

**ECONOMICS***Sociology*

Šárka Papadaki,  
Tomas Bata University in Zlín,  
Zlín, Czech Republic,  
E-mail: papadaki@fame.utb.cz

Pavla Staňková,  
Tomas Bata University in Zlín,  
Zlín, Czech Republic,  
E-mail: stankova@fame.utb.cz

Received: May, 2016  
1st Revision: July, 2016  
Accepted: September, 2016

DOI: 10.14254/2071-789X.2016/9-3/16

**JEL Classification:** I11, L14,  
M21

**Keywords:** horizontal integration, hospital, efficiency, Data Envelopment Analysis.

**Introduction**

Healthcare economy in general and in particular increasing the efficiency in healthcare are currently largely discussed topics. Amongst the most frequently used terms in this context are effectiveness, economy, efficiency, profitability, expediency and prosperity. The efficiency of healthcare is in the interests of not only individual state governments and specific healthcare organisations but it is also widely discussed at the international level as well. One of the strategic goals set by the World Health Organisation is the development of fairer and more efficient health systems, which will be affordable for all people and will respond to their actual needs. This goal was also set by the Ministry of Health of Czech Republic which included it into the National Strategy – Health 2020 (Ministry of Health of Czech Republic, 2014).

Integrating hospitals and other healthcare organisations appears to be a perspective trend from the viewpoint of efficiency. Integration can be characterised as the interlinking of

Papadaki, Š., Staňková, P. (2016), Comparison of Horizontally Integrated Hospitals in Private and Public sectors of Czech Republic, *Economics and Sociology*, Vol. 9, No 3, pp. 180-194. DOI: 10.14254/2071-789X.2016/9-3/16

**COMPARISON OF HORIZONTALLY INTEGRATED HOSPITALS IN PRIVATE AND PUBLIC SECTORS OF CZECH REPUBLIC**

**ABSTRACT.** This article presents the results of the research undertaken at the Faculty of Management and Economics, Tomas Bata University in Zlín. The research focuses on the efficiency of the healthcare system. One of the goals was to compare the efficiency of private horizontally integrated hospitals and horizontally integrated hospitals owned by county, town or municipality. To evaluate the efficiency the Data Envelopment Analysis method was used, which is a benchmarking method applied to measure the efficiency of homogeneous organisational units. When undertaking such measuring it is crucial to assume that inputs are minimalised and outputs are maximised, i.e. outputs must bring a positive result while inputs must be as low as possible. Even though the research did not prove that either private horizontally integrated hospitals or horizontally integrated hospitals owned by the county, town or municipality to be more efficient than the others, the results are valuable as they point at specific options for increasing the efficiency of individual hospitals.

individual organisations with the aim of mutual partnerships that will bring advantages to all parties.

According to Matysiewicz (2011), healthcare services market is predisposed to integrate itself. This flows from the following reasons:

- the structure of the healthcare sector is rather dispersed,
- for a long time centres within the public sector were not independent and were not in competition with one another,
- the structure of patients' needs and the restrictions in centres' resources are essential factors forcing them for mutual partnership,
- system solutions in health protection take into consideration the possibilities of integrating small medical centres as well as private doctors' practices.

Same as in other economy's spheres, two basic types of integration can be identified in the healthcare system:

- a) Horizontal integration – coordination of activities across operating units that are at the same stage of patient services delivering (Pan American Health Organization, 2008). These tendencies are described in many scientific articles, e.g., by Hernandez (2000); Ocampo-Rodríguez *et al.* (2013),
- b) Vertical integration – coordination of services among operating units that are at different stages in the process of delivering patient services (Pan American Health Organization, 2008). Vertical integration in healthcare is debated, for example, by Hernandez (2000); de Albuquerque *et al.* (2011); Byrne & Ashton (1999).

The aim of the research conducted by the Faculty of Management and Economics at Tomas Bata University in Zlín was to compare the efficiency of private horizontally integrated hospitals and horizontally integrated hospitals owned by the county, town or municipality.

The contribution consists of 5 basic parts. In the first part, the role of hospitals in the healthcare system and the basic typology of hospitals are presented. Statistical data were sourced mainly from the Institute of Health Information and Statistics of Czech Republic. The theoretical framework, mainly focused on healthcare efficiency and its measuring are presented in the second part. In this part, the findings published in prestigious international healthcare and economy journals are analyzed. Next follows the problem statement and then the research objective is defined. The research outcomes are presented in the Key Results chapter. At the end of this contribution, the research outcomes are subjected to discussion in which the emphasis is put on practical application of the findings and the research limitations.

## 1. Hospitals and Their role in the Health Care System

Gladkij *et al.* (2003) define a hospital as “an inpatient medical facility which is licenced to provide health care with a certain amount of beds, an organised medical team with appropriate qualifications and is able to provide continuous medical and health care services”. Even though the position of hospitals within the Czech Republic's health care system is not specifically defined in legislation (with the exception of university hospitals), it is evident that the outpatient care is not the main point of focus in a hospital but its mission is to treat those patients who cannot be treated by outpatient facilities (Staňková, 2013).

Hospitals can be subdivided according to various aspects. Such categorisation is dependent on an existing health care system and also on the concept and purpose of the categorisation itself.

