Economic Development, Technological Change, and Growth

Romanian Healthcare System at a Glance

Christiana Brigitte Balan[1], Petronela-Simona Mantaluta[2]

Abstract: The Romanian healthcare system is facing constant challenges to produce high quality care with low costs. The paper aims to analyze the efficiency of the Romanian healthcare system in terms of resources allocation. The evaluation and the dimension of healthcare system efficiency are important for identifying a balance between the resources required and the health outcomes. Previous studies describe the Romanian healthcare system as a system in transition. This study focuses on the relationship between the inputs and outputs of the system. In order to assess the efficiency of the Romanian healthcare system we use Data Envelopment Analysis approach. Both input and output healthcare indicators are observed for the period 1999-2010 and the years when healthcare inputs have been used efficiently are identified. The results show that human, financial, and technological resources have been used at maximum capacity in 1999, 2003, 2004, 2007 and 2010. Though efficiency is defined differently by diverse stakeholders, healthcare policies should focus on rising the responsibility of communities and individuals for better treatments and services and better access to information on healthcare providers. The paper is an empirically based study of the healthcare resources allocation in Romania.

Keywords: Efficiency; Health resources; Data Envelopment Analysis

JEL Classification: C67; H51; I18

1. Efficiency of Healthcare System

There are many ways to define efficiency, such as restraining resources, benefits higher than costs, shorter time, or best outcomes. Whatever the definition and the area of interest are, it becomes compulsory to consider efficiency whenever we aim to reach development, evolution and wellbeing.

The increased use of this concept in issues related to economy, made efficiency become synonym to economic efficiency. It means obtaining the highest output with a fixed volume of resources. In the same time, it is desirable to reach the output in a smaller time or, to maximize the output in a fixed time period.

[1] Senior Lecturer, PhD, University "Alexandru Ioan Cuza" of Iasi, Romania, Address: 22 Ave. Carol I, 700505, Iasi, Romania, Corresponding author: christiana.balan@uaic.ro.
[2] MSc, University "Alexandru Ioan Cuza" of Iasi, Romania, Address: 22 Ave. Carol I, 700505, Iasi, Romania, e-mail: simona.mantaluta@yahoo.com.

Efficiency is expressed numerically as the ratio between output and input or between outcomes and resources (Matei & Bailesteanu, 1996).

When defining efficiency, one should take into consideration the components of efficiency, such as efficacy, social impact, costs and time (Jaba & Robu, 2011). The efficacy expresses in which measure the desired outcomes are attained. It represents the ratio between the real and projected outcomes (Manea, 2011).

In health, the efficient allocation of resources is the main component of the health system along with other aspects related to health system structure, healthcare services, drug policies, and hospitals services (Couturier, 2009).

The efficiency of healthcare system represents the dimension of costs that allow for any improvement in the health system. When assessing two different strategies with the same efficacy, the one less costing is also the most efficient one (Donabedian, 1990).

The analysis of efficiency allows to study the relationship between health resources (equipments, goods, human resources) and both the intermediate (number of patients under treatment, waiting time) and final results (longevity, quality of life) (Palmer & Torgerson, 1999, Chirila & Chirila, 2012, Anton, 2013).

The health system efficiency may be assessed through three dimensions (Palmer & Torgerson, 1999): technical efficiency (the highest improvement is made with fixed resources; if the same outcome could be achieved with fewer resources, than we use the concept of technical inefficiency); productive efficiency (involves maximizing the output or the outcomes for a given level of resources and minimizing the costs for the results set) and allocative efficiency (it considers not only the productive efficiency of resources for maximizing the results, but also the efficiency of results distribution; it occurs when resources are allocated for the benefit of society) (Health Care Services, 2006).

Efficiency is an essential part of healthcare systems that have to be dimensioned, reported, and optimized (Committee on Quality of Health Care in America, 2001). The issues related to measurement and expression of efficiency in the healthcare systems are at the core of the healthcare policies. It is important to avoid losses, whether equipment, consumables, energy and information.

Efficiency is also defined as: diminished use of resources to achieve the same or better results (MedPAC, 2007); dimensioning care costs or using resource associated to a specified level of quality of healthcare (National Quality Forum, 2011); a component of performance that is dimensioned by studying the relationship between output and input (McGlynn, 2008); offering specific care at the smallest cost (National Commission for Hospitals Accreditation, 2010).

