Efficiency Evaluation of Using Resources by Hospital Units

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Abstract:

Purpose: The aim of this article is to present an efficient evaluation methodology for the hospital resources used in a study on units of healthcare system and their analysis in the organizational and legal forms.

Design/Methodology/Approach: A research group constituted 48 health care units has been used. For the empirical part, a non-parametric DEA method was used to evaluate the efficiency of functioning of hospital units (surgical and internal medicine, both public and private) for 2014-2018. All the units that were qualified to the study had a contracted hospital agreement.

Findings: Past analysis on the units of a healthcare system proved that efficiency of the usage of material or personal resources was underestimated and only a financial result was vital which in the units of healthcare system cannot play a major role. The authors proved that to manage efficiency it has to be previously measured with usage of the DEA method and the outcomes can be treated as a basis for developing and publishing detailed ranking lists that allow comparison between medical units. Results did not confirm that public health care units were less efficient than private units, which is very often taken as given.

Practical Implications: Presented results – together with a recommended method – apart from experimental virtue also have a huge practical value. They can be used in a process of benchmarking which is getting more important as one of modern managing conception and is easily used in a health care sector.

Originality/Value: Limitation of the resources in a system of health care determines necessity to constantly control the area of input-outcome. Conducted studies and conclusions constitute a new view on efficiency of health care units. The authors believe that it is necessary to continue studies in the regional field and also on different levels of protection systems.

Keywords: Health care, hospital, health service, DEA method, financing policy.

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1. Introduction

Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity. The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition. This is how World Health Organization determined a right of each human being to health care. According to WHO individual and community health is influenced by e.g. access to and usage of health care understood as ‘organized actions of a defined system of health care service that assures a good state of health or give back in case it is lost and when it is impossible – minimizing effects of the disease and softening afflictions’. The right to health care for Polish citizens is guaranteed by the Polish Constitution of May 3.

From the conducted analyses of results of surveys prepared in 2018 by the Centre for Public Opinion Research, based on a representative group of adult Polish citizens, it follows that:

- a system of health care functioning in Poland, after changes and long evolution since 1989, is still evaluated in a negative way. This evaluation was given by 66% surveyed, including 27% who has given a totally negative evaluation for health care functioning in Poland;
- the worst evaluation was given for access to appointments to specialists (83% of negative marks) and too few health professionals in hospitals (70%). (24%) of people surveyed claim that problems with accessibility and quality of service financed from public resources follows from improper usage of funds.
- a negative view of the presented evaluations was enhanced by the fact that 57% of Polish citizens consider keeping good health as most important thing in life just after happiness in a family.

An evaluation of chosen elements of health care is conducted by the Supreme Audit Office every year which confirms that this area is a vital part of state functioning both for the authorities and the society. A report from the last control of health care system in Poland was presented by the Supreme Audit Office in May 2019. This time the

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6See: Konstytucja Światowej Organizacji Zdrowia, Porozumienie zawarte przez Rządy reprezentowane na Międzynarodowej Konferencji Zdrowia i Protokół dotyczący Międzynarodowego Urzędu Higieny Publicznej, podpisane w Nowym Jorku dnia 22 lipca 1946 r. (Dz. U. z 1948 r. Nr 61, poz. 477).
7See: Konstytucja Rzeczypospolitej Polskiej z dnia 2 kwietnia 1989 r. uchwalona przez Zgromadzenie Narodowe w dniu 2 kwietnia 1997 r., przyjęta przez Naród w referendum konstytucyjnym w dniu 25 maja 1997 r., podpisana przez Prezydenta Rzeczypospolitej Polskiej w dniu 16 lipca 1997 r. (Dz. U. 1997 Nr 78, poz. 483).
8See: Opinie na temat funkcjonowania opieki zdrowotnej. Komunikat z badań CBOP, Fundacja Centrum Badania Opinii Społecznej, Warszawa 2018, Nr 89, https://cbos.pl/SPISZOM.POL/2018/K_089_18.PDF [accessed on 05.05.2020].
9See: Raport: System ochrony zdrowia w Polsce – stan obecny i pożądane kierunki zmian. Informacja o wynikach kontroli, https://www.nik.gov.pl/plik/id,20223,vp,22913.pdf [accessed on 30.08.2019].
study entailed the whole system of health care. In the report it was stated that: “all the actions that had been taken so far did not bring expected results – quality improvement and better accessibility of health benefits. As it should be anticipated demographic and epidemiological conditioning will cause a growth of health care needs of the patients and an access to benefits, in case of no system changes, may get worse”.

In the area of hospital health care, it was stated that:

- more than 50% of share costs of hospital treatment in health service costs which is financed by the National Health Fund systematically grows. Hospital treatment is the most expensive;
- diagnostics and patients’ treatment are too often performed in hospitals instead of general practitioners and basic medical centres (as ambulatory care units);
- Poland among other countries of the European Union has one of the highest rates of the number of hospital beds for 100 thousand citizens;
- there is no reliable estimation of benefits, pertinent for the real costs incurred;
- cost intensity of health benefits is determined by remunerations of medical staff; which is then influenced by organization of work at medical units and high expectations of this occupational group. Employee claims additionally enhance pay rises of chosen groups of medical staff which are introduced through legal regulations and are financed from resources that are additionally submitted by National Health Fund. These pay rises were not linked with medical benefits; their quality or accessibility;
- benefit providers accomplished many investments, without recognizing the needs, such as: building or isolating, in organizational or venue terms operating theatre where capability overruns the needs of hospital departments and the number of contracted services with NHF; buying technical equipment; employing specialists and organizing specialized teams although such services were provided by other units in this area. These investment actions finally led to low usage of available resources, including hospital beds.

In the light of presented results from the survey and analyses of efficiency management of medical units (understood as efficiency of turning inputs into outcomes), it should be treated as priority especially with limited financial resources for health care, increasing cost intensity of medical services and the obligation to guarantee an access to benefits financed from public resources. The need to investigate and to improve efficiency of health care units10 functioning is connected with a necessity to limit constant growth of costs. Improving efficiency of the units functioning should allow for proper activity of health care units in the future when a demand for medical benefits will additional grow due to occurring demographic changes (extending average lifetime and increasing a share of people in their adulthood in highly developed countries).

