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MEASURING THE EFFICIENCY OF MEDICAL TOURISM INDUSTRY IN EU MEMBER STATES

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Abstract

Under the Directive 2011/24/EU, medical tourism and cross-border health are interrelated terms regarding the freedom to move to get the most accessible medical treatment into EU Member State within the defined procedures for reimbursement. Little known empirically regarding the efficiency of the cross-border health/medical tourism industry. This study aims to measure its efficiency in Europe for the years 2010-2014, by using Data Envelopment Analysis (DEA). Data obtained from OECD and the European Core Health Indicators (ECHI), which is collecting the data through Eurostat. Eurostat collects data on health care activities and provides data on hospital discharges, including the hospital discharges of non-residents and these include hospital discharges of in-patients and day care patients. The analysis uses “DEA.P, 2.1 for windows” by Coelli (1996). The results show that the Members States health systems were very efficient in handling non-residents in-patients, however when managing day cases/outpatients the efficiency scores dropped. The findings would have significant associations affecting intentions to revisit clinics and the destination country. In addition, will be useful to those seeking a better understanding of the cross-border health and medical tourism industry efficiency. Extending the findings of the European Commission report (2015c) by examining how well medical tourists are informed about the decision they are making, would be of perceived value. These are important indicators at European level by helping each Member State to measure its medical tourism services.

Key words: cross-border health, medical tourism, efficiency, DEA

JEL codes: I11, Z33, Z38

1. Introduction

In June 2010, the European Commission adopted the Communication, ‘Europe, the world's No. 1 tourist destination – a new political framework for tourism in Europe’. This communication set out a new strategy and action plan for EU tourism. Tourism has a wide-

ranging impact on growth, employment and social development in the EU. The inbound tourism is contributing €356 billion in annual revenue to the European Economy (European Commission 2017b). In EU policy debates, cross-border care also often refers to short and long term visitors to another EU country who find that they have to seek health care when they are abroad. These two categories include those who fall ill when abroad and those who go abroad for planned treatment (WHO 2014). Temporary visitors abroad include individuals travelling for work and for leisure (WHO 2014). According to WHO (2014) temporary visitors are those who have travelled abroad for work and for leisure, and cross border health can be for them the most accessible or appropriate care. There has been a considerable increase in the volume of tourism in Europe, with especially large numbers travelling from northern to southern Europe in summer (Patterson 2006). Medical tourism refers to people traveling to a country other than their own to obtain medical treatment (Horowitz et al. 2007, Horowitz et al. 2007). Medical tourism will play a significant role in shaping the future of medical care globally, as it sits at the growing intersections of technology, economy, cultural and other global relations (Jenner 2008).

Health has always been on the European agenda. Several factors make health policies and the health systems across the European Union increasingly interconnected: i) patients receive healthcare across the EU, ii) health professionals work in different EU countries, iii) higher expectations for healthcare, iv) new developments in health technologies (European Commission 2017).

The number of individuals choosing to travel across national borders or overseas to receive medical treatments has been on the rise (European Commission 2014). Making cross-border health care for European Union (EU) citizens possible, the Directive 2011/24/EU makes it easier for EU citizens to get medical treatment in another EU Member State and ensure that at least some of the costs are reimbursed in their own country. However, the

Directive emphasises that Member States retain responsibility for providing safe, high-quality care on their territory, and that care should be provided according to their own standards of quality and safety. Health system performance is key to achieving the maximum that could be expected given the level of resources. Countries need to measure how well the health systems achieve to manage the arrival of the non-resident patients seeking treatment. Measurement of performance requires an explicit framework defining the goals of a health system against which outcomes can be judged and performance quantified. Performance comparison efforts are still in their early stages and there are many challenges involved in the design and implementation of comparison schemes.

Cross-border health including medical tourism has become a simpler way to get treatment abroad; and for temporary visitors such as medical tourists, can be the most accessible or appropriate care. Little is known empirically regarding the efficiency of the cross-border health/medical tourism industry. This study aims to measure the efficiency of the cross-border health/medical tourism industry for the years 2010-2014.