The common point to all definitions is that evaluation and dimensioning of efficiency in healthcare involves taking into account interactions between inputs

(human, material resources, financial. and informational resources) and outputs (number of patients treated or discharged, waiting time) in relation to the final results of the health system (changes in health status of the population, increasing the number of lives saved or deaths avoided).

Measuring the efficiency may be achieved at three levels: at the system level, by various diseases, and by sub-sectors of the healthcare system (European Commission and the Economic Policy Committee, 2010). The analysis of the healthcare system as a whole takes into account the interaction between sub-sectors so that, even if each sub-sector is highly efficient by itself, the improvement in the relationship cost-efficiency of the entire system may be achieved, either by relocating the patients or the resources between sub-sectors.

2. Romanian Healthcare System and Resources

Many countries face disparities between available resources and demand for health services. Romanian healthcare system has major dysfunctions, with repercussions on the health of the population. According to a report of the Presidential Commission, the Romanian healthcare system is one of the most inefficient in Europe and it is characterized by lack of transparency in the funds allocation and inefficient use of resources" (Healthcare Commission, 2008).

In search of ways to improve efficiency of using resources, the experiences of other countries are a good example, however, it is necessary to adapt to the conditions of the national system.

The analysis of the efficiency of the healthcare system should converge to the following actions: the available resources should not be wasted; the outcomes should be achieved at minimal cost; the type and quantity of outcomes should be consistent with people needs (Vladescu, 1999).

Therefore, efficiency is related to the way in which human, material, financial, and information resources are used to achieve the objectives at the expectation level of the of service users.

The resources of the healthcare system in Romania are financial, human, material and information resources.

There are different types of financial resources, according to the provider. The hospitals of national interest are funded by the Ministry of Health, while other hospitals are funded by local authorities, Municipality or County Council, and the Ministry of Health funds only the purchase of high-performance equipment. The biggest problem arises from the need to make available a minimum set of fair and effective interventions for the high incidence of communicable and non-communicable diseases. The healthcare system encourages the treatment of

164

patients in hospitals, therefore the expenditures on in-patient units have the highest share of total expenditures. For the health sector development, it is necessary to restructure health expenditures so that resources are more focused on ambulatory care and prevention programs rather than in the hospitals or medication. Also, inadequate funding of primary health care in rural areas causes the patient to come to the doctor too late, requiring thus more expensive treatment and longer hospitalization time (Romanian Academic Society, 2010).

The human resource is represented by the medical and non-medical workforce that enables public health intervention. It is the most important resource of the health system (Health Commission, 2008). The small number of doctors in Romania is justified by the large amount of immigrants in other parts of the world. In early 2007; there was an export of 6,000 thousand doctors that have decided to practice abroad. Estimates show that, in the next period, around 10,000 specialist doctors are expected to emigrate (Pupaza, 2011). An alarming situation emerged in hospitals where there is a shortage of specialists in important areas such as cardiovascular and thoracic surgery, geriatrics or radiotherapy. The explanation resides in the attractive salary and better working conditions than in Romania. The red cod limit set by the WHO for a country to implement policies to limit emigration is 2%. In Romania, the level is 10%, but does not seem to be sufficient to rise awareness of the situation of the health system (Pupaza, 2011). Material resources of the healthcare system refer to the infrastructure represented by the number of beds, number of hospitals, high-tech equipment. The number of hospital beds decreased in the last ten years by 21% due to the IMF requirements to reach the EU levels by 2013. This measure, however, affects the functionality of the Romanian health system. Current hospital infrastructure in Romania is poor, only 6.5% of hospitals are ranked in the top category (maximum of performance), meaning they have a minimum of medical devices: digital radiology, computed tomography, magnetic resonance imaging and angiography . Most hospitals (58%) are ranked as fourth and fifth category (Ministry of Health, 2011). Despite the shortcomings of the system, equipment purchase dynamics in Romania is accelerated. Technological advances in health infrastructure creates potential for new methods of diagnosis and treatment with the inherent risk of price changes in the health sector.