American Hospital Association (SHSMD, 2012, pp. 2-10) divides hospitals according to its business approach on:

- Stand-alone hospitals – hospitals which have a legal entity and which are not a part of a group of hospitals; these are further divided into hospitals with a number of beds lower than 201 and the ones with a number of bed equal to or higher than 201.
- Hospitals in health systems – these are hospitals with an interlinked ownership structure; the association of hospitals divides these according to size: hospitals with a number of beds lower than 401 and ones with a number of beds equal to or higher than 401.

Equally, such categorising can also be used for the hospitals in the Czech Republic, see *Figure 1*:

1. Stand-alone hospitals – an independent hospital business with a legal entity which is not a part of a hospital integration.
2. Integrated hospitals – the hospitals which are a part of a hospital integration of various forms:
  - a) Vertically integrated hospitals,
  - b) Horizontally integrated hospitals. These are further divided into:
    - i. Private horizontally integrated hospitals.
    - ii. Horizontally integrated hospitals owned by the county, town or municipality. There are two kinds of horizontally integrated hospitals in the Czech Republic: hospital holdings (independent hospitals with their own line of business and their own budget but co-operating with others in certain fields of business) and Joint ventures hospitals (joining individual hospitals into one single unit which is organised into a single budget for all the hospitals).

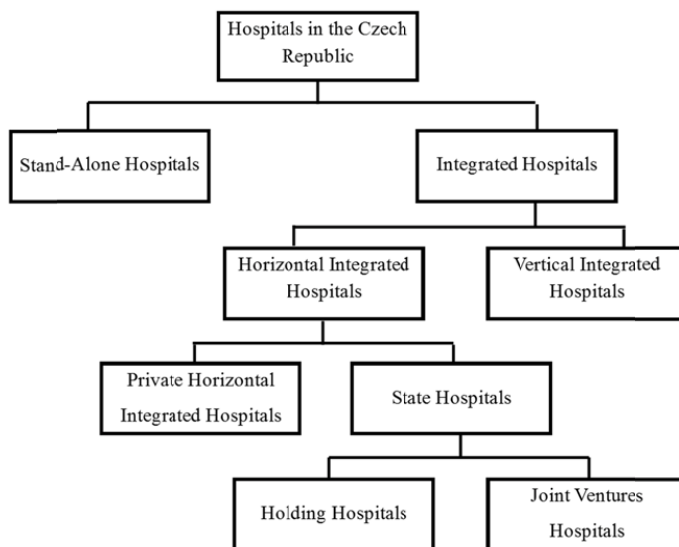


Figure 1. Typology of the hospitals in the Czech Republic

Source: own.

American Hospital Association (SHSMD, 2012, pp. 2-10) further divides hospitals according to the fact whether their organisation includes an Academic Medical Centre (AMC) or not. Hospitals with an AMC are privileged hospitals with the goals of providing treatment, educating future doctors and undertaking cutting-edge research. The equivalents of such hospitals in the Czech Republic are university hospitals.

The basic categorisation of hospitals in the Czech Republic which was used in the researches at the Faculty of Management and Economics is the categorisation by the Ministry of Health and the Institute of Health Information and Statistics of the Czech Republic (UZIS, 2014):

- a) University Hospitals – the Law no. 372/2011 Coll. defines University Hospitals as government founded institutions under the management of a ministry. University hospitals provide health care and undertake research or development projects and provide clinical and practical training.
- b) Hospitals – this term is used for hospitals providing urgent treatment, thus hospitals with an average treatment time of within 30 days.
- c) Hospitals of subsequent care – hospitals for people with long standing illnesses, with an average treatment time of over 30 days (Staňková, 2013).

For the purposes of this article, categorisation according to business model is also used (Gladkij *et al.*, 2003):

- a) State-owned hospitals – in the Czech Republic such hospitals are owned by the Ministry of Health, the Ministry of Defence or the Ministry of Justice,
- b) Public hospitals owned and managed by counties, towns and municipalities – contributory organisations,
- c) Non-profit private hospitals owned by Church institutions (ecclesiastical),
- d) Private hospitals managed as Public limited companies and partnerships.

It is also crucial to differentiate the terms '*founder*' and '*owner*'. The '*founder*' category reflects the legal status of a hospital, either as a legal entity or contributory organisation. A legal entity is an organisation founded with the aim of turning profits. It manages its business in compliance with the Civil Code and the Business Corporation Act while a contributory organisation is a type of non-profit organisation managed by an organisational body of the state (ministry) or regional authorities (town, county, municipality). The '*owner*' category reflects the ownership of a hospital, which in the case of hospitals means that even a legal entity can be owned by regional authorities.

According to the Institute of Health Information and Statistics of the Czech Republic (UZIS, 2014) there were 188 recorded hospitals on 31.5.2013. Concerning the term '*founder*', the structure of the hospitals in the Czech Republic is as shown in *Figure 2*:

- a) Hospitals founded by the Ministry of Health – the Ministry of Health acts as the founder of 19 hospitals in total, 9 of which are University Hospitals and 10 are hospitals providing urgent treatment.
- b) Hospitals founded by a county, town or municipality – currently, counties act as the founders of 18 hospitals providing urgent treatment and 5 hospitals of subsequent care while towns and municipalities act as the founders of 15 hospitals providing urgent treatment and 2 hospitals of subsequent care which makes a total of 40 hospitals.
- c) Hospitals founded by a natural or legal entity or ecclesiastical – currently there are 99 hospitals providing urgent treatment and 25 hospitals of subsequent care, which makes 124 hospitals in total.
- d) Hospitals founded by other central authorities – the Ministry of Defence acts as the founder of 1 university hospital and 2 hospitals providing urgent treatment while the Department of Justice acts as the founder of 2 hospitals, which makes total of 5 hospitals.