10More in Ćwiąkala-Małys Anna, Durbajło-Mrowiec Małgorzata, Łagowski Paweł Diagnostyka efektywności wykorzystania zasobów lecznictwa szpitalnego Wrocław 2020 : Uniwersytet Wrocławski. E-Wydawnictwo. Prawnicza i Ekonomiczna Biblioteka Cyfrowa.
It is estimated that an average share of health expenses (in a gross domestic product) in a group of countries that belong to the Organization for Economic Cooperation and Development (hereafter: OECD) doubled in the last 50 years\textsuperscript{11}. However, in recent years dynamics of input increase for health care has speeded up. It happens due to already mentioned demographic changes but also due to a development of medical technologies or simply higher social expectations.

Polish health care system has been considered, especially by the patients, as unwieldy and inefficient\textsuperscript{12}. In recent years, there have been and still are many attempts of changes that should improve the situation, nevertheless, until now none of the reforms has been introduced from beginning to end. A major problem is an increasing indebtedness of public units, in particular hospitals. In response to these challenges a bill was passed on medical activity on 15 April 2011\textsuperscript{13}. It was supposed to improve functioning of the whole system by increasing efficiency at the lower level, that is a provider level. In mind of originators legal and organizational form of independent public health care units (hereafter: SPZOZ) is one of the reasons for inefficiency of health care system. A unit such as SPZOZ was admitted as a defective and inefficient legal form\textsuperscript{14}, that is why it is necessary to change it to a different, well-adjusted to functioning in a market economy environment – originators believe that limited company would be the one.

For the needs of this article a following research hypothesis was made: SPZOZ are not less efficient organizational-legal forms than limited company\textsuperscript{15}, in particular with reference to benefits offered. This assumption is, to a certain degree, a kind of denial of major causes of real difficulties in Polish health care system given as an explanation to a draft bill on health care services\textsuperscript{16}. Efficiency measurement of analysed units from the Lower Silesia Province was conducted with usage of non-parametric DEA method on the basis of data form 2014-2018.

2. Efficiency Term

Contemporarily a term ‘efficiency’ is very often used, in particular in terms of discourse between politicians, economists and entrepreneurs. Those interested in

\textsuperscript{11}Evaluaions on the basis of statistic data from OECD Available online: http://stats.oecd.org/viewhtml.aspx?datasetcode=SHA&lang=en# [accessed on: 30.06.2020].

\textsuperscript{12}Used statement appears in results of eg. Euro Health Consumer Index, which classifies Polish health care system on 32 place out of 35 analysed. A. Björnberg, Euro Health Consumer Index Report 2018, Health Consumer Powerhouse Ltd. 2019, p. 18; available online: https://healthpowerhouse.com/media/EHCI-2018/EHCI-2018-report.pdf [accessed on: 30.06.2020].

\textsuperscript{13}Ustawa z dnia 15 kwietnia 2011 r. o działalności leczniczej (Dz.U. 2011 nr 112 poz. 654).

\textsuperscript{14}See: Sejm Rzeczypospolitej Polskiej VI Kadencji, Uzasadnienie do rządowego projektu ustawy o działalności leczniczej z dnia 15 października 2010 r., Druk sejmowy nr 3489.

\textsuperscript{15}This research refers to efficiency study in its technical aspect, without quality factors. Unfortunately, in Poland we do not have enough data that would allow for conducting study on efficiency of particular units of health care in quality and quality-value context.

\textsuperscript{16}Druk sejmowy nr 3489.
health care system, particularly patients, can very often hear about the need for changes, in terms of actions that will lead to an improvement of efficiency. However, there are very rarely any attempts to define efficiency, to explain what is understood under this term.

Efficiency is characterized by ambiguity. Polish dictionary edited by Witold Doroszewski defines efficiency as ‘productivity, a positive result or efficacy’¹⁷. For a full understanding of this term it is necessary to refer to a context in which it is used. In economic literature many authors, for the need of their considerations, precisely described the term of efficiency, in other words they put emphasis on meanings in created, by themselves, definitions of efficiency (Table 1).

| Author | Definition |
|--------|------------|
| W. Gasparski (2007) | Economic activities should be capably performed, that is efficiently – successfully and economically |
| S. Nowosieński (2008) | In a narrow meaning efficiency is identified with praxeological economic category, however, in a broad meaning component of efficiency are efficacy, favourability and economy |
| P.A. Samuelson, W.D. Nordhaus (1999) | Efficiency is using resources in the most effective way |
| T. Lubińska (2009) | Efficiency refers to a level of gaining aims with minimal costs or with gaining maximal level of the aims with given costs. |
| J.A.F. Stoner, R.E. Freeman, D.R. Gilbert (2002) | Efficiency is a measure of effectiveness, a measure to what degree stated aims are gained |
| H. Zadora (2002) | Efficiency is a quantification of effectiveness |
| L. Bialoń (1995) | An entrepreneurship can be efficient and effective, efficient and ineffective, inefficient and effective, inefficient and ineffective |
| P. Drucker (2005) | Efficiency is doing things right, and effectiveness is doing the right things. Effective actions do not have to be efficient and the other way round. |
| M. Sidor-Rządowska (2005) | Effective work can be inefficient, as well as efficient work does not have to be effective |
| T. Dudycz (2007) | Efficiency in an economic sense is a relation of gained results to input used to gain the outcomes |
| A. Hamrol (2008) | In a technical economic view efficiency is understood as productivity |
| G. Osbert-Pociecha (2007) | The closest synonym of efficiency is productivity, so called, general understood as a ratio of all results of economic activity to resources used |

¹⁷ Słownik języka polskiego, red. W. Doroszewski. Available online: http://doroszewski.pwn.pl/haslo/efektywno%C5%9B%C4%87/ [accessed on: 23.05.2020].
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Efficiency is maximisation of production resulting from a proper allocation of resources with stated limitations of supply (costs incurred by producers) and demand (consumers preferences).

Efficiency is an optimal allocation of resources production factors, products, and optimal distribution of income.

Efficiency means that there is no mismanagement. Economy functions efficiently when increase of production of one good does not decrease production of the other one.

All presented definitions confirm that efficiency entails many aspects and strands. Proper understanding of this definition needs to be connected with the context in which it was used. Apart from differences in a way of describing and defining efficiency majority of economists shares the same idea that efficiency is made of capability and effectiveness which interact together. Form the point of view of organizing an economic unit more important is effectiveness than capability because it is effectiveness that determines a success of an economic unit.