3. Data and Method

a. Data

An easy way to comply with the review paper formatting requirements is to use this document as a template and simply type your text into it. Headers, footers or page numbers must not be included. The paper must be set as follows:

For the analysis of the efficiency in the allocation of resources in the Romanian healthcare system, we used two categories of data: input and output indicators.

The input indicators of the healthcare system are: number of physicians, number of pharmacists, number of dentists, number of hospital beds, and health expenditure. The number of physicians, pharmacists and dentists represents the human resource of the health system. Data are taken from the World Health Organization database, HFA-DB. Data on the number of hospital beds are taken from the database of the National Institute of Statistics of Romania. If for other health indicators, Romania has a backward position in the ranking of European countries, when considering the number of hospital beds, Romania is ahead of countries like Poland, Austria, Malta and Hungary. Compared with 1999, in 2010 the number of beds decreased significantly, with a percentage of 20%. By the Ordinance 48/2012 of the Ministry of Health a number of 125,639 beds were approved for 2012, less than the number recorded for 2010 (132,004 beds), that is 5.84 beds per thousand inhabitants. The health expenditure indicator represents the absolute costs in million USD (national currency /U.S. dollar).

The output indicators are life expectancy at birth and infant mortality rate. These indicators are the outcomes of the health system resulting from the use of resources. Life expectancy at birth estimates the average number of years a person would live, while maintaining unchanged the age-specific death rates for a reference year. Infant mortality rate represents the number of deaths between 0-1 years reported per 1000 live births in the same period and area.

Both indicators are observed for Romanian healthcare system for twelve years, during the period 1999-2010. The data are from the World Health Organization Database.

b. Method

DEA (Data Envelopment Analysis) is a non-parametric linear programming technique used to create efficient frontiers and assess the efficiency of certain decisions. DEA estimates the maximum potential output for a given set of inputs. DEA measures the relative efficiency of various organizations or units (branches, departments, individuals) with multiple inputs and outputs. The organizations or units under consideration are called decision-making units or DMUs. DEA calculates the resource savings that can be achieved by making each inefficient unit as efficient as the best practice (Sherman & Zhu, 2006).

The results generated by DEA may be explained in various ways. Thus, 100% efficiency is achieved by any DMU, if and only if, none of the inputs or outputs can be improved without changing in worse the inputs or outputs. Also, a DMU is rated as 100% efficient, given the information available, if and only if, the

performance of other DMUs can not be improved without affecting the inputs or outputs (Seiford & Thrall, 1990).

DEA models can assess the relative technical efficiency for each unit, allowing a distinction between efficient units and inefficient decision. Those DMUs identified as most efficient (on the frontier) are evaluated with a value equal to one, whereas the extent of technical inefficiency of other units is based on the Euclidian distance of the input-output ratio of the frontier (Coelli, 1998).

A range of DEA models were developed according to the way efficiency is measured. There are two categories: models oriented towards inputs (input oriented models) and models oriented towards outputs (output oriented models). DEA input oriented models define the efficiency frontier, aiming at reducing at maximum, for each DMU, the use of resources while maintaining the output constant. Output-oriented models keep constant the inputs while producing a maximum possible output.

If the relationships between inputs and outputs for efficient DMUs is linear or non-linear, the models are classified as CRS (Constant Returns to Scale) or VRS (Variable Returns to Scale). CRS reflects the fact that output will change by the same proportion as inputs are changed (e.g. a doubling of all inputs will double output); VRS reflects the fact that production technology may exhibit increasing, constant and decreasing returns to scale (Pascoe, et al. 2003). An example of CRS and VRS frontier for a model with one input and one output is presented in Figure 1. The efficient frontier allows to identify both efficient decision units, such as units A B, C, D and E that are placed on the border, and inefficient units such as F. The unit C represents the most productive scale size (Banaeian et al., 2011).
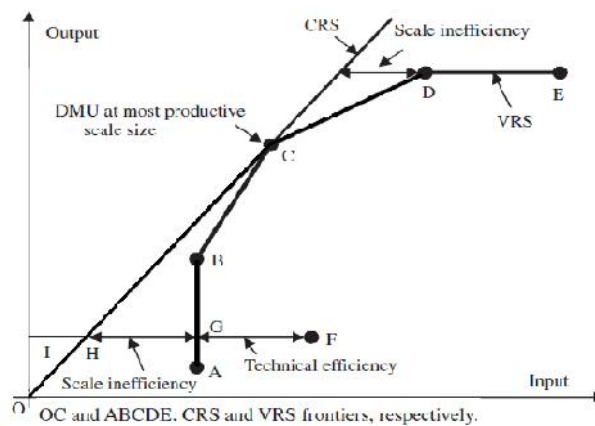