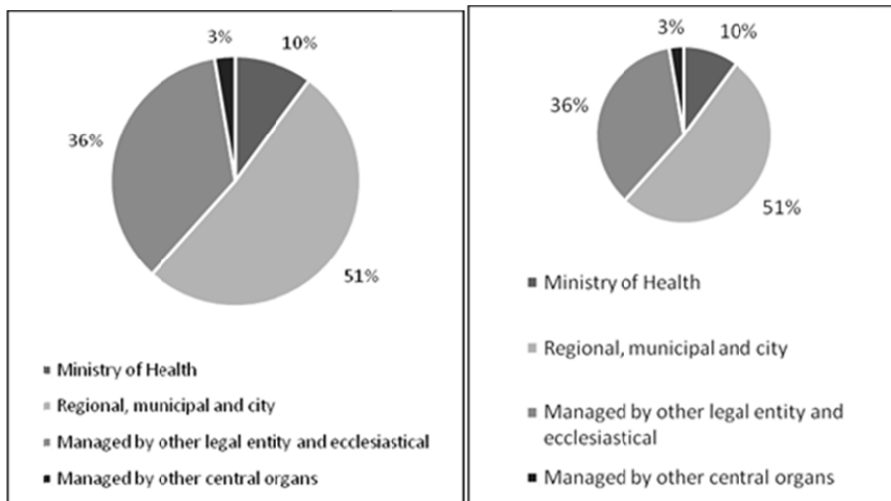


Figure 2. Percentages of hospitals in the Czech Republic according to their founders on 31.5.2013  
*Source: UZIS, 2014.*

Figure 3. Percentages of hospitals in the Czech Republic according to their owner on 31.5.2013  
*Source: UZIS, 2014.*

When we concentrate on categorisation according to the ‘owner’, the structural changes are the most apparent in the ‘Managed by other legal entity’ category. Looking at hospital owners who run hospitals from a position of other legal entity (i.e. joint-stock company, limited company etc.), the majority owners are a county, town or municipality in 57 cases, out of which 46 have a form of joint-stock company, 1 has a form of limited company and 1 has a form of public partnership company.

For comparison, the structure of the hospitals in the Czech Republic according to the owner is following, see the *Figure 3*. 51% of all hospitals are in the ownership of county, town or municipality (97 hospitals), 36% of hospitals are owned by natural or legal entity or Church, i.e. ecclesiastical (67 hospitals), 10% remains in the ownership of the Ministry of Healthcare (19 hospitals), 2% are ecclesiastical institution (3 hospitals) and 3% are owned by the Ministry of Defense and Ministry of Justice (5 hospitals).

## 2. Health Care Efficiency and the measuring of it

According to Otrusínová and Pastuzsková (2013) efficiency can be characterised as an equation of objectives with minimum input at maximum output. Health Academy (2006) declares that efficiency is a relative term. Its perspective has a great influence on what elements of health care delivery are valued. Efficiency is defined differently by purchasers, payers, planners, consumers and providers all of whom have a different perspective on what constitutes quality and appropriate cost. Health Academy presents a typology of efficiency in health care, see *Figure 4*.

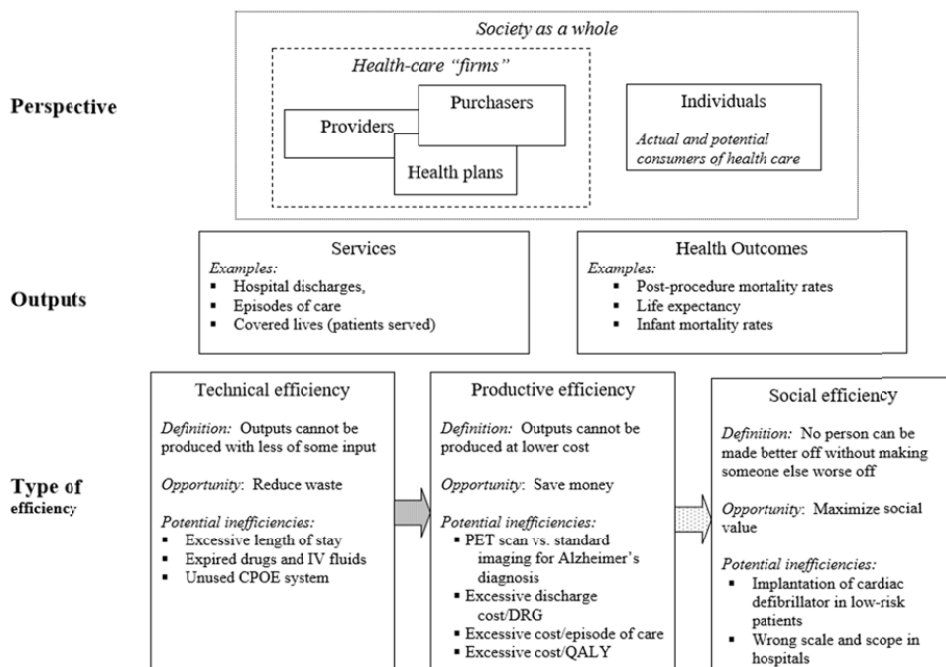


Figure 4. A Typology of Efficiency in Health Care (Health Academy, 2006)

