HEALTHCARE SYSTEMS AND PERFORMANCE EVALUATION: COMPARISON OF PERFORMANCE INDICATORS IN V4 COUNTRIES USING MODELS OF COMPOSITE INDICATORS

Pavlína Hejduková, Lucie Kureková

Introduction

Healthcare systems have been providing clients with services of an increasingly higher quality thanks to many positive developments in healthcare, primarily the high level of expertise of healthcare personnel, improvements in technology, and speedier approaches to treating illnesses. However, the healthcare system has struggled with other various negative aspects: inappropriate structuring, poor management, or ineffective financing. In light of these negative aspects and the support and development of the positive, these systems should be managed properly and their performance should be evaluated (Hejduková & Kureková, 2016b).

According to Donabedian (1972), the defining goal for the healthcare system is to improve the health of the population. If healthcare systems did not contribute to improving health, we would choose not to have them at all. The health of the population should reflect the health of individuals throughout the course of their lives and include both premature mortality and non-fatal health outcomes as key components. Many studies highlight the fact that health and healthcare systems an important role in the economy, see Stroukal (2016) and point to the link between social capital and public goods (Son, 2016).

In regard to the system of healthcare as a whole, responsibility for its effective operation lies with the government of a given country. Public healthcare policy must then define strategies and include healthcare in public finances on one hand and support private institutions in the area of healthcare provision on the other (WHO, 2000).

Measuring and evaluating performance in the field of healthcare must then be included in public policy – for more see for example Wouter et al. (2010) or Barták (2010).

In order to measure and evaluate performance on the level of healthcare systems, many interesting indicators have been created by e.g. the WHO, Eurostat, OECD Health Statistics, or OECD Health Policy Studies – selected indicators are compared in the paper below.

This paper begins with theoretical research on the issue and specifies the basic aspects of the selected healthcare systems. The paper then focuses on presenting goals, methodology, and data, and also provides its own model of composite indicators. The article continues with a chapter devoted to results and discussion on the topic before drawing its final conclusion.

1. Literature Review
1.1 Healthcare Systems and Their Performance

A high-quality healthcare system provides high-quality services to all individuals who require them. The basic building blocks of the healthcare system differ from country to country; however, these systems all need sources of financing, educated personnel, and reliable information (Hejduková & Kureková, 2016a).

According to Roemer's definition (2002), the healthcare system is a combination of resources, organization, finances and management, which culminates in the provision of services for a given population. The World Health Organization offers a different definition,

which describes the healthcare system as "all the activities whose primary purpose is to promote, restore and/or maintain health." In previous years, this definition was expanded by the World Bank (2007) to include the prevention of domestic poverty due to illness. According to the definition given by Plsek and Greenhalgh (2001), the healthcare system is a complex adaptive system that plays a significant role in influencing healthcare systems primarily in producing better results in the field of health.

In terms of long-term sustainability, the healthcare system must have a clear concept. According to Kelley and Hurst (2006a), the conceptual framework of the current healthcare system must include the following aspects: effectiveness, safety, responsiveness, accessibility, equity and efficiency.

Other authors, e.g. Kacíř (2010), claim that the following criteria must be fulfilled in order for a healthcare system to properly function: availability, quality, reasonable financial burden, effectiveness, equal access, and

social acceptability. Sassi et al. (2002) state that the performance of healthcare systems is evaluated as the performance of individual activities in a healthcare system.

The WHO (2006) provides interesting insight into the healthcare system in its definition of the six pillars of the healthcare system – see Tab. 1.

As is evident in Tab. 1, the healthcare system is primarily based on economic, social, legal, and political frameworks. We can also summarize this by stating that public policy plays the primary role in each of the pillars listed above.

Measuring and evaluating the performance of healthcare systems on a national level requires analysis of the relationship between performance and public values – see Hood (1991) and his discussion of ideas known as „New Public Management".

