may mean that patients are not treated in their first choice hospital.

Hospital efficiency and perceived quality

In recent years, there has been a growing interest in evaluating the efficiency of different healthcare organisations. Although efficiency can hardly be considered the final outcome of a healthcare organisation, improvements in this aspect can help in the achievement of other organisational objectives (Prior, 2006). In the healthcare sphere, the difficulties of measuring health outcomes makes the evaluation of efficiency a controversial topic so health outcomes are usually replaced by output data (Linna, Hakkinen & Magnussen, 2006). While output measurements, such as the number of treated patients or the number of bed-days, are more easily measured than health outcomes, there is still little consensus about the comparability of indicators because of variations in case-mix and the need to include quality measures (Smith, 2005; Hollingsworth, 2008). Nevertheless, the use of output measurements provides useful data to assess the effects of healthcare reforms and the factors that determine differences in performance (Linna et al., 2006).

The methodology to measure efficiency is also a controversial issue. The variety of production processes of healthcare providers makes it difficult to measure their efficiency and makes it advisable to use non-parametric techniques (Pina & Torres, 1996; Pilyasvky & Staat, 2008). Economics provides two main methods to measure the efficiency of healthcare providers: stochastic frontier analysis (SFA), based on regression techniques, and data envelopment analysis (DEA), based on linear programming (O'Neill, Rauner, Heidenberger & Kraus, 2008). Each of these methods has strengths and weaknesses, but both give comparable results for individual efficiency scores (Nayar & Ozcan, 2008).

Among the different factors that have been studied to explaining differences in hospital efficiency, this study focuses on whether the hospital is in a rural or urban location. Several authors have analysed the existence of differences in efficiency between rural and urban hospitals without reaching a clear consensus in their results. On the one hand, the results of Athanassopoulos & Gounaris (2001) indicate that urban hospitals tend to be more efficient than rural hospitals and large hospitals more than medium-sized or small hospitals because they reduce the unitary cost, suggesting the existence of economies of scale. Mick & Morlock (1990) find that, in the US, rural hospitals with fewer than 50 beds tend to be inefficient whereas bigger rural hospitals perform as efficiently as urban hospitals. They argue that hospitals with fewer than 50 beds do not provide the range of services to attract the necessary number of patients to cover fixed costs. On the other hand, Schuhmann (2008) reports that rural acute hospitals in the USA show better financial performance than urban hospitals because the former are more focused on outpatient activity and have lower personnel costs. Kim (2010) finds that the factors that affect the financial performance of urban and rural hospitals are different. In particular, market competition mainly affects urban hospitals, whereas rural hospitals are affected by the way they are funded by governmental sources. Finally, other studies, (Gruca & Nath, 2001; Nayar & Ozcan, 2008) do not find significant efficiency differences between rural and urban hospitals. Gruca & Nath (2001) indicate that rural and urban hospitals are competing in different activities; rural hospitals focus on long-term care in their communities whereas urban hospitals concentrate on acute care. Nayar & Ozcan (2008) find that hospital inefficiency is mainly due to bad clinical quality and both types of hospitals present similar levels of quality.

The size of hospitals is the most recurrent element used to explain differences in their efficiency. Location and size are two highly correlated factors because rural hospitals are

usually smaller than urban hospitals. Some studies find that larger hospitals operate better than smaller ones, supporting the existence of economies of scale (Ferrier & Valdmanis, 2004; Prior, 2006). Other studies have found that economies of scale arise for hospitals with around 100 beds but become exhausted for those with around 200-300 beds or, if they do, economies of scale are present only for small hospitals (Dranove, 1998; Lindrooth, Sassi & Bazzoli, 2003; Ahgren, 2008). However, other studies conclude that smaller hospitals perform better than larger ones because the former are easier to manage (Pina & Torres, 1996; Huerta, Ford, Peterson & Brigham, 2008; Oliveira & Bevan, 2008), or do not find any relationship between size and efficiency and explain differences in performance as a consequence of internal management factors (Mick & Wise, 1996; Chern & Wan, 2000; Weil, 2003).

As regards perceived quality, the last ten years have brought a renewed emphasis on citizen involvement in health policies, planning and service provision (Baggott, 2005). The passive role of patients is being replaced by an active demand for personalised, attentive and courteous service, and medical service providers are under increasing pressure to be more attentive to patients' wishes (Ruyter & Wetzels, 1998). Patients' experiences and judgements have become an important input to service improvement and quality monitoring in hospitals (Draper & Hill, 1996). Patient satisfaction is also an important performance indicator of the overall effectiveness of the organisation (Sweeney, Brooks & Leahy, 2003). It should be an indispensable element in managing and assessing healthcare systems and is a desirable outcome of healthcare in its own right (Donabedian, 1988). The freedom of patients to choose hospitals has given patient satisfaction a new dimension and it has become a dominant concern intertwined with strategic decisions in healthcare services (Pakdil & Harwood, 2005).

Rural hospitals usually obtain better overall quality assessments from their patients than urban hospitals (Pink, Murray & McKillop, 2003). As rural hospitals are usually smaller

than urban hospitals, their size allows them to provide a quieter and friendlier environment that makes patients feel more comfortable (Finkelstein, Singh, Silvers, Neuhauser & Rosenthal, 1998; Young, Meterko & Desai, 2000; Pink et al., 2003). Rural hospitals may be favoured by the sociodemographic characteristics of the population they attend to, because elderly people and people with lower levels of education tend to give better quality assessments to hospitals than the rest of the population (Tengilimoglu, Kisa & Dziegielewski, 2001; Niakas, Gnardellis & Theodorou, 2004). Rural areas usually have a greater proportion of people with these two demographic characteristics. Studies also indicate that more complex cases and more severe illnesses are usually associated with lower satisfaction assessments (Etter & Perneger, 1997). Patients with better self-reported health were associated with greater levels of satisfaction (Rosenheck, Wilson & Meterko, 1997). It seems logical to assume that less severely ill patients (most of the cases dealt with in small hospitals) will have a better self-reported health than those with more severe illnesses (who are mainly treated in big hospitals). In rural areas, it is also more likely that the patients and the hospital staff are relatives, friends or acquaintances (Pink et al., 2003).

The Andalusian Health Service (SAS)

Andalusia, a region in the south of Spain, has a population of more than 8 million, greater than 11 of the 27 countries in the EU. The Andalusian Health Service, *Servicio Andaluz de Salud* (SAS), is the public entity in charge of managing the Spanish National Health System in this region and, in terms of population attended, is one of the biggest public health services in Europe. It has similar functions and competences to other European Health Services, such as the National Health Services of the UK, Italy and the Scandinavian

countries, in which the provision of specialised healthcare is mainly provided through public hospitals funded by general taxation.