Several concepts can be used when evaluating efficiency in the health care sector, for example:

- Cost-minimisation analysis (CMA) – based on calculating economic losses caused by sickness, injuries etc. The CMA method has been applied in the healthcare sector for example by Jones, Wilson, Parker *et al.* (1999); Strnad (2002), Walsh *et al.* (2005).
- Cost-effectiveness analysis (CEA) – based on evaluating whether the value of a certain service is adequate to the cost of providing the said service. The CEA method within the healthcare sector has been presented for example by Strnad (2002); Siegel *et al.* (1996).
- Cost-utility analysis (CUA) – compares benefits represented by any positive effects with cost or losses represented by negative effects of investments, for example Strnad (2002); Johannesson & O'Connor (1997).
- Balanced Scorecard (BSC) which can be described as a management tool which links both financial and non-financial indicators of company efficiency. Kaplan and Norton (1996, pp. 53-79) state in their studies that definition of a basic vision and strategy is based on 4 critical perspectives: financial perspective, perspective of internal processes, perspective of learning and development and customers' perspective. Examples of successful implementations of the BSC in health sector can be found, for example in work of Stewart & Bestor (2000); Chow *et al.* (1998); Chen *et al.* (2006).
- Activity-Based Costing (ABC) allocates the overhead cost of organisation to the products via a defined structure of activities. The application of the ABC method in the health care sector has been debated for example by Popesko *et al.* (2015); Lawson (2005); Arnaboldi, & Lapsley, I. (2005).
- Benchmarking – benchmarking is a strategic management tool which allows operating costs or other metrics to be assessed against similar properties and to evaluate how a

given property or portfolio performs relative to its peers. Through a detailed comparative analysis, the benchmarking process can identify priority areas for implementing both more efficient operations and management practices by trimming costs or adjusting service levels (Castro *et al.*, 2015). Benchmarking is used both for evaluating the efficiency of specific health systems (Bernal-Delgado *et al.*, 2015; Huxley, 2015; Adler-Milstein, 2014) and for the evaluation of individual hospitals and other health care institutions (Castro *et al.*, 2015; Jon Magnussen & Kari Nyland, 2008, *et al.*).

According to Prochazkova (2011) the following benchmarking methods can be used to measure the efficiency of health care organisations. Stochastic Frontier Analysis, Corrected Ordinary Least Squares, Ordinary Least Squares, Data Envelopment Analysis, Performance Indicator and Total Factor Productivity.

For the purposes of the research presented in this paper, the research team chose the DEA method, which is, according to previous researches and relevant literature, the most commonly used method in the health care field, for example Magnussen & Nyland (2008), Vitikainen *et al.* (2009), Chu & Chiang (2013), Yang & Zeng (2014), Varabyova & Schreyögg (2013) etc. The DEA model is used in the health care field to evaluate the efficiency of hospitals, hospital departments, private surgeries *et al.*

### 3. Methodology

The main task of the research is:

“Are private horizontally integrated hospitals more efficient than horizontally integrated hospitals owned by the county, town or municipality (using the Data Envelopment Analysis model to evaluate efficiency)?”

We used the data available from the following sources:

- data from the Institute of Health Information and Statistics of the Czech Republic – mainly the data of the structure analyses of health organisations in the Czech Republic.
- Albertina database – data for calculating the efficiency of health organisations (operating costs, the number of beds, the number of hospitalised patients, bed usage in days).
- annual reports published by each individual organisation – these were used to update and add the missing data for the efficiency analyses of health organisations.

We benchmark the operational performance of these organisations on the basis of the following functional variables:

- Operating costs – Total operating cost incurred to maintain and develop the operation of the facility during the reporting period.
- The number of beds – the average complement of beds physically existing and actually available for overnight use.
- The number of hospitalised patients – The number of patients formally admitted to a type of health care in the facility.
- Bed usage in days – the quotient of the number of treatment days and the average number of given beds.

There were 188 hospitals in the Czech Republic in 2013. Some of this number are included into holdings or into other types of horizontal integration. Three types of horizontal integration are going to be in the centre of interest:

1. Horizontal integration of holding type without financial cohesion (managed as autonomic accounting entities), which are presented particularly by holdings owned by regions:
  - a) Health holding Královéhradecký region. One of the oldest associations of hospitals owned by the region in the Czech Republic. Founded in 2004, it originally associated five of the following hospitals: City Hospital Dvůr Králové nad Labem, Regional Hospital Jičín, Regional Hospital Náchod, Regional Hospital Rychnov nad Kněžnou, Regional Hospital

Trutnov. In 2013 Regional Hospital Rychnov nad Kněžnou became a part of Regional Hospital Náchod, therefore 4 hospitals are currently part of the association.