3. Non-Parametric DEA Method

DEA method was considered to be the most suitable for the efficiency analysis. Its dominance among other methods follows mainly from the fact that in multidimensional data sets, both input and outcome sets, traditional ratio methods and other econometric methods do not work out. It happens because in these two methods it is estimated that we can define how big input of a kind was directly used in order to gain particular results. In practice such calculations require specific accounting information which in many cases is impossible to submit. DEA method was presented for the first time by A. Charnes, W. Cooper, and E. Rhodes in 1978 in the article Measuring the efficiency of decision-making units. In the literature it appeared at the end of 1970s, but it was mainly based on a concept of efficiency presented by M.J. Farrell twenty years earlier.

In 1978 in “European Journal of Operational Research” Abraham Charnes, William Wager Cooper and Edwardo Rhodes published the article Measuring the
efficiency of decision-making units\textsuperscript{21,22}. They presented a model of data envelopment based on a concept of productivity presented by Gérard Debreu\textsuperscript{23} and M. J. Farell\textsuperscript{24}. They defined a measurement of efficiency as a quotient of a single result from a single input by generalising its multidimensional case in which many outcomes have many inputs.

A subject of an analysis in DEA method is a DMU, decision making unit and its aim is to measure efficiency that a given unit uses to transform inputs into outcomes (it is not necessary to define dependence between inputs and outcomes). At the same time, we can distinct two functions of an aim: one maximisation of outcomes with unmodified inputs and minimisation of inputs with the same level of outcomes. To solve such aim function, we use techniques of linear programming, on the basis of which an efficiency curve is determined (envelope). All the efficient units are located on it. In case of these units an efficiency measure ($\theta$) equals 1 and for inefficient units this measure is from 0 to 1\textsuperscript{25}. The difference between a level of efficiency of given DMU and 1 indicates a possibility to reduce inputs with the same outcomes. Alternatively, it shows how outcomes should increase with the same level of inputs and the unit stays efficient. In order to get authoritative results of efficiency of a research group following conditions should be fulfilled:

1. The number of units analysed should be at least three times bigger than a number of variables which constitutes a sum of a number of inputs and results as to guarantee sufficient levels of space\textsuperscript{26}.
2. Increase of an input leads to increase of an outcome, it means that there is an important positive dependence between the variables.
3. Homogeneity of DMU\textsuperscript{27}.

Very often, apart from aforementioned conditions, in the literature you can find additional condition to exclude extreme values from the research group\textsuperscript{28}. Below you can find advantages and disadvantages of DEA method (Σφάλμα! Το αρχείο προέλευση της αναφοράς δεν βρέθηκε.\textsuperscript{2}).

\textsuperscript{21}A. Charnes, W.W. Cooper, E. Rhodes, Measuring the efficiency of decision-making units, “European Journal of Operational Research” 1978, Vol. 2, Issue 6, p. 429–444.
\textsuperscript{22}Wiecej: Boussofiane A., Dyson R.G., Thanassoulis E., Applied Data Envelopment Analysis, „European Journal of Operational Research” 1991, Vol. 52(1), Bowlin W.F., Measuring Performance: An Introduction to Data Envelopment Analysis (DEA), „Journal of Cost Analysis” 1998, Vol. 15, Issue 2, p. 3–27.
\textsuperscript{23}G. Debreu, The coefficient of resource utilization, „Econometrica” 1951, Vol. 19, No. 3.
\textsuperscript{24}M.J. Farell, The Measurement of Productive Efficiency, „Journal of the Royal Statistical Society. Series A” 1957, Vol. 120, No. 3.
\textsuperscript{25}Zob. H.O. Fried, C.A. Knox Lovell, S. Schmidt, The Measurement of Productive Efficiency Techniques and Applications, New York–Oxford 1993, p. 10.
\textsuperscript{26}The number of degrees of freedom relates to the number of independent random variables.
\textsuperscript{27}See. W.F. Bowlin, Measuring Performance: An Introduction to Data Envelopment Analysis (DEA), „Journal of Cost Analysis” 1998, Vol. 15, Issue 2, p. 3–27.
\textsuperscript{28}See. K. Stępień, Konsolidacja a efektywność banków w Polsce, Warszawa 2004, p. 140.
Table 2. Advantages and disadvantages of DEA method

| Advantages                                                                 | Disadvantages                                                                 |
|---------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Does not require stating values of input and outcomes.                    | Calculates only relative efficiency measures for all DMUs from one trial.    |
| It can be used in a multidimensional situation in which there is more than one input and more than one outcome. | A number of investigated units cannot be too small and too big. In case of a small group there is a possibility of false identification of inefficient units as efficient. On the other hand, too many units can lead to imbalanced homogeneity of a group. |
| Estimates inputs to save or to gain better outcome with given input.      | High sensitivity for abnormal variables. Measurement error can influence a shape of an envelope and at the same time an efficiency outcome. Sometimes ranking of units due to their efficiency is impossible, especially when too many units are considered as efficient. Then, it is necessary to use additional super efficiency measures. For only few variables an efficiency analysis gives more chances for a compete ranking but then a process of production is not realistic. On the other hand, taking into consideration a more data makes a production process more realistic but makes it difficult to create a ranking. |
| It does not require to specify function dependency between inputs and outcomes. | Efficiency is measured in ratio of an analysed group of DMUs that’ why adding or excluding given DMU may influence efficiency of a particular DMU. |
| Inputs and outcomes are put in different physical units, it is useful especially when values of inputs and outcomes are clearly defined. |                                                                                       |
| It enables to find extreme values which are not visible when other methods are used due to data averaging. |                                                                                       |
| Formulas are defined on the basis of results from economic practice. Comparison of a model unit with a combination of model units enables inefficient units to identify areas to improve. Additionally, it allows to define aims to gain and to evaluate the level of realization at a period of time. |                                                                                       |

Source: Self-study based on Boussofiane A., Dyson R.G., Thanassoulis E., Applied Data Envelopment Analysis, „European Journal of Operational Research” 1991, Vol. 52(1), Bowlin W.F., Measuring Performance: An Introduction to Data Envelopment Analysis (DEA), „Journal of Cost Analysis” 1998, Vol. 15, Issue 2, p. 3-27., Charnes A., Cooper W.W., Rhodes E., Measuring the efficiency of decision making units, „European Journal of Operational Research” 1978, Vol. 2, Issue 6, p. 429-444, Cylus J., Anderson G.F., Multinational Comparison of Health Systems Data, 2006 [online], The Commonwealth Fund 2007, Debreu G., The coefficient of resource utilization, „Econometrica” 1951, Vol. 19, No. 3, p. 273-292, Farell M.J., The Measurement of Productive Efficiency, „Journal of the Royal Statistical Society. Series A” 1957, Vol. 120, No. 3 p. 253-290,Gattoufi S., Oral M., Reisman A., A taxonomy for Data Envelopment Analysis, “Socio-Economic Planning Sciences” 2004, No. 38(2-3), E.Szymańska, Zastoswanie metody DEA do badania efektywności gospodarstw rolnych, Journal of Agribusiness and Rural Development 2 (12), 2009, s.249-255.
From the time of presenting the first DEA model in 1978, a so called CCR-DEA model, (an abbreviation CCR comes from first letters of the authors surnames – Charnes, Cooper and Rhodes), there have been many modifications. Currently, a family of DEA models is well developed and the most important criterion that differentiates them is a kind of taken returns to scale\textsuperscript{29} and model exposure. In the first case, there is another division into models with constant returns to scale CRS (constant returns to scale) or with variable returns to scale VRS (variable returns to scale). Among the models with returns to scale we can distinguish:

- DRS model (decreasing returns to scale),
- NDRS model (non-decreasing returns to scale),
- IRS model (increasing returns to scale),
- NIRS model (non-increasing returns to scale).

Returns to scale (in the literature interchangeably defined as economies of scale or benefits of scale) are connected with microeconomic theory about production function\textsuperscript{30}. In this article a DEA model with constant and variable returns to scale was used without detailed definition of variability of the returns because all the data gathered was not sufficient for a correct identification.

Second criterion differentiating DEA model is an orientation of a model that can be either disorientated or orientated, however, this orientation is defined with reference to inputs or outputs. In case of input-oriented model, we get information how we should decrease inputs to keep the same level of outputs and to make a unit efficient. Output orientation shows how the outputs need to be increased with a current level of inputs to keep the unit efficient.

Primary form of DEA model (formula 1) assumes definition of DMU efficiency rate understood as a maximisation of a quotient of measured outcomes to measured inputs under condition that such rates will be less or equal 1 for each unit.

\[
Max h_0 = \frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_i x_{i0}} \quad 1.
\]

under condition that:

\[
\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1; \quad dla \ j = 0, \ 1, \ ..., \ n \quad 2.
\]

\[
u_r, v_i \geq 0; \quad r = 1, ..., s; \quad i = 1, ..., m
\]

where:

\textsuperscript{29}\text{See G. Rogowski, Analiza efektywności banków na potrzeby zarządzania strategicznego bankiem. Część 1. Metodologia, „Badania Operacyjne i Decyzyjne” 1999, no 1, p. 75.}

\textsuperscript{30}\text{More on returns to scale, compare Z. Dach, Podstawy mikroekonomii, Kraków 1999, p. 146-151; D. Begg et al., Mikroekonomia, Warszawa 2007, p. 200-202; G. Mankiw, M. Taylor, Mikroekonomia, Warszawa 2009, p. 361-362.}
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$y_{rj}$ – return $r$ gained by a unit $j$,
$x_{ij}$ – input $i$ used by a unit $j$,
$u, v$ – measures from solving the abovementioned formula,
$j$ – unit of a research group.

With the usage of a transformation method of Charnes–Cooper such issue changes into a line function which can be solved by a linear programming$^{31}$. Aim function takes the form of:

$$\text{max}_{u,v} w_0 = \sum_{r=1}^s u_r y_{r0}$$  \hspace{1cm} 3.

with limitations:

$$\sum_{i=1}^m v_i x_{i0},$$

$$\sum_{r=1}^s u_r y_{rj} - \sum_{i=1}^m v_i x_{ij} \leq 0,$$

$u_r \geq \varepsilon$

$v_l \geq \varepsilon$

4.

where:

$y_{rj}$ – return $r$ gained by a unit $j$,
$x_{ij}$ – input $i$ is used by a unit $j$,
$u, v$ – values from solving the formula,
$j$ – unit of a research group,
constant $\varepsilon$ – indefinitely small number preventing from zero values for particular variables.

This kind of issue can be solved with the usage of linear programming (formula 3) with limitations (formula 4), that allow to get an optimal solution. In case of no limitations this task has indefinite number of solutions. While using the DEA method to estimate efficiency it is important to remember that the results refer only to relative efficiency in each group, and it is not possible to easily get its absolute value.

4. Measuring Efficiency of Medical Units

Before getting to an operationalization of a research problem there had been many assumptions made.$^{32}$

$^{31}$See. G. Rogowski, Metody analizy i oceny działalności banku na potrzeby zarządzania strategicznego, Poznań 1999, p. 134.

$^{32}$See. Rebba V., Rizzi D., Measuring hospital efficiency through Data Envelopment Analysis when policymakers’ preferences matter, „Working Papers, Department of Economics” 2006, No. 13.
- the first one was a choice of a research group, where we qualified only general hospitals, more precisely hospital departments. Research area was limited only to the Lower Silesia Province because analysed units should be functioning in a similar environment (external, in particular in a homogenous legal and administrative surrounding."

- the choice of only functioning units in a given province allows to meet the condition, its common element is cooperation with regional branch of NHF and State Sanitary Inspectorate. A consequence of taking such assumptions is limiting an analysis only to two legal-organisational forms such as SPZOZ and limited company and reducing the number of units that a research group was chosen from.

Provincial Lower Silesian branch of NHF (hereafter: DOW NFZ) in 2018 had at its disposal around 6,093,684,000.00 PLN (six billion ninety three million six hundred eighty four thousand PLN) for buying health benefits within general insurance and from this sum around 3,167,886,000.00 PLN (three billion one hundred and sixty seven million and eight hundred eighty six thousand PLN), that is almost 52% of annual budget that was allocated to finance hospital treatment in Lower Silesia Province. In order to do this, in 2018 DOW NFZ signed 172 agreements with 76 providers in a scope of stationary health service. Within a chosen research group there were excluded those that are small, most often with one profile of activity and they did not perform constantly. Finally, there were 48 providers qualified for the research of technical efficiency. The aggregated value of agreements with DOW NFZ in terms of hospital treatment in 2018 reached 3,155,000,000.00 PLN (three billion one hundred fifty five million PLN) and that constituted 99% of the budget for financing hospital treatment in the whole Lower Silesia Province.

A specialized research group of health service units is composed of particular hospital departments that are managed within their structures. The research involved two departments that are contractual products – general surgery and internal medicine. A selection followed from a level of generalness. A general surgery and internal medicine are counted as basic departments, that is why they can be found in almost every county of Lower Silesia Province. 39 of internal medicine departments and 35 of general surgery departments were taken into consideration in the analysis. For the need of the research two authorial research models were created a basic model and an extended one.