Bouckaert and Halligan (2008) define performance on three levels: micro, middle, and macro. If we focus on the micro level according to these authors, the performance of a given

Tab. 1: Six basic pillars of the healthcare system

Pillars of the healthcare system	Specification
1. Service delivery	▪ Supply ▪ Demand ▪ Infrastructure ▪ Management ▪ Protection and quality
2. Health workforce	▪ National employment policy ▪ Legal framework ▪ Norms ▪ Standards
3. Information	▪ Information systems ▪ Monitoring systems ▪ Global information standards
4. Health products and technologies	▪ Policy ▪ Public tenders ▪ Norms ▪ Acces and quality
5. Financing	▪ Structure of public finance policy in the field of healthcare ▪ Data on healthcare expenditures ▪ Calculations
6. Leadership/governance	▪ Sector policies ▪ Monitoring and regulation ▪ Intervention ▪ Harmonization and unified methods

Source: own, based on WHO (2006)

situation is evaluated. On the middle level, the authors mostly point to the performance of a certain branch (e.g. health care). On the macro level, discussions are typically led on the performance of a country, e.g. countries of the OECD or EU. As states Krechovská (2014), every entity should choose an approach and a performance evaluation method that will best correspond to their needs, goals and current situation.

Approaches to measuring and evaluating performance in healthcare have begun to expand significantly in connection to the instatement and implementation of healthcare reforms and changes in attitudes toward health in developed countries (Háva & Mašková-Hanušová, 2009a). These new approaches and concepts stem primarily from supranational institutions, primarily the OECD, WHO, European Observation, or the UN.

In evaluating the performance of healthcare systems, it is important to consider the fact that not only the financial aspects are evaluated; simultaneously, a growing emphasis is also being placed on non-financial characteristics – for more, see e.g. Roberts et al. (2003), Preker et al. (2000), Donabenian (1982), or Smith et al. (2008).

If we state the basic goals of the institutions and authors listed above, we can claim that the WHO (2000) defines three goals in evaluating the performance of a healthcare system. These are: health, responsiveness, and fair financing. On the contrary, the OECD (2004) and Kelly and Hurst (2006a; 2006b) approach the issue of healthcare system evaluation in a broader sense and cite additional factors, e.g. satisfaction of the patient, adequacy, or timeliness of care.

International comparisons of the performance of healthcare system discuss many authors – see Barták (2012), Dlouhý (2009), Hadad et al. (2013) or Lawson et al. (2012). There exist many indicators which are used to measure and evaluate the performance of healthcare systems. The WHO lists one level of evaluation as "better health" linked to the first of the three goals listed above (WHO, 2000). According to the University of Ljubljana (2015), two types of indicators exist on this level: indicators of chances for living a full life and indicators of lost years of life. Other approaches use the following indicators: number of doctors and nurses, education of the healthcare personnel, infant mortality, overweightness and obesity, or consumption of alcohol (OECD, 2016). In her article, Hejduková (2015) uses other indicators for evaluating performance, for instance health care expenses or the number of given devices or equipment used in medicine.

1.2 Healthcare Systems in V4 Countries

As was noted above, reforms play an important role in current healthcare policy and thus in healthcare systems. Among V4 countries, these reforms are similar to one another and show cooperation between the reforming institutions, law firms, and entities on the financial market primarily in areas of modernizing healthcare facilities with a strong focus on the market (Preker & Harding, 2004; 2007). All four V4 countries share similarities, such as recent historical events, but there are also different socio-economics and political differences in Visegrad Group (Piotrowicz, 2015).

The healthcare system in the Czech Republic is characterized by extensive utilization of healthcare goods and services (Martin, 2016). The Czech Republic is a V4 country that has gone through many reforms in recent years in the field of healthcare. These reforms have dealt not only with the healthcare system itself, but also with the fields of public finance and private law. The OECD (2008b) describes the healthcare system of the Czech Republic in a wholly positive manner, but points out some possible risks: "cream skimming" by health insurance companies, asymmetric information between the management of healthcare companies and politicians, possible deterioration in the quality of healthcare as a result of the growing number of healthcare facilities, or issues with the instatement and subsequent cancellation of doctor fees.

Similarly to other V4 countries, the Hungarian healthcare system has been influenced by the country's transformation from a transitive to market economy. According to the OECD (2008c), risks linked to economic, fiscal, or market-oriented reforms (co-pays, competitions in public healthcare) can have very negative impacts on the healthcare system. "On the other hand, Hungary is a target country for cross-border health care, mainly for dental care but also for rehabilitative services, such as medical spa treatment. The health industry can thus be a potential strategic area for economic development and growth."