2. Cross border health

The EU has a compendium of Directives dealing with health issues; with laws and Directives applying to the most crucial areas such as cross-border health including medical tourism. European Union's Treaty and its Charter of Fundamental Rights (C364/1 2000) and the EU institutions are bound to principles that ensure a high level of health protection. These are the right to benefit from medical treatment; access to healthcare - preventive, diagnostic and curative treatment regardless of financial means, gender or nationality (European Commission 2015a). The Directive 2011/24/EU on the application of patients' rights in cross-border healthcare came into force on 24 April 2011 and aims to provide all EU citizens with equal access to quality healthcare, responding to their specific needs (European Commission 2015b). In 2014 the Communication on health systems shows that the Commission promotes

cooperation at EU level with a view to strengthen effectiveness, increase accessibility and improve resilience of the national health systems in the EU (European Commission 2014). In 2015 the European Commission released a report on the “Operation of Directive 2011/24/EU on the application of patients’ rights in cross-border healthcare” (European Commission 2015c).

Moreover, it has released two Eurobarometers; one on patients’ rights in cross-border healthcare in the European Union (Eurobarometer 2015/425) and one on the preferences of Europeans towards tourism (Eurobarometer 2015/414).

The first Eurobarometer (2015/425) describes that as for the proportion of Europeans who reported that they actually received medical treatment in another Member State, there was a relatively small difference from one EU country to another. The findings show that in eight Member States, the percentage of people who used cross-border healthcare in another EU Member State at greater than 5% were Luxembourg (LU) 16%, 12% Italy (IT) and 10% in Hungary (HU). Other countries which ranked above the average were Romania (RO) (8%), Portugal (PT) (7%), Czech Republic (CZ) (7%), Poland (PO) (7%) and Ireland (IE) (6%). The high rates observed in LU compared to other EU countries may be because its population is made up of many citizens from other Member States who are therefore more likely to seek healthcare abroad. For 27% of the respondents, language was a major obstacle to receiving healthcare abroad, which could actually make them feel more vulnerable. 23% of respondents would want to know the waiting times for the treatment they are looking for and the same proportion would want information on healthcare providers (Eurobarometer 2015/425).

The second Eurobarometer (2015/414) under study, showed that spending time in the sun or at the beach continues to be the main reason for going on holiday, and the second reason for going on holidays was health treatment with a response of one person in eight (13%). Very high scores were observed in PT, Latvia (LV), Sweden (SE), MT, Hungary (HU),

and Slovakia (SK). It is worth mentioning that holidaymakers reported factors related to sports or health not as the main motive for their main vacation in 2010 (3%) but as an important factor boosting their holidays' choice.

These two Eurobarometers showed that health problems within the medical tourism spectrum can be an opportunity for travelling and accessing quality health care treatments in another country.

In 2016, the European Commission released a study aiming to contribute to effective cross-border cooperation between EU-Member States by means of pooling resources for high-cost medical equipment investments (European Commission 2016).

The aforementioned reports and Eurobarometers showed that the European Commission is putting a considerable effort into simplifying the process of travelling abroad and getting treatment.

3. Medical tourism

Health tourism is defined as "the organized travel outside one's local environment for the maintenance, enhancement or restoration of an individual's wellbeing in mind and body". A subset of this is medical tourism, which is "the organized travel outside one's natural healthcare jurisdiction for the enhancement or restoration of the individual's health through medical intervention" (Carrera and Bridges 2006). In the past, this usually referred to those who travelled from less-developed countries to major medical centers in highly developed countries for treatment unavailable at homes (Horowitz et al. 2007, Horowitz et al. 2007). Medical tourism is becoming increasingly popular, is driven by marketplace forces and occurs outside of the view and control of the organised healthcare system (Horowitz et al. 2007). Medical tourism is one growing dimension of health care globalisation, whereby consumers elect to travel across borders or to overseas destinations to receive their treatment (Lunt and

Carrera 2010). There are some of the interrelationships between different areas of health and medical tourism, including wellness and wellbeing tourism, dental tourism, stem-cell tourism, transplant tourism, abortion tourism, and xeno-tourism. Key to defining these areas are the relationships to concepts of wellness and illness and the extent to which regulation encourages individuals to engage in cross-border purchase of health services and products (Hall 2011).