The SAS has 29 acute hospitals, 15 of which are classified by the SAS as rural hospitals. The rest are urban hospitals. In addition to location, SAS hospital classification also takes case-mix and size into account. Rural hospitals are located in small cities, most of them with less than 50,000 inhabitants. Each hospital attends the less severe cases in its area, providing acute care to a population of around 100,000. They have between 100 and 300 beds, with an average size of 200. Their size can be considered large, but it allows them to have the necessary infrastructure to treat the most frequent hospital cases. Urban hospitals are located in big cities and provincial capitals, most of them with more than 200,000 inhabitants. They attend all the cases in their jurisdictions and the severe cases from rural areas. On average, each hospital provides acute care to a population of more than 400,000. Urban hospitals have between 400 to more than 1,500 beds, with an average size of around 850 beds. Nonetheless, most of them are in two size intervals, between 600 and 800 beds and more than 1,000 beds. The complexity of the cases treated is correlated with the size of hospitals, as bigger hospitals have more facilities and medical expertise is usually concentrated in them. Between 2003 and 2006 there was a significant reduction in beds in some hospitals, especially in urban hospitals.

The SAS has introduced managerial decentralisation into its hospitals through the use of '*contratos programa*', which are agreements between the SAS and its hospitals about the objectives to be fulfilled. However, this is a limited decentralisation, as there is no formal separation between the purchaser (the SAS) and the providers (hospitals). Hospitals are within the SAS structure, subject to SAS norms and guidelines and the SAS appoints, and dismisses, hospital managers and establishes the economic and service goals for hospitals.

SAS hospitals are paid through a prospective payment system (PPS) using a capitation model. In a system of patient capitation, providers receive a periodical lump sum per person under supervision during a certain period (mostly a year). The capitation strategy is based on the idea that costs are controlled by 'the payment' and the quality of the service is enforced by 'the market'. The total income for hospitals is a function of the number of potential patients, irrespective of the number of activities and contacts performed. Because Andalusian patients have the possibility of choosing their public hospital, SAS hospitals must provide a good service in order not to lose patients, promoting some kind of competition between hospitals. However, SAS data show that the number of patients that choose a different hospital than the closest is, to date, not significant.

The financing formula also includes a tariff (based on the average costs of the SAS hospitals) and the complexity of the cases treated (case-mix) because attending more complex cases increases costs. In this way, risk is adjusted to avoid cream skimming practices. The SAS calculates the case-mix index using the DRG system (SAS, 2007). There are several Diagnosis-Related Group (DRG) classification systems. The SAS uses the *All Patient DRG* classification. Each patient discharged is classified into a DRG with its corresponding weight and this is converted into DRG points. The case-mix index is the result of dividing the total number of DRG points by the number of patients discharged. The more complex the cases treated, the higher the case-mix index. Therefore, three factors are included in the formula applied to determine the payment to SAS: population, tariff and case mix.

Hospital funding = population **x** *tariff* **x** *case-mix.*

Since 1999, an independent public agency, in collaboration with the SAS, has carried out annual surveys to establish the level of user satisfaction with SAS hospitals. The survey conducts 400 telephone interviews for each hospital. Patients are chosen through a simple

random sampling method from among patients who have received treatment that has required a stay of more than 24 hours. By incorporating the users' perspective and opinions as much as possible, the SAS has a valuable instrument for evaluating the system and for focusing management on users (SAS, 1999). Andalusian public hospitals benchmark their results in patient satisfaction against the mean of all SAS hospitals as part of the evaluation of their performance. The results of the annual patient survey are disclosed through its website. The '*contratos programa*' set targets about the satisfaction of the patients in the different aspects surveyed, encouraging the adoption of corrective measures when targets are not met.

Methodology

The analyses in this paper have been carried out in two stages. Firstly, as the SAS does not provide an efficiency measure, we apply the Data Envelopment Analysis (DEA) methodology to evaluate the relative efficiency of the SAS hospitals. Then, we carry out several statistical analyses to study differences in efficiency and perceived quality scores between rural and urban hospitals. The statistical analyses include univariate analyses -Mann-Whitney U test- to compare the performance of urban and rural hospitals and multivariate analyses -multidimensional scaling (MDS)- to obtain a graphic representation of the performance of the hospitals. Due to the lack of valid data for two hospitals, only 27 of the 29 SAS hospitals -13 rural and 14 urban- have been considered for the analyses. We conduct the analysis for two years, 2003 and 2006, in order to observe the evolution of the performance of the hospitals; 2003 is the first year when the capitation payment system for SAS hospitals was fully implemented and 2006 is the last year for which data are available.

1st stage. Measurement of technical efficiency.

We apply the DEA methodology (Charnes, Cooper & Rhodes, 1978; Cooper, Seiford & Tone, 2000) to evaluate the relative efficiency of the SAS hospitals. DEA allows the evaluation of efficiency in cases where multiple input and output factors are observed and when it is not possible to turn them into one aggregate input or output factor. DEA provides a comparative efficiency indicator of the units to evaluate (in this case hospitals), which are called decision-making units (DMUs). The relative efficiency of a DMU is defined as the ratio of the total weighted output to the total weighted input. DEA does not require any external production function to be taken as reference and the actual inputs and outputs observed are used to estimate a benchmark production frontier. In other words, the union of the hospitals whose inputs produce more outputs forms the efficient frontier with which the relative performance of all hospitals in the sample can be compared. We use the input-oriented model and the constant return to scale (CRS) approach, which is consistent with the majority of the DEA literature on healthcare (O'Neill et al., 2008). CRS is especially appropriate for working with reduced-sized samples (Prior, 2006; Vitikainen, Street & Linna, 2009). The mathematical expression of the model is the following;

$$\text{Min } f_0 = \Theta o - e \left(\sum_{i=1}^{m} s_{i-} + \sum_{r=1}^{s} s_{r+} \right)$$

subject to:

$$\Theta_o x_{io} - \sum_{j=1}^{n} x_{ij} a_j - s_i^- = 0$$

$$\sum_{j=1}^{n} a_j y_{rj} - s_r^+ = y_{ro}$$

for all a_j, s_r, s_i >0; r=1,….s; i=1,….m; j=1,….n; where 'e' is a small number which has the aim of assuring that no output or input is excluded from the final solution; s_i^- and s_r^+ represent the slack variables; Xij and Yrj represent the inputs and outputs observed for the DMU 'j'. A DMU is efficient if Θo = 100% and inefficient if Θo < 100%. The solution to this problem seeks values of a_j to form a composite DMU more efficient than the DMU i_o being evaluated with the inputs and outputs of all DMUs of the sample. If DMU i_o is indeed efficient, the slacks will equal 0 and Θo will equal 100%. That is to say, it is impossible to find a composite DMU outperforming i_o. If i_o is not efficient, Θo will be less than 100% and some slacks are greater than 0 and more efficient composite DMUs have been found.