(European Observatory on Health Systems and Policies, 2011, p. 20)

As Wóyciska and Grabowski (2007) note, Poland is a V4 country that has not been successful in making a satisfactory shift to meet welfare-state trends and in doing so create a model of modern social security. In the area of healthcare, Poland's largest problems lie in its overall expenditures on healthcare and the state of its citizens' health (Watson, 2006; Kuszewski & Gericke, 2005). According to a study created by Háva and Mašková-Hanušová (2009a), problems in Polish healthcare are also evident in the field of medical fees, a national health insurance fund, disagreements in politics, and others. According to the OECD (2008a), one of Poland's major problems lies in the fact that the country has one of the highest degrees of income inequality in the OECD; for other information see – Pavolini and Guillén (2013) or Costa-Font and Greer (2016).

Slovakia is the first V4 country to have instated wide-scale reforms in the field of healthcare. Despite this fact, however, Slovakia still lags behind its V4 partners in the effectiveness of its healthcare. Here we can mention the higher mortality of its system, which is 15% higher in comparison to other V4 countries. Characteristic for Slovakia is also the high use of medicine and high rates of medical visits. Higher costs in comparison with the other V4 countries in the area of diagnostics and laboratory work are also evident (Zdravotnický deník, 2016). Despite its initial reforms, Slovakia has been strongly influenced by disagreements in politics, for example the establishment and cancellation of medical fees, a moratorium on transforming the legal status of healthcare institutions, and so on. (Verhoeven et al., 2007).

According to the OECD (2016a), all V4 countries show less expenditure on healthcare than the OECD average, which is also confirmed by conclusions in the studies by Háva and Mašková-Hanušová (2009b) or OECD (2016b). We can also claim that the V4's healthcare systems continued to be underfinanced in comparison to the OECD average (OECD, 2016b; 2015).

In addition to the fact that these countries are still facing challenges with their transformation from a transitive economy to a market economy, the structure of healthcare systems in V4 countries is also influenced by demographic developments, fiscal problems, efforts toward constant economic growth, and globalization. Basic problems in the healthcare systems of the V4 can be found in the orientation of individual systems on primarily economic goals, whereas international trends are more focused on non-economic and non-financial aspects.

Measuring and evaluating the performance of healthcare systems can be seen as one of the most important aspects of effective healthcare management. In structuring and creating a method for the performance evaluation of healthcare systems, it is necessary (if at all possible) to focus on objectively measurable indicators. Thus, it is important to determine and evaluate the capability of interpreting results of measurement. Such measurement provides for comparisons of performance to be made in time and in terms of selected regional units (e.g. on the level of a country's individual regions, or on a national level). Scientific studies have paid only little attention to these measurable/qualitative forms of performance evaluation of healthcare systems, thus providing an opportunity for us to carry out research and create a composite indicator for performance evaluation in this area.

2. Methodology and Research Data

The goal of this paper is to compare and evaluate the performance of healthcare systems in V4 countries using selected indicators of healthcare systems and determine the state of the Czech Republic's healthcare system in comparison to other V4 countries.

This paper will attempt to answer the following questions: What is the Czech Republic's position in terms of healthcare indicators in comparison to other V4 countries? What results do the selected indicators show and how can we interpret them? Research of literature and selected statistical indicators provided the answers to these questions.

Data for this paper was mainly taken from OECD Health Policy Studies. The healthcare systems studied in this paper were chosen due to the fact that V4 countries are transitive economies of the CEE with a poorer state of health among of their general population than in developed countries of the OECD or EU. In addition, these countries share certain characteristics – their systems have long been underfinanced and reforms in these countries have mostly been geared toward economic goals. As Háva and Mašková-Hanušová (2009b)

point out, however, international discourse has helped to develop broader concepts of long-term sustainability with an emphasis on overall effectiveness, quality of provided services, and human rights with regard to health.

The calculation of composite indicators is some solution that provides the ability to capture a complex phenomenon. The authors realize that a certain level of abstraction will always occur when trying to quantify phenomena using composite indicators. In composite indicator, the degree of abstraction is multiplied because it is based on multiple indicators. This disadvantage, however, is balanced by the fact that the composite indicator reflects fact by means of several sub-indicators and includes different, often contradictory, aspects of the phenomenon.