Figure 1. CRS and VRS models

Source: (Banaeian et al., 2011, p. 187)

The relationship among different forms of efficiency is given by the ratio:

$$Scale\ efficiency = \frac{Technical\ efficiency}{Pure\ techncal\ efficiency} = \frac{CRS\ score}{VRS\ score}$$

DEA is applied with the free trial version of the software DEAFrontier[TM1].

4. Results

The paper presents the results of the DEA input oriented model with constant returns to scale (CRS) or variable returns to scale respectively (VRS). The DEA input oriented model allows to define the efficiency frontier so that for each decision unit (DMU) the aim is to reduce the maximum possible amount of resources but to maintain constant the output level. Thus, we can assess if, over the years, resources have been used efficiently, considering the outcomes obtained in the health system.

Based on the outcomes obtained in the Romania healthcare system, we calculated the values of technical efficiency (resource use), per years, and we summarized them in Table 1. The ratios between CRS and VRS scores are the scale efficiency.

Table 1. Efficiency scores of the resources use in the health system

DEA Input Oriented Model				
DMU	**Technical Efficiency**		Scale efficiency	Returns to scale
	CRS	**VRS**		
1999	1.00000	1.00000	1	constant
2000	0.98739	1.00000	0.98739	decreased
2001	0.97965	0.99549	0.98408	decreased
2002	0.99736	1.00000	0.99736	increased
2003	1.00000	1.00000	1	constant
2004	1.00000	1.00000	1	constant
2005	0.98508	0.98515	0.99999	decreased
2006	0.98824	1.00000	0.98824	decreased
2007	1.00000	1.00000	1	constant
2008	0.98720	1.00000	0.98720	decreased
2009	0.98211	1.00000	0.98211	decreased
2010	1.00000	1.00000	1	constant
Mean	0.99230	0.99840	0.99390	

Parameters shown in Table 1 represent technical efficiency of the considered units. We note that for 2001 technical efficiency is TE = 0.97965. This means that in 2001, the consumption of resources could be reduced by 2% without adversely affecting the output. The number of doctors could be reduced from 43,574 to

---

[1] DEAFrontier[TM] software available at www.deafrontier.net/frontierfree.html.

42,687, the number of dentists from 8,208 to 7,274, the number of pharmacists from 7,083 to 6,523, health expenditures from 2,183.93 to 1,935.5 and the number of beds from 167,888 to 164,470.

For 2009, technical efficiency (of the CRS model) equals TE=0.98211, representing that, in 2009, consumption of resources could be also reduced by about 1.79% without diminishing the output. Thus, the system could either have made a significant saving of resources or could use the given resources to improve the output. Therefore, the health system could have been dispensed with 901 physicians, 422 dentists, 566 pharmacists, 233.8 USD and 2,484 hospital beds. Available resources of the health system have not been used at maximum capacity, so the waste was quite important.

The percent of savings, based on the CRS model, are presented in Table 2.

Table 2. The percentage of resources used inefficiently, resulting from minimizing the input

DMU	Ratio
2001	2.035%
2009	1.789%
2005	1.492%
2008	1.280%
2000	1.261%
2006	1.176%
2002	0.264%

The results show that 5 years present maximum efficiency of resource use, in other words, the resources have been used without losses. In 1999, 2003, 2004, 2007 and 2010 human, financial, technological were used at maximum capacity, so we can not minimize any more their value without influencing the output.

On the other hand, in 2000, 2001, 2005, 2006, 2008, 2009 the efficiency score (CRS) shows a downward trend. The maximum percentage of efficiency obtained by minimizing the amount of resources is noticed for 2001, followed by 2009 and 2005. In contrast, in 2002, the value of wasted resources is minimum.

The level of resources that health system could be dispensed with, when reaching the same level of outcome or the maximum efficiency threshold, are presented in Table 3.