At the international level, health tourism is an industry sustained by 617 million individuals with an annual growth of 3.9% annually and worth US\$513 billion (Carrera and Bridges 2006). The medical tourism industry is a fast-growing global niche market that generated \$20 billion in income for destinations around the world (Woo and Schwartz 2014). Some estimates on medical tourism between countries are made by consultancies in the process of assessing the potential of the medical tourism business. They range from estimates based on Deloitte's 2008 report on medical tourism, quantifying the number of people travelling abroad for healthcare at 30 and 50 million each year (Keckley and Underwood 2008). Also, according to the Global Wellness Tourism Economy (2013), medical tourism market is worth US\$50-60 billion. The latest projection on medical tourism is estimated to be \$100 billion dollar industry ([Fetscherina](#) and [Stephano](#) 2016). There are several studies providing estimate on medical tourism growth, but they are based on US figures (Keckley and Underwood 2008, Gan et al. 2011, Gan et al. 2012, Jacobs et al. 2013). To provide reliable and accurate data on the flow of medical tourists is very hard as agreed by other authors, because most of the records are held by private entities (Johnson and Garman 2010, Turner 2012, Lunt et al. 2012). Data collection, measures, and studies of medical tourism all need to be greatly improved if countries are to assess better both the magnitude and potential health implications of this trade (Hopkinset al. 2010). Despite the increasing number of people, companies and countries involved in medical tourism, very little is known about the key drivers and how countries are perceived as medical tourism destinations. Studies have tried to

estimate the costs and the benefits of medical tourism (Hanefeld et al. 2013; Beladi et al. 2015); to investigate the understanding of the factors that influence the travel intentions of medical tourists through its empirical investigation, and especially in its targeting of customers' value perception (Wang 2012); to investigate the decision to engage in medical tourism (Runnels and Carrera 2012); or to investigate tourist executives' opinions, aspects and beliefs in medical tourism and examine factors affecting their potential investments (Sarantopoulos et al. 2014); and to explain the development, functioning, purposes and possible implications of cross-border contracting (Glinos et al. 2010). Other studies suggest and test a mechanism to assess the medical tourism providers, perceptions about the tourists, perceived important product attributes when selecting a medical tourism destination (Woo and Schwartz 2014). In addition, research has been conducted to develop a model explaining international medical travellers' intention formation by considering the impact of quality, satisfaction, trust, and price reasonableness (Han and Hyun 2015) or to develop a model by introducing and explaining main elements of medical tourism such as types of medical tourists (Ko 2011).

Measuring the medical tourism industry efficiency through frontier methods such as Data Envelopment Analysis (DEA) method has not been performed. To our knowledge, this is the first study trying to use available data that would provide evidence on measuring the efficiency of the cross-border health/medical tourism industry in the EU, by using DEA. DEA analysis has been widely used in other economic sectors since 1957 by (Farrell 1957) as organisations have struggled to improve productivity and efficiency. DEA has a long history with lots of important publications in measuring efficiency of hospitals and clinics (Caves et al. 1982, Lovell 1996, Cook and Seiford 2009, Charnes et al. 1978, Färe et al. 1994, Coelli et al. 2005, Coelli and Perelman 1996, Hollingsworth et al. 1999, Färe et al. 1989, Halkos and Tzeremes 2010, Ancarani et al. 2009, Maniadakis et al. 2007, Androutsou et al. 2011, Staat

2006, Geitona et al. 2013, Pulina et al. 2010, Khushalani and Ozcan 2017, Steinmann and Zweifel, 2003; Leleu et al., 2014; Samut and Cafri, 2016; Moran and Jacobs, 2013, Linna et al. 2006, Varabyova and Schreyögg 2013, Medina et al. 2013).

DEA method has been also used in tourism industry by measuring the performance of the hotels (Assaf and Agbola 2011, Barros 2006, Tingting and Liang 2015, Wöber 2008, Meng-Chun et al. 2011, Halenur 2017, Jin-Li Hu 2014, Debata et al. 2013). Therefore, this method has been selected as it has been used in both industries to measure efficiency and provide reliable results.

4. Material and Method

Data was obtained from the Organisation of Economic Co-operation and Development (OECD) and the European Core Health Indicators (ECHI), which is collecting the data through Eurostat. Eurostat collects data on health care activities and provides data on hospital discharges, including the hospital discharges of non-residents and these include hospital discharges of in-patients and day care patients. The results were obtained by using “DEA.P Version 2.1 for windows” by Coelli (1996).

The computation of cross-border health/medical tourism industry efficiency of the EU Member States has been explored by using the non-parametric mathematical programming approach – DEA. Efficiency measurement refers to technical efficiency (TE), which aims at the maximisation of outputs for a given level of inputs, or conversely the minimisation of input use for a given output level. In this study, an input-oriented measure has been performed in order to evaluate by how much quantities can be proportionally increased without changing the output quantities used (Banker et al. 1984, Charnes et al. 1978, Hollingsworth et al. 1999).