There is not only one correct CI approach, so there is not one right solution to this task, so the authors offer three methods (models) of CI calculation. Threats associated with the use of composite indicators are (i) the risk of incorrect calculation, and (ii) the possibility of simple interpretation can lead to too simplified and thus incorrect conclusions. The authors tried to eliminate these threats by studying appropriate literature and using their experience with statistics and indicators.

The authors are aware that using the same weights of components there is a risk that certain areas (one pillar or component) will be assigned a greater weight by being represented by a larger number of indicators in CI. This may have a stronger impact on overall CI than it does with the intended CI and its theoretical framework. The same weights are appropriate if the correlation between the indicators does not indicate the double counting of the same aspect of the measured phenomenon due to the redundant sub-index. The use of the same weights as evidenced by the presence of a large number of partial indicators, i.e. 50-100 partial indicators (Gulliksen, 1950). In the case of a large number of indicators, it is difficult to adequately determine the weights for each indicator, and the more complex weighing scheme would make it difficult to interpret the impact of the individual sub-indicators. Similarly, if we have only a small set of data that consists of less than 30 observations, the same weights are appropriate (Raju et al., 1999). Hopkins (1991) says that if it is impossible to obtain a general consensus for weight determination,

the simplest solution is the best. The authors eventually applied linear weighing, this process is further supported by the results in the empirical part, the results are consistent with results in other studies (see Dlouhý, 2016a; Dlouhý, 2016b).

A composite indicator of the performance of the healthcare system was created. The main advantage of using composite indicators is that they allow us to summarize and express complex phenomena into one indicator. In our case, the indicator expresses the performance of the healthcare system. The composite indicator enables us to create a relatively simple comparison of a selected unit (e.g. country, region, company, etc.) in time or between individual units. According to Booysen (2002), another advantage of composite indicators is their flexibility in the sense that computations or methodology can be easily changed (selection of indicators, normalization, weighting systems, aggregation). These changes, however, are made at the expense of the comparability of indicators in time. This problem can be partially dealt with via retrospective revision according to new methodology.

Data from the OECD Health Policy Studies was used to construct the composite indicator. The period of time chosen for the study was ten years, i.e. from 2005 to 2014. Based on expert selection, ten indicators were chosen and the assumption was made that indicators and their values reflect the performance of healthcare systems in the individual member states of the V4. Indicators were divided into two pillars (Pillar I and II) based on how positively or negatively they contribute to heightening the performance of healthcare systems. Six of ten selected indicators were included in Pillar I and are in direct dependence on the performance of the healthcare system. The remaining four have been included in Pillar II, which are in indirect dependence on the performance of the healthcare system. A summary of the selected variables is listed in Tab. 2.

A mean was calculated for each indicator during the given period. Indicator ID_8 shows available data over the course of the whole period only for the Czech Republic. The mean for indicator ID_8 for the remainder of countries was calculated only for 2009 and 2014. As regards indicator ID_10, complete data was available only in the case of Poland; in the Czech and Slovak Republic's case, information

Tab. 2: Selected indicators of the performance of healthcare systems

Pillar	Indicator	
I	ID_1	Number of doctors per 1,000 people (in %)
	ID_2	Number of nurses per 1,000 people (in %)
	ID_3	Life expectancy at birth in terms of the overall population (in years)
	ID_4	Healthcare expenditures in terms of GDP (in %)
	ID_5	Prevalence of examination technology: Magnetic resonance imaging machines per 1,000,000 people (number of machines)
	ID_6	Prevalence of examination technology: Computed tomography scanners per 1,000,000 people (number of machines)
II	ID_7	Alcohol consumption per person among people over 15 years of age (in liters)
	ID_8	Consumption of tobacco products, % of population over 15 years of age who are daily smokers (%)
	ID_9	Infant mortality, number of deaths per 1,000 live-born individuals (in number of deaths)
	ID_10	Thirty-day mortality after admission to hospital for AMI based on admission data (Age-sex standardized rate per 100 patients)

Source: own based on OECD (2016a)

was published in two-year intervals. Missing values were thus substituted by the value of the arithmetic mean and, in Hungary's case, data was available only for the period between 2005 and 2009. The method of linear regression was selected for the imputation of absent values. Values were imputed based on an estimate of the regressive axis by using the least squares method. Mean values of individual indicators are presented in Tab. 3.