Table 3. Amounts of inefficiently used resources after minimizing the input (based on CRS model)

DMU	Input Slacks				
	Physicians	**Dentists**	**Pharmacists**	**Expenses**	**Hospital beds**
1999	0.00	0.00	0.00	0.00	0.00
2000	24.77	614.28	416.18	0.00	0.00
2001	0.00	766.66	415.25	203.97	0.00
2002	0.00	956.46	493.53	576.67	0.00
2003	0.00	0.00	0.00	0.00	0.00
2004	0.00	0.00	0.00	0.00	0.00
2005	450.33	0.00	0.00	362.87	0.00
2006	0.00	0.00	355.05	183.82	0.00
2007	0.00	0.00	0.00	0.00	0.00
2008	3.19	0.00	753.43	3636.48	0.00
2009	0.00	198.58	351.48	67.96	0.00
2010	0.00	0.00	0.00	0.00	0.00

Maximum number of physicians used inefficiently is found in 2005, the number of dentists (956) in 2002, and the number of pharmacists in 2008 (753). Regarding financial resources, in 2008 the system could save 3,636.47USD of the total expenditure of the health system in Romania without affecting the outcomes.

5. Conclusions

In the paper, we approached the analysis of the efficiency of the healthcare system. Financial, human and technological resources of the Romanian healthcare system are insufficient to allow implementing all necessary measures in order to improve the health status of the population. However, a prioritization of actions is necessary in order to reach higher efficiency of resource use.

The analysis of the efficiency of the healthcare resource use show that, over the last 12 years, the resources could have been used more efficiently. In 2010, we see a maximum efficiency of resource use, considering the outcomes delivered by the healthcare system, in terms of life expectancy and infant mortality. The average technical efficiency is 99.23% implying that 0.77% of overall resources could be saved by raising the performance to the highest level.

The main issue of the Romanian healthcare system relies not only in the under funding, but also in inequalities in medical workforce and equipment distribution and access of old persons, children and deprived families to healthcare services.

The Romania healthcare reform should focus on rising the responsibility of communities and individuals for better treatments and services, higher safety and satisfaction, increased transparency, and better access to information on healthcare providers.

6. Aknowledgement

7. References

Anton, S.G. (2013). Technical efficiency in the use of health care resources: a cross-country analysis, *Scientific Annals of the "Alexandru Ioan Cuza" University of Iasi ~ Economic Sciences Section*, 60 (1), pp. 1-12.

Banaeian, N, Omid, M. & Ahmadi, H. (2011). Application of Data Envelopment Analysis to Evaluate Efficiency of Commercial Greenhouse Strawberry. *Research Journal of Applied Sciences, Engineering and Technology*, 3(3), pp. 185-193.

Chirila, C. & Chirila V. (2012). Unemployment and Business Cycles in Central and Eastern European Countries. *Annals of West University of Timisoara. Economics Sciences Series*, Vol. IX.

Coelli, T. (1998). A multi-stage methodology for the solution of orientated DEA models. *Operations Research Letters*, 22, pp. 143-149.

Comisia de Sanatate/Healthcare Commission (2008). *Un sistem sanitar centralizat pe nevoile cetateanului/ A healthcare system focused on the citizens' needs*. Raportul Comisiei Prezidentiale pentru analiza si elaborarea politicilor din domeniul sanatatii publice din Romania/ Report of the Presidential Commission for Public Health Policies Analysis and Development. Retrieved from http://www.presidency.ro/static/ordine/COMISIASANATATE/UN_SISTEM_SANITAR_CENTRAT_PE_NEVOILE_CETATEANULUI.pdf.

Comisia Nationala de Acreditare a Spitalelor/ National Commision of Hospitals Accreditation (2010). *Calitatea ingrijirilor de sanatate in spitale/ Quality of healthcare in hospitals*. Suport de curs/ Course material, Bucharest, Retrieved from http://www.pneumo-iasi.ro/legislatie/06-cisssc.pdf.

Committee on Quality of Health Care in America . Institute of Medicine (2001). *Crossing the quality chasm - A New Health System for the 21st Century*. Washington, D.C.: National Academy Press.

Couturier, B. (2009). *Economie de la santé. Notes de cours/ Health economics. Lecture notes*. Alexandru Ioan Cuza" Universty of Iasi. February 2009.