- b) Hospital of Ústecký region. Hospital of Ústí nad Labem region was founded on September 1, 2007, and currently it comprises of 5 hospitals: Děčín Hospital, Chomutov Hospital, Most Hospital, Teplice Hospital, Masaryk Hospital in Ústí nad Labem.
  - c) Hospital holding of Středočeský region. Hospital holding of Středočeský region was founded on September 18, 2009, and its original members were 5 hospitals: Hospital of Rudolf and Stefanie Benešov, Regional Hospital Kladno, Regional Hospital Kolín, Regional Hospital Mladá Boleslav, Regional Hospital Příbram. Hospital Kutná Hora became a part of the association on January 1, 2010, but insolvency proceedings were initiated in February 2010.
  - d) Hospitals of Pardubický region. Hospitals of Pardubický region is the youngest association that was established on January 1, 2015. It links the following hospitals: Hospitals of Pardubický region – Pardubice Hospital, Chrudim Hospital, Svitavy Hospital, Litomyšl Hospital, Ústí nad Orlicí Hospital.
2. Horizontal integration of hospitals consolidated into one corporate body. There is one holding of this kind in the Czech Republic:

Health holding of Plzeň region. Health holding of Plzeň region was formed on June 30, 2010. The members of the holding company are the following hospitals: Domažlice Hospital, Klatovy Hospital, Rokycanská Hospital, Stod Hospital, Hospitals of subsequent care Horažďovice, Hospital of subsequent care Svatá Anna.

3. Horizontal integration of hospitals, with hospitals acting as subsidiary companies of their parent company. The AGEL company can be seen as a typical example of this integration in the Czech Republic. AGEL was founded by social contract in 1990. In 2003 the legal status was changed from private limited company to joint-stock company. The AGEL company represents both horizontal integration (it owns 11 hospitals) and vertical integration as it runs or rents 6 out-patient clinics, has its own network of pharmacies and laboratories, holds its own distribution company and other specialised health establishments in the Czech Republic. AGEL operates not only in the Czech Republic but also in Slovakia, Poland and Bulgaria. One of another private holding is Vamed-Mediterra, which provides a wide range of care in eight health establishments in the Czech Republic.

Nine hospitals were selected for the DEA analyses, out of which 5 were horizontally integrated hospitals owned by the county, town or municipality and 4 private horizontally integrated hospitals. The choice was limited to hospitals which provide urgent care only. This condition was set because urgent care expenses and subsequent care expenses cannot be separated. If such a selection was not made, the results could be distorted. These two care approaches, from the point of view of expenses, are incomparable. The selected hospitals including the input analyses data are presented in *Table 1*.

The DEA method is commonly used to evaluate the relative efficiency of a number of DMUs. The basic DEA model in Charnes *et al.* (1978), called the CCR model, has led to several extensions, most notably the BCC model of Banker *et al.* (1984). assumes that there are  $n$  DMUs, ( $DMU_j$ ;  $j = 1, 2, \dots, n$ ) which consume  $m$  inputs ( $x_i$ ;  $i = 1, 2, \dots, m$ ) to produce  $s$  outputs ( $y_r$ ;  $r = 1, 2, \dots, s$ ). The BCC input oriented (BCC-I) model evaluates the efficiency of  $DMU_o$ , DMU under consideration, by solving the following linear program:  
Equation:



$$\begin{aligned}
& \max \sum_{r=1}^s u_r y_{rj} - u_0 \\
& \text{s.t.} \sum_{i=1}^m w_i x_{io} = 1 \\
& \sum_{r=1}^s u_r y_{rj} - u_0 - \sum_{i=1}^m w_i x_{ij} \leq 0, j = 1, 2, \dots, n \\
& u_0, \text{ free} \\
& w_i \geq \varepsilon, i = 1, 2, \dots, m \\
& u_r \geq \varepsilon, r = 1, 2, \dots, s
\end{aligned} \tag{1}$$

here  $x_{ij}$  and  $y_{rj}$  (all nonnegative) are the inputs and outputs of the  $j$ th DMU,  $w_i$  and  $u_r$  are the input and output weights (also referred to as multipliers).  $x_{io}$  and  $y_{ro}$  are the inputs and outputs of DMU<sub>o</sub>. Also,  $\varepsilon$  is non-Archimedean infinitesimal value for forestalling weights to be equal to zero. In account of the fact that the basic DEA models identify more than one DMU as efficient units, finding the most efficient DMU is an issue.

Amin and Toloo (2007) proposed an integrated model for finding most CCR-efficient DMU, as follows:

$$\begin{aligned}
& M^* = \min M \\
& \text{s.t.} M - d_j \geq 0, j = 1, 2, \dots, n \\
& \sum_{i=1}^m w_i x_{ij} \leq 1, j = 1, 2, \dots, n \\
& \sum_{r=1}^s u_r y_{rj} - \sum_{i=1}^m w_i x_{ij} + d_j - \beta_j = 0, j = 1, 2, \dots, n \\
& \sum_{j=1}^n d_j = n - 1 \\
& 0 \leq \beta_j \leq 1, d_j \in \{0, 1\}, j = 1, 2, \dots, n \\
& w_i \geq \varepsilon, i = 1, 2, \dots, m \\
& u_r \geq \varepsilon, r = 1, 2, \dots, s
\end{aligned} \tag{2}$$

where  $d_j$  as a binary variable represents the deviation variable of DMU<sub>j</sub>. DMU<sub>j</sub> is most CCR-efficient if and only if  $d_j = 0$ . The constraint  $\sum_{j=1}^n d_j = n - 1$  forces among all the DMUs for only single most CCR-efficient unit (Toloo & Nalchigar, 2009).