Based on the selected indicators, composite indicators were constructed. These indicators are meant to reflect the performance of healthcare systems of the V4 member states. Three methods for modeling these indicators were used in order to establish the comparison of healthcare system performance. These three methods are: (i) using the area of a radar chart, (ii) determining performance based on order, and (iii) determining performance based on distance from the reference unit. These three methods for determining the performance of healthcare systems allow us to compare the situations of individual healthcare systems in terms of performance.

3. Models of Composite Indicators
The first model is primarily based on a graphic representation of the composite indicator. For these purposes, a radar or "spider web" chart is used. This chart is a basic analytical tool that allows us to visualize several indicators in one chart and thus offers a visualization of the variable's area (in our case the performance of the healthcare system). Based on the size of the web's area, we can then easily compare the healthcare systems between given countries.

Tab. 3: **Summary of mean values for individual indicators**

	CZ	HU	PL	SK
ID_1	3.61	3.02	2.20	3.30
ID_2	8.04	6.19	5.26	6.02
ID_3	77.56	74.52	76.24	75.47
ID_4	6.80	7.47	6.21	7.32
ID_5	5.70	2.82	4.13	6.20
ID_6	14.03	7.36	12.63	14.20
ID_7	11.81	11.78	10.21	10.46
ID_8	22.92	26.15	23.25	21.20
ID_9	2.84	5.31	5.27	5.92
ID_10	7.41	13.27	6.22	9.02

Source: own based on OECD (2016a)

Based on the radar chart, the theoretical expression of performance can be expressed as the difference between the sizes of the individual areas of the web.

$$A_j = P_I - P_{II} \qquad (1)$$

where A_j represents the difference between the area of the spider web reached in Pillar I (P_I) and Pillar II (P_{II}). The size of the areas P_I and P_{II} is depicted in the following two figures. Logarithmic transformation of the mean values of individual indicators (x_{ij}^{avg}) was used for the visualization. It is formally possible for values A_j of calculated performance based on the radar chart to take on negative values, but determining performance in this manner in our case merely allows us to compare the selected units. It is not possible to state whether a negative value indicates a decrease in performance in time and vice versa. The figures themselves are a part of the following chapter on Results and Discussions. It should also be stated that the charts in Fig. 1 encompass six indicators whose rising values should have a positive effect on the performance of the healthcare system or, in other words, the higher the performance of the healthcare system, the larger the area of the "spider web". On the contrary, Fig. 2 shows four indicators whose rising values should decrease the performance of the healthcare system. In other words, a smaller area of the web can be expected among healthcare systems of higher performance.

The second model for comparing the performance of the healthcare system is the model of a calculated score based on order. In other words, this is a situation in which data was normalized using order in terms of individual countries (j).

$$I_{ij} = order(x_{ij}^{avg}) \qquad (2)$$

where x_{ij}^{avg} is the original value of the indicator i of the compared unit j expressed as the mean over the selected period of time. This means that, for the next analysis, it is possible to use only ordinal information on the order of the given unit. Thus, no conclusions can be drawn on the relative difference between units. On the other hand, the method is easy to comprehend, it is not influenced by remote observation, and it unifies the variance and range for all indicators. The mean from the order uses a rating from The Medicare Study on Healthcare Performance across the United States (Jencks et al., 2003).

In Pillar I, indicators with the highest values reached the best placing. Contrary to this, in Pillar II the index values were placed in descending order, i.e. countries with the lowest indicator value reached the best placing. Furthermore, the mean order of the list was also calculated:

$$S_j^{avg} = \frac{\sum_{i=1}^{n} I_{ij}}{n} \qquad (3)$$

For the third model of comparing performance of healthcare systems, score calculation based on distance from the reference unit was selected. The distance from the reference unit was used to normalize data, and the best unit was used as a reference unit in Pillar I and the worst unit as a reference unit in Pillar II. A reference value was selected in each indicator and an indicator value was expressed as the ratio of the reference value (which is 100%).

$$I_{ij}^{P} = \frac{x_{ij}^{avg}}{x_{ij=\bar{j}}^{avg}} \qquad (4)$$

where x_{ij}^{avg} is the original mean value of the indicator and the compared unit j and $x_{ij=\bar{j}}^{avg}$ is the value of reference unit $\bar{j}$ for indicator i. It is clear that if the maximum value is chosen as the reference unit, then the values of the normalized indicators are lesser or equal to one – this applies to Pillar I. If the worst unit is chosen as the reference value, the normalized data is always greater or equal to one – this applies to Pillar II. This method preserves the relative differences between units.