33It is possible to distinguish a general environment (macro environment), deliberate (microenvironment) and regional (meso environment). Among the most important external factors which condition functioning of medical unit we can point out a cooperation between provincial units of NHF that are responsible for benefits contracts in a given area. In each region a management of provincial NHF has its own, differentiated policy eg. in terms of payment for extra benefits. 34Plan finansowy NFZ na 2018 r., available online: http://nfz.gov.pl/bip/finanse-nfz/ [access: 6.06.2020]. 35Due to high rating of benefits with reference to actual costs, eg. from ophthalmology area (cataract treatment) there were private planned units brought into existence. In case of such units it is not necessary to constantly provide benefits, which transfers into lower costs of this kind of activity. That is why comparing efficiency of units working all the time with planned units is impossible.
A basic model is composed of two variables on an input side (the number of doctors in total, the number of nurses) and one variable on an outcome side (the number of patients). This is a model focused on outcomes with variable returns to scale. A change of a number of workers does not make a proportional change of gained outcomes and available data does not allow for a clear-cut distinction of a way of changes – thus variable returns to scale assumption.

An extended model is a modification of a basic model and is made of the same variables on an input side (the number of doctors in total, the number of nurses and one variable on an outcome side (the number of patients measured on the basis of JGP points). These models are consolidated on an input side by one of the most important – in authors’ judgement – inputs that are used in health care service, medical staff. Lack of professionals in Polish system of health care, in particular in a context of ominously low number of specialists without who particular hospital department could not function properly, can lead to a structural inefficiency of a system. That is why, it is so important to use appropriately, efficiently and in an optimal way available resource. Parameters of the model are outcomes oriented and with variable returns to scale. Calculations were made with the usage of a modern programming DEAp.

5. Analysis Results

Average value of a rate in the efficiency analysis of general surgery department with the usage of a basic model was from 0,700 (the lowest value in 2015) up to 0,770 (the highest value in 2014). In this time a minimal value was on the similar level comparing year 2014 and 2018. The model identified, in the first year of a study, 9 units that were fully efficient, 5 of which were independent public units of health care service and 4 of them limited companies. In case of five periods of time, it was a limited company that was the least efficient. A decrease of efficiency, in a set of units that are not of a business type, is also visible in case of an average value for this group – it also decreased similarly as average efficiency of limited companies.

Table 3. Results of personal model – general surgery

| DMU  | Model DEA VRS outcomes oriented, Inputs: number of doctors, number of nurses, Outcomes: number of patients |
|------|---------------------------------------------------------------------------------------------------------|
|      | 2014 result | 2015 result | 2016 result | 2017 result | 2018 result |
| DMU_10 | 0.375 | 0.409 | 0.421 | 1.000 | 0.877 |
| DMU_12 | 0.704 | 0.521 | 0.600 | 0.653 | 0.509 |
| DMU_13 | 0.693 | 0.364 | 0.388 | 0.392 | 0.365 |
| DMU_16 | 0.706 | 0.592 | 0.532 | 0.566 | 0.526 |
| DMU_17 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| DMU_18 | 0.913 | 0.732 | No data | No data | No data |

36Homogenous group of patients
37The programme that was used is DEAP Version 2.1 (A Data Envelopment Analysis Program). It was created by Tim Coelli from Centre for Efficiency and Productivity Analysis, School of Economics, University of Queensland. Available online: http://www.uq.edu.au/economics/cepa/ [access: 6.06.2020].
Second model used in an efficiency analysis of general surgery department functioning has the same variables on the input side as a basic model, however, on the outcome side the number of patients is measured on the basis of JGP points. Results of the study, in which this extended model was used, are presented in Table 4. In case
of all analysed units’ average efficiency in 2014-2018 went down from z 0,730 to 0,663. Bigger differences are visible after gradation because of organizational-legal form. Average value of efficiency rate for SPZOZ in 2014 was 0,802 and was higher than in a limited company case (0,645). In the last year of an analysis we can see significant dominance of fully efficient units. Among units that were not of a business type we could distinguish four units fully efficient and only one being a limited company.