The formulation used to define efficiency in this study is described as follows. In order to characterise production technology related to the efficiency measurement, each clinic uses

variable inputs $\chi = (\chi_1, \dots, \chi_N) \in \mathbb{R}^N_+$ to produce variable outputs $y = (y_1, \dots, y_M) \in \mathbb{R}^M_+$. The clinic inputs can be transformed into outputs using technology that can be described by $GR = \{(x, y) : x \text{ can produce } y\}$. Corresponding to the GR, there is a family of input sets $L(y) = \{x : (x, y) \in GR\}$, $y \in \mathbb{R}^M_+$. Input sets are assumed to be closed and bounded above, and to satisfy strong disposability of inputs. The input sets contain isoquants $Isoq L(y) = \{x : x \in L(y), \theta x \in L(y), \theta \notin (0, 1)\}$, $y \in \mathbb{R}^M_+$. Also corresponding to the GR of the technology is a family of output sets $P(x) = \{y : (y, x) \in GR\}$, $x \in \mathbb{R}^N_+$. Output sets are assumed to be closed and bounded above, and to satisfy the properties of convexity and strong disposability of outputs. A Farrell radial measure of the technical efficiency of input vector x in the production of output vector y is given by: $TE(x, y) = \min \{\theta : \theta x \in L(y)\}$, where $\theta = 1$ indicates radial technical efficiency and $\theta < 1$ shows the degree of radial technical inefficiency.

DEA efficiency scores at EU Member States, are related to the relative efficiency of the services provided by each Member State or to inefficiencies related to the excessive and incorrect input utilisation. Fully efficient EU Member States per year are those which score 1.00 and achieve the highest performance, 100% efficiency scores. Inefficiency or minimum levels of performance refer to any regressed scores below 1.00 or below 100% efficiency scores.

This study runs two (2) models in order to analyse the efficiency of the Member States health systems when treating non-resident patients. The reason of creating these 2 models is due to data availability. The study used all the data available per year and per reference country. The study used as output the indicator hospital discharges of non-residents, which includes hospital discharges of in-patients and day care patients. Medical tourists can be classified as a non-resident category of patients that have been discharged by the hospital after an episode of care.

The study considers hospitals as a multi-product organisation with the annual number of practising physicians and practising qualified nurses and midwives per 100,000 inhabitants

per EU Member State used as labour inputs and the number of beds as an aggregate proxy of capital inputs. Table 1 shows the inputs and outputs used in the two models along with a description of the data used and the sources of the data. In both models, it used three (3) inputs (hospital beds, total number of practising physicians, per 100,000 inhabitants and practising qualified nurses and midwives, per 100,000 inhabitants).

.....(Table 1 about here).....

The difference in the two models is that model no1 used two outputs (hospital discharges in-patients per 100,000 inhabitants, number of non-resident people among all people discharged from hospital per 100,000 inhabitants) while model no. 2 used two outputs by keeping the same indicator “the number of non-resident people among all people discharged from hospital per 100,000 inhabitants”, but as a second output indicator it used the day cases/number of outpatients. The indicator on patient mobility meets the increasingly important EU-health policy issue of cross-border care. Increased patient mobility raises a number of issues and concerns in Member States such as health care availability and utilisation, health infrastructure development, cost sharing and patient safety. Therefore, the main indicator taken into consideration in measuring the efficiency of the cross-border/medical tourism industry is the number of non-resident people among all people discharged from hospital per 100,000 inhabitants. A non-resident patient is a patient living in another country/region but coming in the country/region of reference for treatment and/or care. Each EU Member State is considered as a single Decision Making Unit (DMU) in terms of provision of in-patient care and day cases/outpatients. The available data provided by more than one EU Member State per year was for the period 2010 – 2014, therefore the DEA models were evaluated in terms of their cross-country performance over that period. The study used 49 DMUs for the aforementioned years.

The input-oriented method has been chosen due to the fact that the output used in this study -the non-resident people among all people being discharged– is a source which presents the arrival of medical visitors to the host Member State hospitals, which regarding to the usual health systems procedure is an indicator that in terms of budget and resources allocation cannot be predicted, but is aggregated to the number of “health care users”. A hospital discharge is the formal release of a patient from a hospital after a procedure or course of treatment (episode of care) (ECHI 2017). The inputs used; hospital beds, and the human resources are indicators forming a health care system and can be crucial when planning a reform to achieve efficiency.