Although some studies (Dmitruk & Koshevoy, 1991; Bol, 1986) suggest some examples that question the suitability of DEA for evaluating efficiency, Cooper, Huang & Zhu (2008) demonstrate the validity of the model by solving those examples. In any case, the DEA has some limitations. The inclusion of a large number of variables reduces the discriminatory power of the model because it increases the number of efficient DMUs (Emrouznejad, 1995-2001). This is because the number of dimensions in which a particular DMU can be relatively unique (with no partners to be compared with) increases. DMUs that have no similar comparison partners are considered efficient by default. Johnes & Johnes (1993) argue that a DMU can sometimes achieve one hundred percent efficiency simply because no one else is competing in that niche of activity. The technique has been also criticised for its inability to capture the need for some idle capacity in hospitals to respond to unpredictable variations in demand for hospital care (Newhouse, 1994), which may lead hospital decision makers to overestimate resource needs. Avkiran (2001) argues that DEA helps to set targets but does not instruct the user on how to reach them. Despite these criticisms, DEA has been widely used to measure efficiency in healthcare entities.

Hollingsworth (2008) and O'Neill et al. (2008) provide recent revisions of the extensive literature using DEA in hospitals. The method is especially appropriate for evaluating the efficiency of non-profit entities, like public hospitals, that operate outside the market since, for them, measures of efficiency such as profitability do not work satisfactorily.

The selection of the variables to be included in the model is critical in the development of DEA. Therefore, we have worked with variables which have been widely used in previous studies as representative of the principal input and output indicator categories in hospitals in accordance with the revision of O'Neill et al. (2008). As input variables, we have used the *number of beds*, the *number of full time equivalent* (FTE) *physicians* and *FTE nursing staff*. The number of beds represents the size and capital of hospitals. O'Neill et al. (2008) report that the majority of studies use this variable as an input indicator, although some of them disaggregate hospital beds into acute and intensive care unit (ICU) beds and long-term beds. The hospitals in our sample are acute hospitals which need to have some ICU beds. The number of ICU beds depends on the complexity of the cases treated. The ratio of ICU beds to acute beds grows as the case-mix grows but it is low in any case. Our variable *beds* is the addition of both types of beds, because the impact of including ICU beds is not significant for the purpose of our study. The number of FTE physicians and FTE nursing staff represent the human capital of hospitals. They are a key factor in healthcare decision-making processes because personnel costs represent a significant proportion of hospital operating costs (Weil, 2003). Many studies have introduced some indicator of the number of clinical staff as a proxy for labour costs (e.g. Pina & Torres, 1996; Prior, 2006; Nayar & Ozcan, 2008).

As output variables, we have used indicators which reflect three main hospital output categories: hospital stays -*inpatient stays*-, the surgical and inpatient activity -*surgical*

operations- and -*diagnoses*- (the number of medical and clinical tests to inpatients conducted to determine the diagnosis of each patient) and the outpatient activity -*outpatient visits*- and *emergencies*. Surgical activities and diagnoses are adjusted by the case-mix of each hospital, in order to increase the homogeneity of these indicators by reflecting the difference in the complexity of the activities carried out by each hospital. Table 1 presents the main descriptive figures of the input and output variables for the DEA analyses. Hospitals are grouped into rural or urban according to the SAS classification, which follows the previously explained criteria. Input and output data are obtained from the SAS annual reports.

INSERT TABLE 1 HERE

Because the lack of a consensus about the most appropriated indicators of the different activities carried out by hospitals, we define 4 different DEA specifications, or models, by maintaining the inputs fixed in all the 4 models and combining different indicators of outputs (see Table 2). The use of more than one DEA model provides different measurements of hospital efficiency with alternative variables for the same type of output in each model. Each of the 4 models includes one indicator per output category. This approach allows us to obtain a more consistent measurement of efficiency because we include alternative variables representative of hospital activity without increasing their number in each model.

INSERT TABLE 2 HERE

2nd stage. Statistical analyses

The previous stage has allowed us to obtain efficiency measures for the SAS hospitals. For perceived quality, we use 4 indicators obtained from the SAS annual survey: *satisfaction with medical staff*, *satisfaction with nursing staff*, *satisfaction with the care provided* and *satisfaction with rooms and facilities*. The indicators represent the percentage of patients who responded that they were satisfied or very satisfied with these aspects of hospital care. They

are frequently used as indicators of perceived quality in healthcare and their selection is consistent with the two perceived quality dimensions identified in the literature: a 'human dimension' and a 'facilities dimension' (see e.g. Lam, 1997; Garcia-Lacalle, 2008). Woodside, Frey & Daly (1989) indicate that patient satisfaction with the respect and the information provided by the nursing staff is strongly associated with the overall patient perceived quality.

To analyse the differences between rural and urban hospitals, we carry out the Mann-Whitney U test for the four DEA scores and the four perceived quality indicators for the two years. Then, we apply the multidimensional scaling (MDS) technique in order to jointly analyse efficiency and perceived quality which provides us with a visual representation of the performance of the hospitals analysed. The MDS tends to form 'clouds' of common objects which can be intuitively grouped by the analyst. For the MDS analysis, we have used the 4 DEA results and the 4 above mentioned perceived quality indicators. Additionally, a cluster analysis is carried out to classify the hospitals into homogeneous groups according to their performance. The cluster analysis, employing the Ward method, uses the same 8 indicators as in the MDS analysis. The use of the same number of variables for each dimension keeps the two dimensions balanced.

The interpretation of the axes in the MDS map has been done by using a *Pro-Fit*, or property fitting, analysis. Pro-Fit analysis (for a detailed explanation, see Serrano et al., 2003) attempts to relate the position of an object (hospitals) with the values that it adopts for each variable (efficiency and perceived quality scores) which locate the object in the MDS map. Eight ordinary least squares (OLS) regressions are performed, one for each of the 8 efficiency and perceived quality scores, which are considered as dependent variables. The results of the multidimensional scaling analysis are the independent variables. The results of the OLS

regressions are used as the projections of 8 Pro-Fit vectors onto axes X and Y. Each vector shows the direction of growth of a variable for both axes.

Results

Descriptive figures, for 2003 and 2006, of the DEA results, the 4 perceived quality indicators and the results of the U test are shown in Table 3. For 2003, the efficiency analysis shows, on average, a better performance in rural hospitals than in urban hospitals for the four models defined, except for model 2, but the differences are only significant in model 3. The higher standard deviation of rural hospitals in the DEA models, except for model 4, indicates that they are performing less homogeneously than urban hospitals. As regards perceived quality, rural hospitals obtain better scores for all the indicators and for two of them, *satisfaction with nursing staff* and *satisfaction with rooms and facilitie*s, the difference is significant. Once again, the higher standard deviation of rural hospitals in the perceived quality indicators shows that this type of hospital is also performing less homogeneously in this dimension. The results for 2006 show that the relative performance of the hospitals has remained almost unchanged during the period. Rural hospitals achieve higher DEA scores, except for model 2, but the differences are not significant in any model. As for the perceived quality indicators, urban hospitals are performing better in *satisfaction with the process of care,* but rural hospitals obtain better scores in the rest, particularly in *satisfaction with nursing staff* and *satisfaction with rooms and facilitie*s, where the differences are significant, as in 2003.