The CCR model is designed with the assumption of constant returns to scale. This means that there is no assumption that any positive or negative economies of scale exist. It is assumed is that a small airport should be able to operate as efficiently as a large one – that is, constant returns to scale. In order to address this, Banker, Charnes, and Cooper developed the BCC model (1984). The BCC model is closely related to the standard CCR model as is evident in the dual of the BCC model:

$$\begin{aligned}
 \min(\theta, \lambda) &= \theta \\
 \theta x_0 - x\lambda &= s^- \\
 Y\lambda &= y_0 + s^+ \\
 e\lambda &= 1 \\
 \lambda \geq 0, s^+ \geq 0, s^- &\geq 0
 \end{aligned} \tag{3}$$

The difference compared to the CCR model is the introduction of the convexity condition  $e\lambda = 1$ . This additional constraint gives the frontiers piecewise linear and concave characteristics (Schaar & Sherry, 2008).

The following input and output criteria were chosen for the DEA analysis of the hospitals:

- a) the operating cost in the year 2013 as the input,
- b) the following three indicators, all for the year 2013, as outputs:
  - The number of beds,
  - The number of hospitalised patients,
  - Bed usage in days.

Table 1. Inputs and Outputs Data for DEA Model

Name of hospital	Number of beds	Number of hospitalised patients	Bed usage in days	Operating cost in CZK
Kladno Regional Hospital	531	26523	263,5	1 073 400 000
Kolín Regional Hospital	541	24921	236,1	1 311 933 000
Mladá Boleslav Regional Hospital	483	24926	254,4	1 133 144 000
Jičín Regional Hospital	362	15405	274,1	581 202 000
Trutnov Regional Hospital	315	11539	227,9	495 989 000
Musculoskeletal Therapy Centre	33	1446	340,3	57 236 000
Hospital Podlesí	153	9652	231,9	1 144 747 000
Hospital Nový Jičín	396	19408	274,7	1 407 995 000
Hospital Atlas	71	4576	212,6	124 777 000

Source: own.

Taking into consideration the entire sample of hospitals researched we can describe them as follows. *Table 2* shows the minimum, maximum, mean and standard deviations of each researched input and output.

Table 2. Description of researched hospital sample

Name	Minimum	Maximum	Mean	Standard Derivation
Number of beds	33	541	320.5556	182.4988
Number of hospitalised patients	1446	26523	15377.3333	8698.6246
Bed usage in days	212.6	340.3	257.2778	35.7116
Operating cost in CZK	57236000	1407995000	814491444.4444	481011202.22

Source: own.

#### 4. Key Results

The results of the efficiency DEA analysis of the 9 chosen hospitals using the two basic DEA models are presented in *Table 2*. For the output oriented models, the level of efficiency is calculated to be higher than one. From the interpretation point of view, a hospital with an efficiency value of 100% can be considered as efficient. Based on the theoretical assumptions it is evident that the BCC models have at least the same or higher effectiveness as the CCR models. In this case it is better to take into consideration the CCR model according to which four hospitals can be considered as efficient. Those hospitals are: Hospital Jičín, Trutnov, Hospital Atlas and Musculoskeletal Therapy Centre. The remaining hospitals and relevant results are presented in *Table 3*. The hospitals show better results in the BCC model in which only three hospitals appear to be inefficient. However, such a result is determined by the chosen method, which always brings better results than the CCR method.

Table 3. DEA Results

Name of hospital	Output oriented model		Input oriented model	
	CCR	BCC	CCR	BCC
Kladno Regional Hospital	82%	100%	82%	100%
Kolín Regional Hospital	67.2%	100%	67.2%	100%
Mladá Boleslav Regional Hospital	71.1%	95.9%	71.1%	88.5%
Jičín Regional Hospital	100%	100%	100%	100%
Trutnov Regional Hospital	100%	100%	100%	100%
Musculoskeletal Therapy Centre	100%	100%	100%	100%
Hospital Podlesí	23.4%	75.8%	23.4%	29.6%
Hospital Nový Jičín	46.4%	97.2%	46.4%	54.4%
Hospital Atlas	100%	100%	100%	100%

Source: own.

The following tables specify the target results for currently inefficient hospitals from the CCR analyses point of view. The table points out how the outputs should be changed for a hospital to reach such results that it would match the most efficient hospitals in the research sample.