5. Results

In this paper, EU Member States performance has been assessed by measuring cross-border/medical tourism industry efficiency through a set of similar DMUs. The results at a European level by running model no.1, showed that in 2010 all the countries with available data (HU, IE, LU)] were fully efficient when providing medical treatment to those that are non-residents. In 2011 six [HU, IE, LU, IT), Slovenia (SI), Lithuania (LT)] out of ten countries were fully efficient, while CZ and Croatia (HR)] had the lowest efficiency scores. In 2012 six [IE, LU, SI, Malta (MT), RO and Slovakia (SK)] out of fourteen countries were fully efficient, while HR, CZ and Spain (ES) showed the lowest efficiency scores among the countries studied. In 2013 five (IE, LU, MT, RO, SI) out of thirteen countries were fully efficient, while HR and Italy (IT) where those with the least efficient scores. In 2014 four (LU, SI, MT, RO) out of ten countries were fully efficient, while Germany (DE) showed the lowest efficiency score. Overall, the countries under study were very efficient, as the ranking between the scores throughout the years was from the lowest 0.71 (HR) to the highest 1 (LU, IE, SI, RO and SK).

The results by running model no. 2 showed that in 2010, 2011 and 2012 two countries (IE, LU) out of three, ten and fourteen accordingly, were fully efficient. In 2013 three (IE, LU, MT) out of eleven countries scored 1. In 2014, four out of ten countries were fully efficient. Throughout the years, IE and LU were fully efficient while HU, CZ, DE and LT were the least efficient.

By comparing the 2 models the results show that IE and LU were fully efficient run by both models throughout the years. The rest of the Member States run by Model 1 achieved better scores than run by Model 2, meaning that they could manage better in-patients than day cases/outpatients. The Member States with the broader differences in scores between the 2 models are HU, CZ, DE and LT. Figure 1 shows the results of the two models for the time horizon of the analysis.

.....(Figure 1 about here).....

6. Discussion

By considering the importance of the cross-border Directive 2011/24/EU that was engaged by the Member States in 2013, this study’s observations were that the efficiency scores achieved per country were similar through the years before and after this milestone. The reason that there is no considerable efficiency improvement after 2013 can be due to the issue that the Directive was not properly disseminated to the citizens, as it was also concluded by the report regarding the operation of European Commission (2015c) Directive. However, it is worth mentioning that after 2011 (the year that the Directive was published) more Member States were collecting data on non-residents patients. The Member States can link this to an observation that cross border health/medical tourism is gaining a great interest and an early stage collection of reliable data has been performed. The results also showed that LU and IE were fully efficient throughout the years of consideration. These results can be linked to the findings of the Eurobarometer 2015/425, which reported that the percentage of people who used cross-border healthcare in another EU Member State and was greater than 5% was LU

and IE. LU high performance can also be due to the facts highlighted at the same Eurobarometer, that was among the countries that were more open to cross-border healthcare and as an international country – with population made up of many citizens from other Member States and many people working in LU but living in neighbouring countries – may support a health system that needs to respond to non-residents provision of health care on a daily basis, meaning that LU health system is more familiar with the cross-border health policy. Another factor which was a major obstacle for respondents to travel, was the language. LU and IE may be fully efficient also due to the fact that health professionals in both countries speak fluent English. This encourages patients to use the health care facilities, but also creates a level of understanding of the health care needs by the health professionals; which may lead to a more efficient health system. Addressing language barriers through interpreters and language training professionals is also important for the safety of mobile patients, but again, these measures have come to be seen as vital for all high-quality care due to the increasing ethnic heterogeneity of Europe (Legido-Quigley et al. 2007). By comparing this study's observations to the Eurobarometer 2015/414 results, the countries with the highest scores of the population that travelled due to health reason were PT, LV, Malta (MT), Hungary (HU), Slovakia (SK); these countries were also very efficient in treating non-residents patients according to the findings of this study. However, the determining factor is whether the cost to the patient is seen as a barrier to free movement (Legido-Quigley et al. 2007).