**Table 4. Results of an extended model – general surgery**

| DMU   | Model DEA VRS outcomes oriented, Inputs: numbers of doctors, number of nurses, Outcomes: number of patients measured by JGP points |
|-------|------------------------------------------------------------------------------------------------------------------|
|       | 2014 | 2015 | 2016 | 2017 | 2018 |
|       | result | ranking | result | ranking | result | ranking | result | ranking | result | ranking |
| DMU_10 | 0.359 | 33 | 0.045 | 30 | 0.542 | 20 | 1.000 | 1 | 0.761 | 12 |
| DMU_12 | 0.622 | 22 | 0.050 | 28 | 0.421 | 27 | 0.577 | 21 | 0.459 | 25 |
| DMU_13 | 0.588 | 28 | 0.036 | 31 | 0.379 | 31 | 0.347 | 30 | 0.357 | 30 |
| DMU_16 | 0.614 | 23 | 0.077 | 18 | 0.463 | 25 | 0.550 | 23 | 0.476 | 24 |
| DMU_17 | 0.779 | 16 | 0.083 | 16 | 0.817 | 10 | 0.928 | 8 | 0.804 | 8 |
| DMU_18 | 0.572 | 25 | 0.051 | 26 | No data | No data | No data | No data | No data | No data |
| DMU_2  | 0.902 | 12 | 1.000 | 1 | 0.448 | 26 | 0.647 | 16 | 0.581 | 19 |
| DMU_20 | 0.630 | 21 | 0.053 | 25 | 0.416 | 28 | 0.409 | 28 | 0.401 | 28 |
| DMU_21 | 0.607 | 24 | 0.059 | 23 | 0.607 | 16 | 0.501 | 27 | 0.530 | 21 |
| DMU_22 | 0.737 | 19 | 0.190 | 5 | 0.645 | 14 | 0.608 | 20 | 0.664 | 16 |
| DMU_24 | 0.565 | 26 | 1.000 | 1 | 0.466 | 24 | 0.610 | 19 | 0.589 | 18 |
| DMU_26 | 0.941 | 11 | 0.126 | 10 | 0.602 | 17 | 0.774 | 11 | 0.763 | 11 |
| DMU_27 | 1.000 | 1 | 0.047 | 29 | 0.393 | 30 | 0.508 | 25 | 0.498 | 23 |
| DMU_28 | 0.729 | 20 | 0.059 | 23 | 0.717 | 12 | 0.862 | 9 | 0.729 | 13 |
| DMU_29 | 0.479 | 30 | 0.051 | 26 | 0.495 | 23 | 0.393 | 29 | 0.410 | 27 |
| DMU_3  | 0.411 | 31 | 0.035 | 32 | 0.398 | 29 | 0.201 | 32 | 0.401 | 28 |
| DMU_31 | 0.951 | 10 | 0.065 | 20 | 0.691 | 13 | 0.634 | 18 | 0.662 | 17 |
| DMU_32 | 1.000 | 1 | 0.189 | 6 | 1.000 | 1 | 1.000 | 1 | 1.000 | 1 |
| DMU_33 | 1.000 | 1 | 0.091 | 14 | 0.768 | 11 | 0.722 | 14 | 0.775 | 10 |
| DMU_34 | 0.847 | 14 | 0.061 | 21 | 0.498 | 22 | 0.645 | 17 | 0.571 | 20 |
| DMU_35 | 0.809 | 15 | 0.089 | 15 | 0.862 | 8 | 0.721 | 15 | 0.716 | 15 |
| DMU_38 | 0.554 | 29 | 0.060 | 22 | 0.538 | 21 | 0.522 | 24 | 0.528 | 22 |
| DMU_4  | 0.305 | 34 | No data | No data | No data | No data | No data | No data | No data | No data |
| DMU_40 | 0.888 | 13 | 0.144 | 9 | 0.992 | 6 | 0.846 | 10 | 0.816 | 7 |
| DMU_41 | 0.760 | 17 | 0.101 | 11 | 0.825 | 9 | 0.740 | 12 | 0.727 | 14 |
| DMU_42 | 0.742 | 18 | 0.068 | 19 | 0.634 | 15 | 0.735 | 13 | 0.776 | 9 |
| DMU_44 | 1.000 | 1 | 0.098 | 13 | 1.000 | 1 | 1.000 | 1 | 1.000 | 1 |
| DMU_45 | 1.000 | 1 | 0.157 | 8 | 1.000 | 1 | 1.000 | 1 | 1.000 | 1 |
| DMU_46 | 1.000 | 1 | 0.099 | 12 | 0.949 | 7 | 0.968 | 7 | 0.860 | 6 |
| DMU_47 | 0.564 | 27 | 0.080 | 17 | 0.549 | 19 | 0.503 | 26 | No data | No data |
| DMU_48 | 1.000 | 1 | 0.159 | 7 | 1.000 | 1 | 1.000 | 1 | 1.000 | 1 |
| DMU_5  | 0.229 | 35 | No data | No data | No data | No data | No data | No data | No data | No data |
| DMU_6  | 1.000 | 1 | 1.000 | 1 | 0.561 | 18 | 0.563 | 22 | 0.457 | 26 |
| DMU_9  | 0.392 | 32 | 0.029 | 33 | 0.298 | 32 | 0.286 | 31 | 0.234 | 31 |
| Average | 0.730 | 0.196 | 0.655 | 0.681 | 0.663 |
| Minimum | 0.229 | 0.029 | 0.298 | 0.201 | 0.234 |
| SPZOZ | 0.479 | 0.047 | 0.393 | 0.393 | 0.410 |
| Private limited company | 0.229 | 0.029 | 0.298 | 0.201 | 0.234 |
| Average inefficiency | 0.636 | 0.085 | 0.592 | 0.608 | 0.598 |
In a summary of a study on efficiency of general surgery departments functioning within two different organizational and legal forms it should be highlighted that results of particular models show dominance of units functioning in a frame of SPZOZ as those more efficient.

Second representative of a set of basic units that was considered in the analysis is a department of general medicine. We found out in the research that it was the most numerous represented. At the end of 2018 it was present in 35 health care units, 16 of which were in a form of limited company and 19 in a form of SPZOZ. General medicine plays a major role in a health care system. On one side it is a diagnostic department where they proceed with tests and in case of a correct diagnosis a patient can be directed to a specialist department or a decision is made to keep him at the department to continue with a treatment. On the other side, a general medicine is used as a unit where patients undergo recuperation after specialist procedures.

Results of efficiency analysis at general medicine departments with the usage of a personal model were presented in Table 5. They show stabilization of efficiency level in the researched period. The average slightly lowered from 0.719 in 2014 to 0.709 in 2018. At the same time there was a drastic decrease of the lowest value, in 2014 it was 0.365 and in 2018 0.056. Results that take into consideration a division into an organizational and legal form show disproportion and at the same time superiority of limited companies over SPZOZ.

In 2014 average efficiency for the first group was close to an average value of an efficiency rate for an independent public health care units – the difference, in favour of limited companies, in a level of efficiency which increased form 0.019 to 0.091 when comparing year 2014 and 2018. During the research time among the number of fully efficient units we could mark additional one and in a second group the number of fully efficient units equaled four both at the beginning and at the end of the analysis.
## Table 5. Results of a basic model – general medicine