As all rural hospitals in the SAS have more than 100 beds, they can take advantage of possible economies of scale. This is probably the reason why there are no significant differences between rural and urban hospital efficiency. Rural hospitals are more efficient

than urban hospitals when emergencies are included in the model. The size of hospitals does not change the fact that rural hospitals perform better than urban hospitals in the perceived quality dimension, which is in agreement with the literature.

INSERT TABLE 3 HERE

Having evaluated the differences in efficiency and the perceived quality of care of the two groups of hospitals independently, the MDS analysis provides a visual representation of the relative position of all hospitals with respect to the two dimensions. Figures 1 and 2 show the MDS representation for 2003 and 2006, respectively. The *Pro-Fit* analysis shows that the four efficiency variables point towards the positive side of the Y axis, so this axis is interpreted as representing efficiency. As the four perceived quality variables point towards the positive side of the X axis, the interpretation is that this axis represents perceived quality. That is, efficiency improves when moving towards the top of the map, whereas patient satisfaction improves when moving towards the right. Hospitals have been grouped in the MDS maps according to the results of the cluster analyses, which have identified four groups for the two years. Figures A.1 and A.2 in the electronic appendix, available with the online version of the paper (INSERT LINK), show the results of the cluster analyses through the dendrograms obtained for the years 2003 and 2006 respectively. These two figures also show the number of beds in the hospitals in each year.

For 2003, three rural hospitals -Ru3, Ru6 and Ru11- form Group 1. Its position on the positive side of the efficiency axis and on the right hand side of the patient satisfaction axis reflects a good performance in efficiency and an outstanding performance in quality. Ten hospitals -five rural and five urban- form Group 2. The more centralised position of the hospitals of this group reflects that they are performing acceptably in both dimensions. The rural hospitals in the group tend to be on the right-hand side of the group, that is, they are

performing better than urban hospitals in the perceived quality dimension. Most of the urban hospitals are located in Group 3, which is made up of twelve hospitals, -nine urban and three rural. The position of the group on the left-hand side of the map indicates that its main feature is a bad performance in the quality dimension. The three rural hospitals in this group -Ru9, Ru10 and Ru13- form an 'optimum frontier' within the group. Finally, two rural hospitals -Ru1 and Ru5- form Group 4. These hospitals are performing fairly well in the quality dimension but are the worst in the efficiency dimension.

INSERT FIGURE 1 HERE

For 2006, most rural hospitals are in Group 1. This group, as in 2003, is mainly located on the positive side of the two axes, indicating that the hospitals included in it are the best performing in the two dimensions jointly. It includes the same three rural hospitals as in 2003 -Ru3, Ru6 and Ru11- with the addition of four rural hospitals and two urban hospitals. The two urban hospitals included in Group 1 are the ones which perform worst in the efficiency dimension within the group. All the remaining urban hospitals are located in Groups 2 and 3. Group 2 -6 urban hospitals- is located on the negative side of the quality dimension but on the positive side of the efficiency dimension, so this group is performing well in efficiency but badly in perceived quality. Group 3 is the most numerous group -ten hospitals-, and its position indicates a bad performance in the two dimensions. Within the group, rural hospitals show a better performance as they tend to be the closest to Group 1. Finally, Group 4 is made up of the same two rural hospitals -Ru1 and Ru5- and occupies a similar position within the map as in 2003. The position indicates a good performance in the perceived quality dimension but a bad performance in efficiency. Therefore, in both years, hospitals are performing quite similarly with respect to the others, although the change in the composition of the groups during the three-year period reflects that more rural hospitals tend

to be included in the best performing group. The two rural hospitals in Group 4 are able to perform well in the perceived quality dimension but, during the three-year period, they have not been able to improve their efficiency.

INSERT FIGURE 2 HERE

Discussion and conclusions

Nowadays, public hospitals are required to be more efficient while providing a high quality of care. The main goal of market-driven reforms is to improve the performance of public healthcare systems by promoting competition between hospitals. This study has analysed the performance of rural and urban hospitals to evaluate whether, in a market-driven context, the provision of hospital services in rural areas is justified in economic and quality terms.

The analysis of the use of resources has shown a similar level of efficiency for most of the SAS hospitals, regardless of their location. The SAS hospitals have autonomy in management aspects but still operate within a centralised system. The SAS has retained the scope for allocating resources to the different hospitals according their needs, assuring a similar level of efficiency in most of the hospitals. Decentralisation initiatives give local communities greater control in hospital management decisions, can help to focus decisions on the needs of the community and give managers greater flexibility in decision making, but central authorities loose some power to make decisions that ensure equity within the whole healthcare system. For example, the English NHS is conferring greater autonomy to hospitals but it is loosing some potential to take decisions that improve the overall efficiency of the whole system. In addition, a greater local community involvement in hospital care may also be to the detriment of the principle of equity that has traditionally ruled in NHS-type systems.

Having a network of relatively large rural hospitals seems to be a source of efficiency, most probably because they are large enough to take advantage of possible economies of scale. Rural hospitals are particularly efficient when emergencies are considered in the analysis. This could be due to patients using the emergency services instead of using hospital appointments or admissions. In any case, one of the main concerns of the population is to have their hospitals close at hand, which ensures the provision of early assistance in cases when immediate care is needed. The rural hospitals with a lower level of efficiency tend to be those with a lower ratio of population per bed, that is, they are, most probably, bigger than the real needs of the local communities.

Territorial equity in the provision of health services constitutes a central objective of health services in Spain (Abasolo, Pinilla & Negrin, 2008). In European countries, the closure of hospitals is a rare measure because of social and political implications. The closure of rural hospitals causes concern from a wide variety of constituencies because hospitals do not only provide specialised care, but serve as an economic and psychological anchor for the community (Hart, Amundson & Rosenblatt, 1990). Rural hospitals are usually one of the largest employers in their area and attract businesses and skilled human resources (Probst, Samuels, Hussey, Berry & Ricketts, 1999). The closure of the only hospital in a rural area decreases the well-being of the community because it makes access to healthcare difficult for the rural population (Trinh & Begun, 1990).