In order to establish our own composite indicator, a so-called "linear composite indicator" related to expenditures on healthcare was used – for more see OECD (2002). The mathematical expression of this selected indicator is shown in the following equation:

$$E_j^{avg} = \frac{\alpha \sum_{i=1}^{n} I_{ij}^{I} + (1-\alpha) \sum_{i=1}^{m} I_{ij}^{II}}{logEXP_j^{avg}} \qquad (5)$$

E_j^{avg} expresses the performance of the healthcare system for the compared unit j. Furthermore, $logEXP_j^{avg}$ represents the mean value of expenditures on healthcare for the compared unit j. In addition, α represents the weight of the pillar in the composite indicator of performance E_j^{avg}. There are many ways to determine weights for individual separate indicators creating an aggregated indicator. In our case, symmetric weights were created, i.e. α takes on the value of 0.5. In the event that we only have a small set of data, Raju et al. (1999) chooses to use the same weights. Hopkins (1991) also claims that if it is impossible to gain common agreement for determining weights, the simplest solution is the best solution, i.e. also setting the same weights.

4. Results and Discussion

For all three suggested methods for determining the composite indicator, their values (A_j, S_j^{avg}; E_j^{avg}) were calculated with results presented in Tab. 4. These show that the Czech Republic reaches the best results in all cases in comparison with other member states of the Visegrad Four. According to results of composite indicators, the second highest-performing healthcare system is the Slovak Republic, while the worst is Hungary.

If we compare countries based on the values of individual Pillars I and II, we reach almost exactly the same conclusions as in the case of comparing values based on composite indicators. Fig. 1 shows that the Czech Republic takes up the largest area in Pillar I, with Slovakia in second place, Poland in third, and Hungary in last. If we compare areas reached in Pillar II, we

Tab. 4: Summary of results of composite indicators

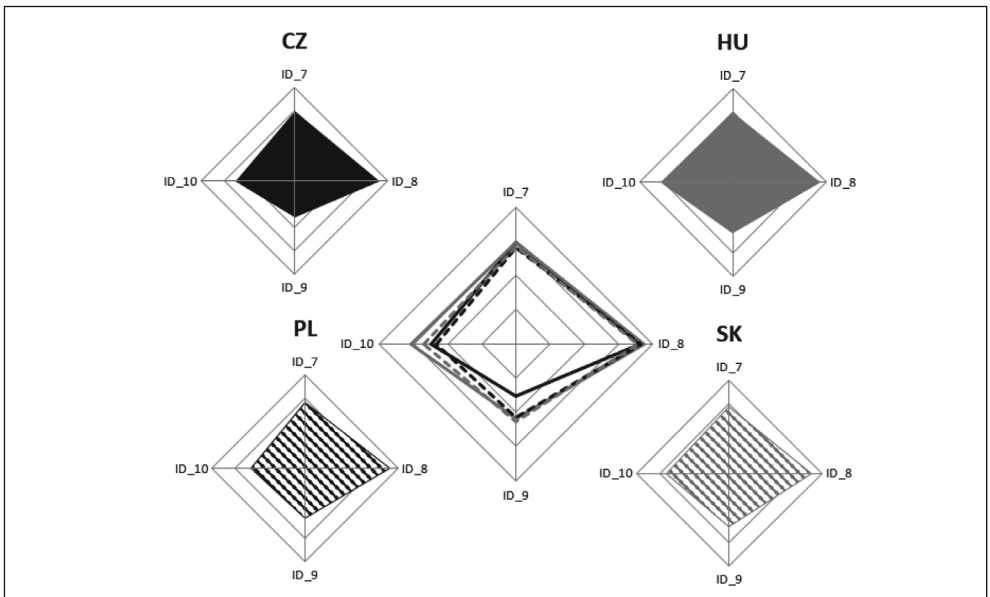|	CZ	HU	PL	SK
P_I	13.59	10.79	10.67	13.04
P_{II}	9.02	12.10	9.91	10.84
A_j	**4.57**	**-1.30**	**0.75**	**2.20**
S_j^{avg}	**1.90**	**3.20**	**2.70**	**2.20**
I_{ij}^{I}	5.82	4.54	4.63	5.62
I_{ij}^{II}	6.02	4.12	5.54	4.83
E_j^{avg}	**3.09**	**2.15**	**2.78**	**2.62**