| DMU | Model DEA VRS outcomes oriented. Inputs: number of doctors, number of nurses, Outcomes: number of patients |
|-----|---------------------------------------------------------------------------------------------------------|
|     | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|     | result | ranking | result | ranking | result | ranking | result | ranking | result | ranking |
| DMU_1 | 0,716 | 18 | 0,546 | 30 | 0,535 | 30 | 0,560 | 26 | 0,575 | 25 |
| DMU_10 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 | 0,859 | 13 |
| DMU_12 | 0,632 | 24 | 0,644 | 22 | 0,773 | 19 | 0,720 | 17 | 1,000 | 1 |
| DMU_13 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 | 0,828 | 15 | 0,529 | 27 |
| DMU_16 | 0,647 | 23 | 0,596 | 26 | 0,572 | 27 | 0,766 | 16 | 0,681 | 20 |
| DMU_17 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 | 0,859 | 11 | 1,000 | 1 |
| DMU_18 | 0,707 | 21 | 0,800 | 13 | No data | No data | No data | No data | No data | No data |
| DMU_2 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 | 0,593 | 24 | 0,579 | 24 |
| DMU_20 | 0,755 | 16 | 0,657 | 19 | 0,595 | 25 | 0,684 | 20 | 0,666 | 22 |
| DMU_21 | 0,879 | 11 | 0,965 | 10 | 0,796 | 17 | 0,640 | 22 | 0,696 | 18 |
| DMU_22 | 0,532 | 32 | 0,551 | 29 | 0,575 | 26 | 0,638 | 23 | 0,532 | 26 |
| DMU_24 | 0,782 | 15 | 0,640 | 23 | 0,905 | 14 | 0,833 | 14 | 0,710 | 17 |
| DMU_26 | 0,703 | 22 | 0,679 | 18 | 0,633 | 24 | 0,693 | 19 | 0,757 | 16 |
| DMU_27 | 0,839 | 13 | 0,777 | 14 | 0,792 | 18 | 0,719 | 18 | 0,886 | 12 |
| DMU_28 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 |
| DMU_29 | 0,407 | 37 | 0,432 | 35 | 0,708 | 21 | 0,448 | 31 | 0,603 | 23 |
| DMU_3 | 0,472 | 34 | 0,487 | 32 | 0,550 | 29 | 0,550 | 27 | 0,380 | 32 |
| DMU_30 | 0,601 | 25 | 0,634 | 24 | 0,430 | 33 | 0,384 | 34 | 0,350 | 33 |
| DMU_31 | 0,790 | 14 | 0,764 | 15 | 1,000 | 1 | 1,000 | 1 | 0,766 | 15 |
| DMU_32 | 0,927 | 10 | 0,914 | 11 | 0,935 | 13 | 0,838 | 13 | 0,776 | 14 |
| DMU_33 | 0,733 | 17 | 0,582 | 27 | 0,748 | 20 | 0,582 | 25 | 0,678 | 21 |
| DMU_34 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 |
| DMU_35 | 0,709 | 20 | 0,652 | 21 | 0,702 | 22 | 0,840 | 12 | 1,000 | 1 |
| DMU_36 | 0,366 | 38 | 0,363 | 37 | 0,312 | 36 | 0,352 | 36 | 0,339 | 34 |
| DMU_37 | 0,570 | 30 | 0,579 | 28 | 0,561 | 28 | 0,461 | 30 | 0,460 | 29 |
| DMU_38 | 0,601 | 25 | 0,716 | 16 | 0,875 | 16 | 0,679 | 21 | 1,000 | 1 |
| DMU_39 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 |
| DMU_4 | 0,524 | 33 | No data | No data | No data | No data | No data | No data | No data | No data |
| DMU_40 | 0,465 | 35 | 0,488 | 31 | 0,498 | 32 | 0,518 | 29 | 0,474 | 28 |
| DMU_41 | 0,365 | 39 | 0,381 | 36 | 0,341 | 35 | 0,365 | 35 | 0,395 | 30 |
| DMU_42 | 0,843 | 12 | 0,914 | 11 | 0,946 | 12 | 0,988 | 10 | 0,985 | 11 |
| DMU_44 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 |
| DMU_45 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 | 0,056 | 35 |
| DMU_46 | 0,581 | 29 | 0,657 | 19 | 0,671 | 23 | 0,399 | 33 | 0,389 | 31 |
| DMU_47 | 0,600 | 27 | 0,457 | 34 | 0,400 | 34 | 0,423 | 32 | Lack of data | Lack of data |
| DMU_48 | 0,543 | 31 | 0,476 | 33 | 0,504 | 31 | 0,548 | 28 | 0,684 | 19 |
| DMU_5 | 0,450 | 36 | No data | No data | No data | No data | No data | No data | No data | No data |
| DMU_6 | 0,599 | 28 | 0,603 | 25 | 1,000 | 1 | 1,000 | 1 | 1,000 | 1 |
| DMU_9 | 0,710 | 19 | 0,688 | 17 | 0,894 | 15 | 1,000 | 1 | 1,000 | 1 |
| Average | 0,719 | | 0,720 | | 0,757 | | 0,720 | | 0,709 | |
| Minimum | 0,365 | | 0,363 | | 0,312 | | 0,352 | | 0,056 | |
| SPZ0Z | 0,365 | | 0,363 | | 0,312 | | 0,352 | | 0,056 | |
| Private limited company | 0,450 | | 0,487 | | 0,535 | | 0,461 | | 0,380 | |
| Average inefficiency | 0,635 | | 0,630 | | 0,650 | | 0,626 | | 0,592 | |
| Average efficiency of SPZ0Z | 0,710 | | 0,712 | | 0,722 | | 0,663 | | 0,667 | |
| Average efficiency of | 0,729 | | 0,731 | | 0,800 | | 0,791 | | 0,758 | |

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Results of the study with the usage of an extended model for a general medicine department were presented in Table 6 – they show even bigger disproportion in an efficiency level between limited companies and independent public health care units, in favour of the first group. A difference in an average efficiency of these two groups increased from 0,019 to 0,143 (comparing 2014 and 2018). The group of limited companies is the most numerous in a group of fully efficient units (4 out of 7 were efficient in 2014 and 5 out of 6 were efficient in 2018).