The analysis of the perceived quality dimension shows that the rural hospitals obtain higher patient assessments. These results are consistent with prior studies. The literature explains the differences in the perceived quality between hospitals on the basis of two factors: the characteristics of the hospitals and the characteristics of the patients treated. Significant differences in patient satisfaction scores have been found in the indicator related to hospital

rooms and facilities and in the indicator related to the nursing staff. The literature identifies hospital size as an explanatory variable of the level of satisfaction of the patients with hospital facilities. In addition, differences in satisfaction with nursing staff are important because, for most patients, the quality of nursing care is more important than satisfaction with facilities (Woodside et al., 1989). As regards the satisfaction of the patients with the process of care and with physicians, rural and urban hospitals are performing similarly. Physicians belong to a group of professionals with a very specific training, deontological codes and the shared protocols and procedures, which may explain the lack of significant differences between the two groups of hospitals in these indicators. Furthermore, patients do not have, in general, the ability to assess the clinical performance of physicians and the frequency of physician-patient contact is lower than that of nurse-patient contact.

The MDS map shows the performance of the SAS hospitals in the two dimensions. Most hospitals have a similar position in the map in both years, indicating that they are performing similarly over time. The hospitals which perform the best in the two dimensions are rural, and this is more evident as time passes. The results indicate that efficiency and quality can be mutually consistent objectives. The reallocation of resources can reduce inefficiencies without harming patient satisfaction (Valdmanis, Rosko & Mutter, 2008). The implementation of a PPS together with a freedom of hospital choice policy may be factor that contributes to align both objectives.

The prospective system used by the SAS to pay hospitals, based on a capitation formula, tries to improve the economic performance of hospitals while ensuring their funding. Hospitals are encouraged not to spend more than the initial budget assigned while maintaining or improving service quality. Vrangbæk & Bech (2004) argue that payment for performance mechanisms, such as those implemented in Norway or in England, introduce an open-ended

element into systems which were closed. This open-endedness introduces uncertainty into the management of the resources. Funding allocation according to hospital performance might increase differences in hospital quality levels in England (Dent & Haslam, 2006). However, the capitation payment model ensures stable funding as long as the quality of the service is similar to others and tries to avoid the unintended effects of PPS, in particular risk-selection practices, by adjusting the payment to the complexity of the cases treated. In addition, in the case of healthcare systems such as the SAS, in which all hospitals belong to the same organisation, there are no incentives to adopt risk-selection practices, because the ability of managers to select cases is limited by central rules.

The combination of a capitation payment system with the freedom of hospital choice policy encourages hospitals to provide a more patient-oriented care and also empowers patients to take a more active role in their own care. It requires the adoption of mechanisms to assess the quality of the service provided and the disclosure of the assessment, which usually triggers initiatives to improve hospital performance (Freeman, 2002). The SAS also establishes targets that hospitals have to meet to ensure that this service quality is satisfactory.

The introduction of economic rationalisation criteria may come into conflict with social welfare objectives and generate an important trade-off between economic considerations and the need to provide healthcare services. Public financial support is required to ensure the survival of hospitals in some rural areas but may reduce the incentives of PPS for performance improvements. This is the result of the implementation of the critical access hospitals (CAHs) program in the USA, which has helped to ensure the survival of these rural hospitals, as they are paid on a cost basis, but they are less efficient than the hospitals not included in the program (Rosko & Mutter, 2010). The SAS experience shows that the implementation of market-driven reforms can be done without breaking the social

equity principle that rules national health services, but does not necessarily introduce competition in the system. In particular, patients have no incentives to move to other than the closest hospitals for better care. The experience in the Scandinavian countries indicates that the number of patients choosing a hospital other than the closest is relatively small (Vrangbæck et al., 2007). Studies in Europe indicate that most patients prefer to use their local hospitals, although they are willing to undertake a journey if a significantly better or earlier care is provided (Garcia-Lacalle, 2008). Nonetheless, organisations in a market-driven context develop better knowledge of their strategic position, as well as their internal cost structures, in order to consider potential strategies in response to this new context (Vrangbæk et al., 2007) and they have to focus more on patients and users. Some level of competition may encourage hospitals to collaborate between them, which may result in a better support of their medical staff and become more efficient (Morgan & Bultje, 2008).

This study does not evaluate to what extent market mechanisms promote improvements in the performance of hospitals and competition in the system. Future research should address dynamic analyses of the performance of the system. International comparisons of the performance of hospitals in different market-driven systems would also provide very interesting lessons , since countries vary in the degree of implementation of the reforms. However, this seems particularly difficult as it would require the use of comparable measures of hospital performance. Another future research question is the inclusion of clinical quality in the evaluation of the performance of hospitals within the Spanish context in order to consider the effect of the quality of the medical results when evaluating the performance of hospitals.

References

Abasolo, I., Pinilla, J., & Negrin, M. (2008). Equidad en la utilización de servicios sanitarios públicos por Comunidades Autónomas en España: un análisis multinivel. *Hacienda Pública Española,* 187(4), 87-106.

Adams, E.K., Porell, F.W., & Robbins, J.D. (1996). Estimating the Utilization Impacts of Hospital Closures Through Hospital Choice Models: a Comparison of Disaggregate and Aggregate Models. *Socio-Economic Planning Science,* 30(2), 139-153.

Ahgren, B. (2008). Is it better to be big? The reconfiguration of 21st century hospitals: Responses to a hospital merger in Sweden. *Health Policy,* 87, 92-99.

Allen, P. (2006). New localism in the English National Health Service: What is it for? *Health Policy*, 79, 244-252.

Allen, P. (2009), 'Payment by Results' in the English NHS: the continuing challenges. *Public Money & Management*, 29(3), 161-166.

Amyx, D., Mowen, J.C., & Hamm, R. (2000). Who really wants health-care choice? *Journal of Management in Medicine,* 14 (5/6), 272-290.

Ankjær-Jensen, A., Rosling, P., & Bilde, L. (2006). Variable prospective financing in the Danish hospital sector and the development of a Danish case-mix system. *Health Care Management Science*, 9, 259-268.

Appleby, J., Harrison, A., & Devlin, N. (2003). *What is the Real Cost of More patient Choice*. King's Fund, London.

Athanassopoulos, A., & Gounaris, C. (2001). Assessing the technical and allocative efficiency of hospital operations in Greece and its resource allocation implications. *European Journal of Operational Research,* 133, 416-431.

Avkiran, N. (2001). Investigating technical and scale efficiencies of Australian Universities through data envelopment analysis. *Socio-Economic Planning Sciences*, 35, 57-80.

Baggott, R. (2005). A funny thing happened on the way to the forum? Reforming patient and public involvement in the NHS in England. *Public Administration*, 83, 535-551.

Bol, G. (1986). On technical efficiency measures: a remark. *Journal of Economy Theory*, 38, 380-385.

Botten, G., Grepperud, S., & Nerland, S.M. (2004). Trading patients lessons from Scandinavia. *Health Policy*, 69(3), 317-327.