Donabedian, A. (1990). The seven pillars of quality. *Arch Pathol Lab Med.*, 114(11), pp. 1115-8.

European Commission and the Economic Policy Committee (2010). Joint Report on Health Systems. European Economy. *Occasional Papers*, 74, European Commission, Brussels Retrieved from http://ec.europa.eu/economy_finance/publications/occasional_paper/2010/op74_en.htm,

Health Care Services (2006). *Performance Measurement: Accelerating Improvement (Pathways to Quality Health Care Series)*. Washington D.C.: National Academies Press.

Jaba, E. & Robu, I.-B. (2011). Obtinerea probelor de audit pentru testarea "Going Concern", folosind metode statistice avansate in analiza influentei factorilor asupra ratei indatorarii globale/Obtaining Audit Evidence for Testing the "Going Concern" Assumption Using Advanced Statistical Methods to Analyze the Influence on Overall Borrowing Rate. *Audit Financiar/Financial Audit,* 9(2), pp. 37-46.

Manea, M.-D. (2011). The fair value - representation of the market value in accounting. trends and perspectives in Romanian accounting practice. *CES Working Papers*, 3(2), pp. 277-292.

Matei, St. & Bailesteanu, Gh. (1986). *Evaluarea eficientei economic/The Evaluation of Economic Efficiencye*. Timisoara: Facla Publishing House.

McGlynn, EA. (2008). *Identifying, Categorizing, and Evaluating Health Care Efficiency Measures. Final Report*. AHRQ Publication. 08-0030. Agency for Healthcare Research and Quality.

Medicare Payment Advisory Commission (MedPAC) (2007). *Promoting Greater Efficiency in Medicare*, Washington D.C.: National Academies Press.

Ministerul Sanatatii/Ministry of Health. (2011). Comunicat de presa/Press release 1.06.2011. Ministerul Sanatatii a finalizat procesul de clasificare a unitatilor sanitare cu paturi, in functie de competenta/ Ministry of Health has completed the classification of health units with beds dependending on competenecies. Retrieved from http://www.ms.ro/?pag=62&id=9038.

National Quality Forum (2012). *National Voluntary Consensus Standards for Cost and Resource Use. Final Report.* April 2012. Retrieved from http://www.qualityforum.org/Publications/2012/04/National_Voluntary_Consensus_Standards_for_Cost_and_Resource_Use.aspx.

Palmer, S., Torgerson, D.J. (1999). Economic notes: definitions of efficiency. *British Medical Journal*, 318 (7191),1136. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1115526/pdf/1136.pdf.

Pascoe, S.; Kirkley, J.E.; Gréboval, D. & Morrison-Paul, C.J. (2003). Measuring and assessing capacity in fisheries. 2 Issues and methods. *FAO Fisheries Technical Paper*, 433/2. Food and Agriculture Organization Rome, Retreived from http://www.fao.org/docrep/006/Y5027E/y5027e00.htm#Contents

Pupaza, A.L. (2011). Premise ale performantei resurselor umane din organizatiile publice de sanatate din Romania/Premises of human resource performance in public health organizations in Romania, *Analele Univeristatii "Constantin Brancusi" din Targu-Jiu. Seria Economice/Annals of "Constantin Brancusi" University of Targu-Jiu. Economic Series*, 1/2011, 288-302.

Seiford, L.M. & Thrall, R.M. (1990). Recent developments in DEA: The mathematical programming approach to frontier analysis. *Journal of Econometrics*, 46, pp. 7-38.

Sherman, D., & Zhu, J. (2006). *Service Productivity Management: Improving Service Performance Using Data Envelopment Analysis (DEA)*. Boston: Springer.

Societatea Academica din Romania/Romanian Academic Society. (2010). Criza si reforma in sistemul de sanatate. O radiografie la zi/Crisis and Reform in the Health Care System. Un up-to-date radiography. *Raport detaliat al SAR/Detailed Report of RAS*. Retrieved from http://www.sar.org.ro/files/rap%20detaliat.pdf.

Vladescu, C. (1999). *Politica de reforma a sistemului de sanatate din Romania - o analiza critica/Romanian Healthcare System Reform Policy – A Critical Analysis*. Bucharest: Infomedica.