Table 6. Results of an extended model – general medicine department

| DMU   | 2014 result | 2015 result | 2016 result | 2017 result | 2018 result |
|-------|-------------|-------------|-------------|-------------|-------------|
|       | ranking     | ranking     | ranking     | ranking     | ranking     |
| DMU 1 | 0.546       | 0.454       | 0.437       | 0.356       | 0.362       |
| DMU 10| 1.000       | 1.000       | 1.000       | 1.000       | 1.000       |
| DMU 12| 0.610       | 0.591       | 0.732       | 0.573       | 0.868       |
| DMU 13| 1.000       | 1.000       | 0.997       | 0.743       | 0.538       |
| DMU 16| 0.621       | 0.577       | 0.585       | 0.716       | 0.694       |
| DMU 17| 1.000       | 1.000       | 1.000       | 0.804       | 1.000       |
| DMU 18| 0.629       | 0.680       | No data     | No data     | No data     |
| DMU 2 | 1.000       | 1.000       | 1.000       | 0.551       | 0.545       |
| DMU 20| 0.787       | 0.672       | 0.611       | 0.588       | 0.632       |
| DMU 21| 0.687       | 0.776       | 0.900       | 0.804       | 0.772       |
| DMU 22| 0.510       | 0.676       | 0.757       | 0.691       | 0.635       |
| DMU 24| 0.849       | 0.262       | 0.811       | 0.721       | 0.673       |
| DMU 26| 0.592       | 0.548       | 0.531       | 0.551       | 0.576       |
| DMU 27| 0.670       | 0.590       | 0.632       | 0.550       | 0.590       |
| DMU 28| 0.989       | 0.872       | 1.000       | 1.000       | 1.000       |
| DMU 29| 0.571       | 0.619       | 0.887       | 0.536       | 0.642       |
| DMU 3 | 0.544       | 0.498       | 0.489       | 0.385       | 0.439       |
| DMU 30| 0.505       | 0.569       | 0.486       | 0.332       | 0.287       |
| DMU 31| 0.923       | 0.852       | 1.000       | 1.000       | 0.820       |
| DMU 32| 0.867       | 0.816       | 0.857       | 0.724       | 0.646       |
| DMU 33| 0.669       | 0.515       | 0.590       | 0.444       | 0.578       |
| DMU 34| 1.000       | 1.000       | 1.000       | 1.000       | 1.000       |
| DMU 35| 0.880       | 0.714       | 0.835       | 0.702       | 0.858       |
| DMU 36| 0.383       | 0.381       | 0.343       | 0.384       | 0.364       |
| DMU 37| 0.539       | 0.603       | 0.472       | 0.354       | 0.394       |
| DMU 38| 0.573       | 0.613       | 0.746       | 0.461       | 0.741       |
| DMU 39| 1.000       | 1.000       | 1.000       | 1.000       | 1.000       |
| DMU 4 | 0.516       | 35          | No data     | No data     | No data     |
| DMU 40| 0.551       | 31          | 0.582       | 26          | 0.576       |
| DMU 41| 0.437       | 38          | 0.401       | 35          | 0.403       |
| DMU 42| 0.806       | 14          | 0.853       | 16          | 0.922       |
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| DMU | 0.908 | 10 | 0.865 | 9 | 0.931 | 11 | 0.869 | 10 | 0.839 | 11 |
|-----|-------|----|-------|---|-------|----|-------|----|-------|----|
| DMU_44 | 1.000 | 1 | 1.000 | 1 | 1.000 | 1 | 1.000 | 1 | 0.040 | 35 |
| DMU_45 | 0.743 | 17 | 0.812 | 13 | 0.786 | 19 | 0.391 | 31 | 0.367 | 31 |
| DMU_46 | 0.662 | 21 | 0.522 | 30 | 0.460 | 33 | 0.432 | 29 | No data | No data |
| DMU_47 | 0.650 | 22 | 0.494 | 33 | 0.602 | 26 | 0.542 | 25 | 0.599 | 21 |
| DMU_48 | 0.556 | 30 | No data | No data | No data | No data | No data | No data | No data | No data |
| DMU_5 | 0.583 | 27 | 0.614 | 21 | 1.000 | 1 | 1.000 | 1 | 1.000 | 1 |
| DMU_6 | 0.784 | 16 | 0.746 | 15 | 0.926 | 12 | 1.000 | 1 | 1.000 | 1 |

**Average** 0.722 0.696 0.759 0.670 0.665
**Minimum** 0.383 0.262 0.343 0.332 0.040

#### Private limited company

- **Average inefficiency** 0.661 0.626 0.678 0.575 0.595
- **Average efficiency of SPZOZ** 0.713 0.671 0.736 0.623 0.599
- **Average efficiency of private limited company** 0.732 0.729 0.787 0.728 0.742

**Efficient DMU** 7 7 9 8 6
**SPZOZ** 3 3 3 2 1
**Private limited company** 4 4 6 6 5

**Source:** Self-study based on data from DOW NFZ.

On the basis of research results efficiency of general surgery departments such statement is justified that it cannot be unambiguously pointed out which organizational-legal form (SPZOZ or limited companies) is more efficient. However, the results confirm that public units are not less efficient than commercial ones.

#### 6. Conclusion

Hospitals are the most important units functioning within a health care system in Poland. Research and analyses of their financial situation also the way of using the resources are vital – form the point of view of many groups of stakeholders – and should be performed by a Ministry of Health and National Health Fund. Improvement of efficiency and organisation of health care system in a context of changing demographic and epidemiologic situation, supporting scientific research, development of technology in a health care system are also major aims of European Union health care policy. Such aim was set in Poland with granted structural funds in 2014-2020. One of the possible scenarios to improve efficiency of the whole health care system in Poland is to improve efficiency of particular units with granted stable legal environment and similar financial perspectives.
Presented results of efficiency analysis of health benefits from medical units of a hospital profile in a Lower Silesia Province do not confirm statements included (and very often repeated by other stakeholders of a system) in the explanation to the Act of 15 April 2011 on medical activity stating as SPZOZ was an inefficient legal form. There is no authorisation for such constatation that limited companies are more efficient and they should constitute major group of providers. Results show that in many cases it was SPZOZ – considered as inefficient legal form – appeared to be more efficient.

Nevertheless, the results show that regardless organizational and legal form improvement of functioning efficiency of medical units is possible. That is why decision-makers of a health care system should aim at eliminating mismanagement on every level of activities through analysis of inputs in a context of generated outcomes/results. This article is a part of a discourse on the efficiency evaluation of units in a health care system. The authors believe that it will constitute to creating new models of efficiency measurement of benefits providers in a system that will be used by the institutions responsible for allocating public funds for health benefits.

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Legal acts:
Konstytucja Światowej Organizacji Zdrowia, Porozumienie zawarte przez Rządy reprezentowane na Międzynarodowej Konferencji Zdrowia i Protokół dotyczący Międzynarodowego Urzędu Higieny Publicznej, podpisane w Nowym Jorku dnia 22 lipca 1946 r. (Dz. U. z 1948 r. Nr 61, poz. 477).

Konstytucja Rzeczypospolitej Polskiej z dnia 2 kwietnia 1997 r. uchwalona przez Zgromadzenie Narodowe w dniu 2 kwietnia 1997 r., przyjęta przez Naród w referendum konstytucyjnym w dniu 25 maja 1997 r., podpisana przez Prezydenta Rzeczypospolitej Polskiej w dniu 16 lipca 1997 r. (Dz. U. z 1997 r. Nr 78, poz. 483).

Ustawa z dnia 28 października 1948 roku o zakładach społecznych służby zdrowia i planowej gospodarce w służbie zdrowia (Dz. U. z 1948 r. Nr 55, poz. 434).

Ustawa z dnia 30 sierpnia 1991 r. o zakładach opieki zdrowotnej (Dz. U. z 1991 r. Nr 91, poz. 408).

Sejm Rzeczypospolitej Polskiej VI Kadencji, Uzasadnienie do rządowego projektu ustawy o działalności leczniczej z dnia 15 października 2010 r., Druk sejmowy nr 3489.

Ustawa z dnia 15 kwietnia 2011 r. o działalności leczniczej (Dz.U. 2011 nr 112 poz. 654).