Braithwaite, J. (1997). Competition, productivity and the culture of 'more is good' in the Australian Health Care Sector. *Australian Journal of Public Administration*, 56 (1), 37-44.

Charnes, A., Cooper, W., & Rhodes, E. (1978). Measuring the efficiency of Decision Making Units. *European Journal of Operational Research*, 2, 429-444.

Chern, JY., & Wan, TTH. (2000). The impact of the prospective payment system on the technical efficiency of hospitals. *Journal of Medical Systems*, 24(3), 159-172.

Cooper, W., Seiford, L., & Tone, K. (2000). *Data Envelopment Analysis: a comprehensive text with models, applications, references and DEA-Solver software*. Kluwer Academic Publishers

Cooper, W., Huang Z., & Zhu, J. (2008). A response o the critiques of DEA by Dimitruk and Koshevoy, and Bol. *Journal of Productivity Analysis*, 29, 15-21.

Dent, M., & Haslam, C. (2006). Delivering patient choice in English acute hospital trusts. *Accounting Forum*, 30, 359-376.

Dmitruk, A., & Koshevoy, G. (1991). On the existence of a technical efficiency criterion. *Journal of Economy Theory*, 38, 380-385.

DoH, (2004) *"Choose & Book" - Patient's Choice of Hospital and Booked Appointment. Delivery Framework for the Implementation of Choice and Booking at the Point of Referral*. Department of Health. London. August

Donabedian, A. (1988). The quality of care: how can it be assessed? *Journal of the American Medical Association,* 260, 1743-1748.

Dranove, D. (1998). Economies of scale in non-revenue producing cost centers: implications for hospital mergers. *Journal of Health Economics,* 17, 69-83.

Draper, M., & Hill, S. (1996). Feasibility of national benchmarking of patient satisfaction with Australian hospitals. *International Journal for Quality in Health Care,* 8, 457-466.

Ellis, R.P. (1998). Creaming, skimping and dumping: provider competition on the intensive and extensive margins. *Journal of Health Economics,* 17, 537–555.

Ellis, R.P., & McGuire, T.G. (1996). Hospital response to prospective payment: Moral hazard, selection, and practice-style effects. *Journal of Health Economics*, 15, 257-277.

Emrouznejad, A. (1995-2001). Ali Emrouznejad's DEA homepage. Warwick Business School, http://www.deazone.com

Etter, JF., & Perneger, TV. (1997). Quantitative and qualitative assessment of patient satisfaction in a managed care plan. *Evaluation and Program Planning*, 20, 129-135.

Ferlie, E. & Fitzgerald, L. (2002). *The sustainability of the New Public Management in the UK.* In: McLaughlin K, Osborne S, Ferlie E, editors. New Public Management: current trends and future prospects. London, Routledge.

Ferrier, GD., & Valdmanis, VG. (2004). Do mergers improve hospital productivity? *Journal of the Operational Research Society,* 55, 1071-1080.

Finkelstein, B.S., Singh, J., Silvers, J.B., Neuhauser, D., & Rosenthal, G.E. (1998). Patient and hospital characteristics associated with patient assessments of hospital obstetrical care. *Medical Care,* 36(8 Suppl), 68-78.

Freeman, T. (2002). Using performance indicators to improve health care quality in the public sector: a review of the literature. *Health Services Management Research*, 15, 126-137.

GAO (1990). *Report to Congress: Rural hospitals: factors that affect risk of closure.* Washington DC. General Accounting Office. June.

Garcia-Lacalle, J. (2008). A bed too far. *Health Policy,* 87(1), 31-40.

Gruca, T.S., & Nath, D. (2001). The Technical Efficiency of Hospitals under a Single Payer System: The Case of Ontario Community Hospitals. *Health Care Management Science,* 4, 91-101.

Hart, L.G., Amundson, B.A., & Rosenblatt, R.A. (1990). Is there a role for the small rural hospitals? *Journal of Rural Health*, 6, 101-118.

Healy, J. (2002). New Zealand. In A. Dixon, & E. Mossialos (Eds), *Health care systems in eight countries: trends and challenges.* London. European Observatory on Health Care Systems.

Healy, J., & McKee, M. (2002). The evolution of hospital systems. In J. Healy, & E. Mckee (Eds), *Hospitals in a changing Europe.* London. European Observatory on Health Care Systems.

Hollingsworth, B. (2008). The measurement of efficiency and productivity of health care delivery. *Health Economics,* 17(10), 1107-1128.

Huerta, T.R., Ford, E.W., Peterson, L.T., & Brigham, H.H. (2008). Testing the hospital value proposition: an empirical analysis of efficiency and quality. *Health Care Management Review,* 33(4), 341-349.

James, A.M. (1999). Closing rural hospitals in Saskatchewan: on the road to wellness? *Social Science & Medicine,* 49, 1021-1034.

Jegers, M., Kesteloot, K., De Graeve, D., & Gilles, W. (2002). A typology for provider payment systems in health care. *Health Policy,* 60, 255-273.

Johnes, G., & Johnes J. (1993). Measuring the research performance of UK Economics Departments: An application of Data Envelopment Analysis. *Oxford Economic Papers,* 4(2), 332-347.

Kim, T.H. (2010). Factors associated with financial distress of nonprofit hospitals. *Health Care Management,* 29(1), 52-62.

Kroneman, M., & Siegers, J.J. (2004). The effect of hospital bed reduction on the use of beds: A comparative study of 10 European countries. *Social Science & Medicine,* 59, 1731-1740.

Lam, SSK. (1997). SERVQUAL: A tool for measuring patients' opinions of hospital service quality in Hong Kong. *Total Quality Management,* 8, 145-152.

Lepnurm, R., & Lepnurm, M.K. (2001). The closure of rural hospitals in Saskatchewan: method or madness? *Social Science & Medicine,* 52, 1689-1707.

Lindrooth, R.C., Sassi, A., & Bazzoli G.J. (2003). The effect of urban hospitals closure on markets. *Journal Health Economics,* 22(5), 691-712.

Linna, M., Hakkinen, U., & Magnussen, J. (2006). Comparing hospital cost efficiency between Norway and Finland. *Health Policy,* 77(3), 268-278.

Mick, S., & Morlock, L. (1990). America's rural hospitals: a selective review of 1980 research. *The Journal of Rural Health,* 6(4), 437-466.

Mick, S., & Wise, C. (1996). Downsizing and financial performance in rural hospitals. *Healtj Care Management Review,* 21(2), 16-25.

Morgan, T., & Bultje, W. (2009). The new wisdom collaborate with the competition. *Healthcare Financial Management*, 63(5), 64-69.

Nayar, P., & Ozcan, Y. (2008). 'Data envelopment analysis comparison of hospital efficiency and quality. *Journal of Medical Systems,* 32, 193-199.