Table 4. Comparing the current and target values for improving the efficiency of hospitals

Name of hospital	Number of beds		Number of hospitalised patients	
	Current value	Target value	Current value	Target value
Kladno Regional Hospital	531	647.866	26523	32360.378
Kolín Regional Hospital	541	804.928	24921	37078.769
Mladá Boleslav Regional Hospital	483	679.212	24926	35051.846
Jičín Regional Hospital	362	362	15405	15405
Trutnov Regional Hospital	315	315	11539	11539
Musculoskeletal Therapy Centre	33	33	1446	1446
Hospital Podlesí	153	654.909	9652	41314.912
Hospital Nový Jičín	396	853.171	19408	41813.982
Hospital Atlas	71	71	4576	4576

Name of hospital	Bed usage in days		Operating cost in CZK	
	Current value	Target value	Current value	Target value
Kladno Regional Hospital	263,5	980.001	1 073 400 000	1 073 400 000
Kolín Regional Hospital	236,1	898.109	1 311 933 000	1 311 933 000
Mladá Boleslav Regional Hospital	254,4	1142.444	1 133 144 000	1 133 144 000
Jičín Regional Hospital	274,1	274.1	581 202 000	581 202 000
Trutnov Regional Hospital	227,9	227.9	495 989 000	495 989 000
Musculoskeletal Therapy Centre	340,3	340.3	57 236 000	57 236 000
Hospital Podlesí	231,9	1869.648	1 144 747 000	1 144 747 000
Hospital Nový Jičín	274,7	1208.697	1 407 995 000	1 407 995 000
Hospital Atlas	212,6	212.6	124 777 000	124 777 000

Source: own.

Using the DEA method the 9 hospitals, out of which 5 were horizontally integrated hospitals owned by a county, town or municipality and 4 private horizontally integrated hospitals were compared. The subject of analyses were medico-economic outcomes taken from the latest currently available financial statements from the year 2013. *Table 5* shows the rank of the individual hospitals according to the overall efficiency achieved in the given year.

Table 5. Ranking of Hospitals Efficiency

Name of hospital	%	Ranking
Hospital Atlas	100	1
Jičín Regional Hospital	100	1
Trutnov Regional Hospital	100	1
Musculoskeletal Therapy Centre	100	1
Kladno Regional Hospital	82	2
Mladá Boleslav Regional Hospital	71.1	3
Kolín Regional Hospital	67.2	4
Hospital Nový Jičín	46.4	5
Hospital Podlesí	23.4	6

Source: own.

Four of the researched hospitals achieved 100% efficiency. Two of these are horizontally integrated hospitals owned by a county, town or municipality and the other two are private horizontally integrated hospitals. Oppositely, the least efficient hospitals are Hospital Nový Jičín (46,4%) and Hospital Podlesí (23,4%), both of which are private horizontally integrated hospitals, see *Figure 5*.

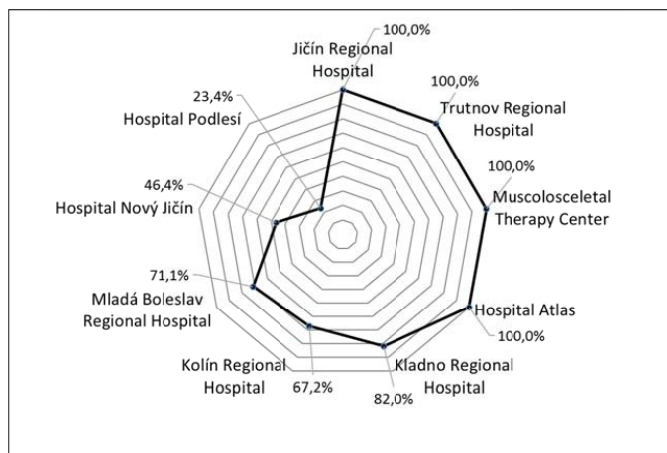


Figure 5. Efficiency Radial Diagram of Hospitals

Source: own.

## Conclusion and discussion

Using the DEA analysis, the research undertaken at the Faculty of Management and Economics at the Tomas Bata University in Zlin, based on samples from horizontally integrated hospitals owned by the county, town or municipality and private horizontally integrated hospitals has not clearly confirmed the premise that private horizontally integrated hospitals are more efficient than horizontally integrated hospitals owned by the county, town or municipality.

As found out, there is no analyse focused on the differences between the efficiency of state horizontally integrated hospitals and private horizontally integrated hospitals. We can compare these results with the general level only, for example with authors like Walston, Kimberly and Burns (1996). They unequivocally present benefits such as: lowering costs and eliminating unnecessary services, economics of scale, increased market and negotiating power, profit and market share gains, better recruitment and longer retention of staff and also environmental acceptance.

Even though the research did not prove a higher efficiency in a specific type of hospital, the DEA model can certainly be used by managers for benchmarking. As Malhotra (2015) states, managers can use a decision support system which stores the company's historical data, competitors' data and other industry specific data and then use the DEA methodology to analyse their organisation's performance. The DEA method provides space for defining key aspects for improving specific areas of efficiency.

It is also important to take into consideration the research limits. These are mainly given by the choices of appropriate outputs and inputs. Apart from this, the data currency and availability of the all researched aspects can also be problematic together with the decision whether to choose the CCR model, which is stricter in evaluating efficiency, or the BCC model, which takes into account variable returns to scale at outputs. Another limitation could be the duration of the holdings. The integration process is a long-term process and some holdings have a short history and the benefits from the integration will take effect in the future. Despite these factors, we believe that the long-term results will show that integrating hospitals is beneficial and this will install positive trends in further health care development.