There are some methodological limitations that should be mentioned as the fact that the data available per year did not include the same countries. It is worth pointing out that the efficiency scores could vary if different models were to be run. Data availability in the EU on provision and utilisation rates of medical tourism is only limited. Institutional barriers such as European comparison of waiting times to enable patients to make informed choices when seeking medical care in another Member State, is very limited. The use of the output data

provides information about the patients that are non-residence to the host country they received treatment and this data includes those that are medical tourists. However, the data available does not distinguish groups. Therefore, for the purposes of this study it is assumed that medical tourists are included in the data of those received cross-border health, as they can lay in the category of temporary visitors that have travelled abroad for work and/or for leisure and cross-border care was for them the most accessible or appropriate care.

In order to create comparable units and avoid heterogeneity of the sample the data used was from the EU Member States that have provided figures on the number of non-resident people among all people discharged from hospital per 100,000 inhabitants. Another important limitation refers to the fact that outputs adjusted for case-mix and in-patients' severity have not been taken into consideration due to the lack of relevant data. Consequently, the data set used does not reflect output qualitative dimensions, which should constitute a primary criterion in the evaluation of hospital care. Moreover, TE has been used as an input-oriented measure but an output-oriented measure including patients' satisfaction of the services may be useful for long-term growth of the industry, as it is an important and commonly used indicator for measuring the quality in health care. It could also be useful to compare the findings of this study with other studies that have measured the efficiency of health systems in the sample countries, but this study has put emphasis on the non-resident patient discharges which is a relatively new issue and most of the available comparable studies have not used such a DEA output.

7. Conclusions

Seeing the necessity for comparative assessment in the hospitals across the EU, this study comes at the right moment to carry out this research at an EU Member State level, as efficiency is particularly crucial in the context of defining new areas of potential national actions such as cross-border health/medical tourism. This study highlighted the fact that cross-

border health and medical tourism can be interrelated concepts regarding the freedom to move to get the most accessible or appropriate medical treatment to any EU Member State within the defined procedures for reimbursement. The introduction of DEA as a practical research tool for examining efficiency across EU-Member States hospitals seems to open a path to evaluate and compare health system performance from a cross-border/medical tourism perspective. The study presented that the efficiency of this market industry differs between EU Member States and the reasons are diverse and can be ascribed to lacking information, differences of national health systems, organisational and administrative hurdles and lacking political support.

Member States need to put more effort into improving and broadening data collection. This study proposes further analysis through field surveys at medical clinics, that will enable measurements regarding perceived quality, satisfaction, and trust in the staff and clinic. Waiting times measurements aiming at EU and international comparisons would also benefit patients who seek cross-border alternatives for their care.

The outcomes of such study would have significant associations affecting intentions to revisit clinics and the destination country. Extending the findings of the European Commission report (2015c) by examining how well medical tourists are informed about the decision they are making, would be of perceived value. These are important indicators to be considered at the European level and would help each Member State to measure its medical tourism services.

Health system performance comparisons have the potential to provide a “rich” source of evidence as well as to influence policy. Measuring its efficiencies at the regional, local or even clinical level aiming at offering high quality health care services that would encourage medical tourists to visit and/or revisit the countries, could potentially bring economic advantages for many EU-Member States. Studies like this can offer a unique tool for policy-

makers interested in understanding whether their health system is performing as well as it could while treating patients from abroad -including medical tourists. Growth is a priority in Europe and the health systems should also aim for it by considering medical tourism as an incentive. The successful integration of European policies into a local system, and the endorsement of other Member States best practices, often involves a degree of adaptation to ensure compatibility with existing structures, that may take time. Therefore, as the degree of adaption of the EU Directive 2011/24/EU is quite recent and aims to have a beneficial effect on health care systems, according to the results of this study it is worth to compliment the Member States for their performance so far.

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TABLE 1: DEA models' design

		Mode 1 1	Mode 1 2	Source of data
Inputs	Hospital beds	x	x	ECHI/OEC D
	Total number of practising physicians, per 100,000 inhabitants	x	x	ECHI/OEC D
	Total number of practising qualified nurses and midwives, per 100,000 inhabitants	x	x	ECHI/OEC D
Output s	hospital discharges in-patients per 100,000 inhabitants	x		ECHI/OEC D
	number of non-resident people among all people discharged from hospital per 100,000 inhabitants	x	x	ECHI/OEC D
	Day cases / number of outpatients		x	ECHI/OEC D

FIGURE 1: Comparison of model 1 and model 2 DEA efficiency scores 2010-2014

COMPARISON OF 2 efficiency models 2010-2014