Newhouse, J.P. (1994). Frontier Estimation: How Useful a Tool for Health Economics? *Journal of Health Economics*, 13(3), 317–322.

Newhouse, J.P. (1996). Reimbursing Health Plans and Health Providers: Efficiency in Production Versus Selection. *Journal of Economic Literature,* XXXIV, 1236-1263.

Niakas, D., Gnardellis, C., & Theodorou, M. (2004). Is there a problem with quality in the Greek hospital sector? Preliminary results from a patient satisfaction survey. *Health Services Management Research*, 17, 62-69.

Noh, M., Lee, Y., Yun, S-C., Lee, S-I., Lee, M-S., & Khang, Y-H. (2006). Determinants of hospital closure in South Korea: Use of a hierarchical generalized linear model. *Social Science & Medicine,* 63, 2320-2329.

Oliveira, M., & Bevan, G. (2008). Modelling hospitals costs to produce evidences that promote equity and efficiency. *European Journal of Operational Research,* 185, 933-947.

O'Neill, L., Rauner, M., Heidenberger, K., & Kraus, M. (2008). A cross-national comparison and taxonomy of DEA-based hospital efficiency studies. *Socio-Economic Planning Sciences*, 42(3), 158-189.

Pakdil, F., & Harwood, T.N. (2005). Patient Satisfaction in a Preoperative Assessment Clinic: An Analysis Using SERVQUAL Dimensions. *Total Quality Management,* 16, 15-30.

Pilyasvky, A., & Staat, M. (2008) Efficiency and productivity change in Ukrainian health care. *Journal of Productivity Analysis,* 29, 143-154

Pina, V., & Torres, L. (1996). Methodological Aspects in Efficiency Evaluation of Public Hospitals. *Financial Accountability and Management,* 12(1), 21-36.

Pink, G., Murray, M.A., & McKillop, I. (2003). Hospital efficiency and patient satisfaction. *Health Services Management Research,* 16, 24-38.

Prior, D. (2006). Efficiency and total quality management in health care organizations: A dynamic frontier approach. *Annals of Operations Research,* 145, 281-299.

Probst, J.C., Samuels, M.E., Hussey, J.R., Berry, D.E., & Ricketts, T.C. (1999). Economic Impact of Hospital Closure on Small Rural Counties, 1984 to 1988: Demonstration of a Comparative Analysis Approach. *The Journal of Rural Health,* 15(4), 375-390.

Propper, C., Burgess, S., & Gossage, D. (2008). Competition and quality: Evidence from the NHS internal market 1991-9. *Economic Journal,* 118, 138-170.

Rosenheck, R., Wilson, NJ., & Meterko, M. (1997). Influence of patient and hospital factors on consumer satisfaction with inpatient mental health treatment. *Psychiatric Services*, 48, 1553-1561.

Rosko, M.D., & Mutter, R.L. (2010). Inefficiency differences between critical access hospitals and prospectively paid rural hospitals. *Journal of Health Politics, Policy and Law*, 35 (1), 95-126.

Ruyter, K., & Wetzels, M. (1998). On the complex nature of patients' evaluations of general practice service. *Journal of Economic Psychology*, 19, 565-590.

SAS (1999). *Una propuesta de gestión pública diferenciada*. Servicio Andaluz de Salud; Seville. Spain

SAS (2007). *Modelo de financiación capitativa de Hospitales, Distritos de Atención Primaria y Áreas de Gestión Sanitaria.* Servicio Andaluz de Salud. Seville. Spain

Schuhmann, T. (2008). Hospital financial performance trends to watch. *Healthcare Financial Management*, 62(7), 59-66.

Serrano, C., Mar Molinero, C., & Bossi, A. (2003). The measurement of intangible assets in public sector using scaling techniques. *Journal of Intellectual Capital*, 4(2), 249-275.

Smith, P. (2005). Performance measurement in health care: History, Challenges and Prospects. *Public Money & Management*, 25(4), 213-220.

Sweeney, J., Brooks, AM., & Leahy, A. (2003). Development of the Irish National Patient Perception of Quality of Care Survey. *International Journal for Quality in Health Care*, 15, 163-168.

Tengilimoglu, D., Kisa, A., & Dziegielewski, S.F. (2001). Measurement of patient satisfaction public hospital in Ankara. *Health Service Management Research*, 14, 27-35.

Trinh, H.Q., & Begun, J.A. (1999). Strategic adaptation of US rural hospitals during the era of limited financial resources: a longitudinal study, 1983 to 1993. *Health Care Management Science*, 2(1), 43-52.

Thomson, S. & Dixon, A. (2006). Choices in health care: the European experience. *Journal of Health Services Research & Policy*, 11(3), 167-171.

Valdmanis, V., Rosko, M., & Mutter R. (2008). Hospital quality, efficiency and input differentials. *HSR: Health Service Research*, 43(5), 1830-1848.

Vitikainen, K., Street, A., & Linna, M. (2009). Estimation of hospital efficiency—Do different definitions and casemix measures for hospital output affect the results? *Health Policy*, 89, 149-159.

Vrangbæk, K., & Bech, M. (2004). County level responses to the introduction of DRG rates for 'extended choice' hospital patients in Denmark. *Health Policy*, 67, 25-37.

Vrangbæck, K., & Østergren, K. (2006). Patient empowerment and the introduction of hospital choice in Denmark and Norway. *Health Economics, Policy and Law,* 1(4), 371-394.

Vrangbæck, K., Østergren, K., Birk, H.O., & Winblad, U. (2007) Patient reactions to hospital choice in Norway, Denmark, and Sweden. *Health Economics, Policy and Law*, 2, 125–152

Weil, T.P. (2003). Hospital downsizing and workforce reduction strategies: some inner workings. *Health Services Management Research,* 16, 13-23.

Woodside, A.G., Frey, L.L., & Daly, R.T. (1989). Linking Service Quality, Customer Satisfaction and Behavioral Intention. *Journal of Health Care Marketing,* 9(4), 5-17.

Woolhandler, S., & Himmelstein, D. (2007). Competition in a publicly funded healthcare system. *British Medical Journal,* 335, 1126-1129.

Young, G.J., Meterko, M., & Desai, K.R. (2000). Patient satisfaction with hospital care: effects of demographic and institutional characteristics. *Medical Care,* 38(3), 325-334.

TABLES

TABLE 1. Descriptive figures of the input and output variables of the SAS hospitals included in the analysis.