## References

- Adler-Milstein, J., Ronchi, E., Cohen, G. R., Winn, L. A. P., Jha, A. K. (2014), Benchmarking health IT among OECD countries: Better data for better policy, *Journal of the American Medical Informatics Association*, Vol. 21, No.1, pp. 111-116.
- Arnaboldi, M. & Lapsley, I. (2005), Activity Based Costing in Healthcare: A UK Case Study, *Research in Healthcare Financial Management*, Vol. 10, No. 1, pp. 61-75.
- Bernal-Delgado, E., Christiansen, T., Bloor, K., Mateus, C., Yazbeck, A. M., Munck, J., Bremner, J. (2015), ECHO Consortium ECHO: health care performance assessment in several European health systems, *European journal of public health*, Vol. 25, pp. 3-7.
- Byrne, M. M., Ashton, C. M. (1999), Incentives for vertical integration in healthcare: The effect of reimbursement systems, *Journal of Healthcare Management*, Vol. 44, No. 1, pp. 34-46.
- Castro, M. F., Mateus, R., Serôdio, F., Bragança, L. (2015), Development of Benchmarks for Operating Costs and Resources Consumption to be Used in Healthcare Building Sustainability Assessment Methods, *Sustainability 2015*, Vol. 7, pp. 13222-13248.
- de Albuquerque, G. M., Fleury, M. T. L., Fleury, A. L. (2011), Vertical integration in service industries: An exploratory study at the healthcare industry in São Paulo, *Producao*, Vol. 21, No. 1, pp. 39-52.
- Healht Academy (2006), *Efficiency in Health Care: What Does it Mean? How is it Measured? How Can it be Used for Value-Based Purchasing?* <https://www.academyhealth.org/files/publications/EfficiencyReport.pdf> (referred on 27/02/2016).
- Hernandez, S. R. (2000), Horizontal and vertical healthcare integration: lessons learned from the United States, *Healthcare Papers*, Vol. 1, No. 2, pp. 59-66.
- Huxley, P. J. (2015), The development and results of the European Mental Health Integration Index, *Journal of Public Mental Health*, Vol. 14, No. 4, pp. 205-210.
- Chen, X. Y., Yamauchi, K., Kato, K., Nishimura, A., Ito, K. (2006), Using the balanced scorecard to measure Chinese and Japanese hospital performance, *International Journal of Health Care Quality Assurance*, Vol. 19, No. 4, pp. 339-350.
- Chow, C. W., Ganulin, D., Haddad, K., Williamson, J. (1998). The Balanced Scorecard: A Potent Tool for Energizing and Focusing Healthcare Organization Management, *Journal of Healthcare Management*, Vol. 43, No. 3.
- Johannesson, M, O'Connor, R. M. (1997), Cost-utility analysis from a societal perspective, *Health Policy*, Vol. 39, pp. 241-53.
- Jones, J., Wilson A., Parker H., Wynn, A., Jagger, C., Spiers, N. et al. (1999), *Economic evaluation of hospital at home versus hospital care: cost minimisation analysis of data from randomised controlled trial BMJ*, Vol. 319, pp. 1547.
- Kaplan, R. S., Norton, D. P. (1996). Linking the Balanced Scorecard to Strategy, *California Management Review*, Vol. 39, No. 1, pp. 53-79.
- Lawson, R. A. (2005), The Use of Activity Based Costing in the Healthcare Industry: 1994 vs. 2004, *Research in Healthcare Financial Management*, Vol. 10, No. 1, pp. 77-94.
- Malhotra, R., Lehrman, S., Malhotra, D. K. (2015), Benchmarking Managed Healthcare Companies, *In Applications of Management Science*, pp. 203-222.
- Matysiewicz, J. (2011), Network Development and Application in Health Care Sector: A Study of Systemic Service, *Economics and Sociology*, Vol. 4, No. 1a, pp. 83-97.
- Ocampo-Rodríguez, M. V., Betancourt-Urrutia, V. F., Montoya-Rojas, J. P., Bautista-Botton, D. C. (2013), Healthcare systems and models, their impact on integrated networks of health services, *Revista Gerencia y Políticas de Salud*, Vol. 12, No. 24, pp. 114-129.

- Popesko, B., Novák, P., Papadaki, S. (2015), Measuring diagnosis and patient profitability in healthcare: economics vs ethics, *Economics and Sociology*, Vol. 8, No. 1, pp. 234-245.
- Siegel, J. E., Weinstein, M. C., Russell, L. B., Gold, M. R. (1996), Recommendations for Reporting Cost-effectiveness Analyses, *JAMA*, Vol. 276, No. 6, pp. 1339-1341.
- Steward, L. J. and Bestor, W. E. (2000), Applying a Balanced Scorecard to Health Care Organizations, *The Journal of Corporate Accounting & Finance*, pp. 75-82.
- UZIS (Institute of Health Information and Statistics of the CR) (2015), *Network of health establishments*, file:///C:/Users/stankova/Downloads/sitzz2013.pdf (referred on 15/02/2016)
- Walsh, B., Steiner, A., Pickering, R. M., and Ward-Basu, J. (2005), *Economic evaluation of nurse led intermediate care versus standard care for post-acute medical patients: cost minimisation analysis of data from a randomised controlled trial*. *bmj*, Vol. 330, No. 7493, pp. 699.