		2003				2006			
		Mean	Std. Dev	Min.	Max.	Mean	Std. Dev	Min.	Max.
Beds	Urban	893	334	411	1,571	847	323	394	1,521
	Rural	199	59	125	305	197	60	111	320
	Total	**559**	**427**	**125**	**1,571**	**534**	**404**	**111**	**1,521**
Physicians	Urban	500	236	210	1,110	511	230	216	1,111
	Rural	118	18	79	145	123	21	85	158
	Total	**316**	**257**	**79**	**1,110**	**324**	**256**	**85**	**1,111**
Nursing staff	Urban	1,848	857	891	3,913	1,838	830	861	3,843
	Rural	391	82	244	543	390	80	240	532
	Total	**1,146**	**959**	**244**	**3,913**	**1,141**	**944**	**240**	**3,843**
In-patient stays	Urban	252,399	96,489	101,008	441,241	235,068	87,066	111,518	394,285
	Rural	50,685	15,862	22,858	75,269	48,425	14,721	23,428	71,440
	Total	**155,277**	**123,774**	**22,858**	**441,241**	**145,203**	**113,673**	**23,428**	**394,285**
Outpatient visits	Urban	535,062	269,651	214,522	1,110,630	545,942	209,534	250,919	1,013,764
	Rural	130,613	38,521	79,357	218,214	134,303	36,689	89,614	224,382
	Total	**340,327**	**281,869**	**79,357**	**1,110,630**	**347,746**	**257,884**	**89,614**	**1,013,764**
Emergencies	Urban	179,310	77,540	71,120	346,325	187,113	76,358	79,725	359,857
	Rural	56,319	17,034	21,912	79,613	58,278	17,888	23,037	82,216
	Total	**120,092**	**84,035**	**21,912**	**346,325**	**125,081**	**85,827**	**23,037**	**359,857**
Diagnoses*	Urban	162,869	87,698	66,521	371,790	203,385	101,285	91,406	447,654
	Rural	34,378	7,788	15,076	42,088	41,376	9,554	23,331	55,724
	Total	**101,003**	**90,298**	**15,076**	**371,790**	**125,381**	**109,436**	**23,331**	**447,654**
Operations*	Urban	20,311	12,370	8,761	56,020	34,042	18,313	12,817	70,821
	Rural	4,837	852	3,803	6,499	6,413	1,205	4,890	8,835
	Total	**12,861**	**11,786**	**3,803**	**56,020**	**20,739**	**19,138**	**4,890**	**70,821**

***** Adjusted by case-mix

TABLE 2. Inputs and outputs used in the 4 DEA models

	M1	M2	M3	M4
Input indicators				
Beds	X	X	X	X
Physicians (FTE)	X	X	X	X
Nursing staff (FTE)	X	X	X	X
Output indicators				
Outpatient visits	X	X		
Emergencies			X	X
Stays	X	X	X	X
Diagnoses*	X		X	
Operations*		X		X

* Adjusted by case-mix

TABLE 3. Descriptive figures of the DEA results and perceived quality indicators, and U test results.

		2003					2006				
		Mean %	**Std. Dev %**	**Min. %**	**Max. %**	**U test[1] %**	**Mean %**	**Std. Dev %**	**Min. %**	**Max. %**	**U test[1] %**
DEA-M1	urban	93.03	5.2	84.52	100	0.587	93.82	5.49	84.00	100	0.486
	rural	93.57	8.05	75.78	100		94.78	7.44	77.45	100	
DEA-M2	urban	93.89	5.38	82.52	100	0.557	93.99	4.07	86.95	100	0.677
	rural	92.72	6.31	80.00	100		93.63	7.52	77.22	100	
DEA-M3	urban	90.89	6.25	79.80	100	0.018*	93.77	5.11	84.00	100	0.255
	rural	96.01	7.03	75.78	100		95.66	6.03	81.10	100	
DEA-M4	urban	93.47	5.11	82.52	100	0.279	94.12	4.10	87.06	100	0.419
	rural	95.79	4.97	87.56	100		95.02	5.59	85.80	100	
Satisfaction with the process of care	urban	71.37	2.69	66.00	75	0.198	73.97	2.56	70.10	79.80	0.207
	rural	73.66	6.6	60.00	82		72.58	5.14	65.45	82.45	
Satisfaction with physicians	urban	90.51	1.5	87.40	92.7	0.052	90.81	1.82	88.00	93.75	0.244
	rural	92.11	3.21	85.00	95.8		91.79	2.15	87.75	95.45	
Satisfaction with nursing staff	urban	88.51	1.76	85.00	91	0.012*	89.08	2.00	85.50	92.50	0.024*
	rural	91.10	3.6	82.00	95		91.31	2.68	87.00	96.30	
Satisfaction with rooms and facilities	urban	57.69	6.28	49.60	70.3	0.002**	61.84	7.13	52.50	75.20	0.000**
	rural	72.62	13.29	47.50	94.2		76.91	8.08	66.60	89.80	

[1] Significance of the Mann-Whitney U test

** Significant at 0.01

* Significant at 0.05

FIGURES

FIGURE 1. MDS for 2003.

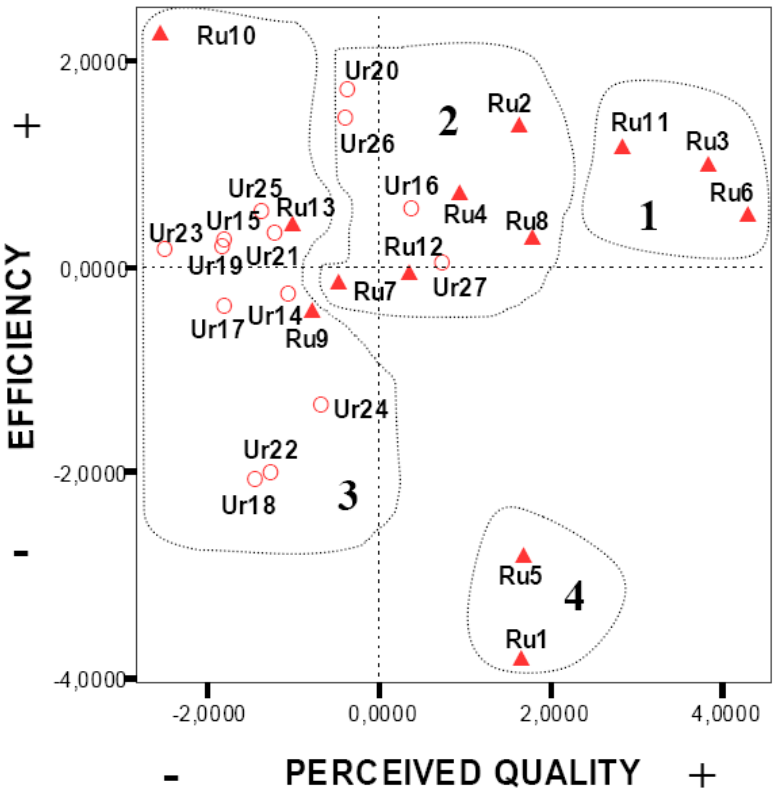

FIGURE 2. MDS for 2006.