Source: own calculation

Fig. 1: **Visualization of Pillar I**
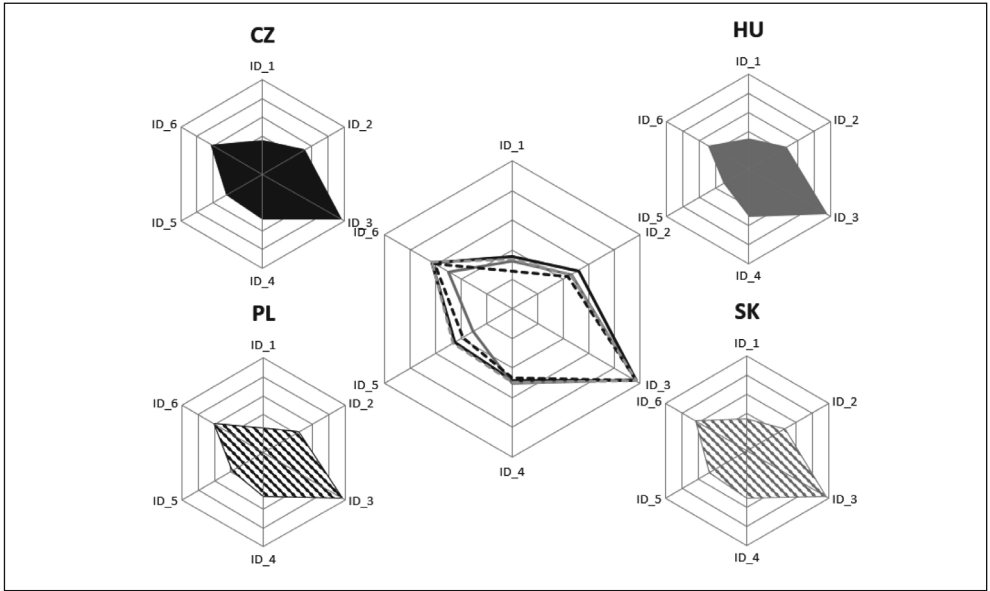
Source: own

Fig. 2: **Visualization of Pillar II**

Source: own

see that Hungary is again in the worst position, as it takes up the largest area of the web, with Slovakia and Poland behind it. As was stated above, the Czech Republic again holds the best position in this comparison. In Pillar II, Slovakia and Poland have switched places (see Tab. 4).

If we look at individual separate indicators, the Czech Republic ended up with the highest reference distance form indicator ID_9, meaning the Czech Republic has the lowest infant mortality. Worst off in this category was Slovakia, whose absolute mean value was 5.92, almost twice as high as the value measured for the Czech Republic. Hungary had the longest distance from reference indicators ID_5 and ID_6, while it had the shortest distance from indicator ID_4 – in other words, although Hungary had the highest expenditures in terms of its GDP, the performance of its system was the lowest according to its composite indicator in comparison with the other three selected countries. In regard to Poland, the best results (i.e. the highest distances from the reference value) were reached for indicators ID_7 and ID_10. Poland thus has the lowest consumption of alcohol per capita among individuals older than 15 years of age, the Czech Republic placed worst with this indicator.

Conclusions

The topic dealt with in this paper is one that is currently and frequently discussed on an international level. This is due to globalization tendencies and economic problems in healthcare systems. Discussions on the topic are now taking place in terms of public policies and scientific studies in the academic sphere.

Health care systems in member states of the Visegrad Group have gone through a long stage of development in which various positive aspects can be found. However, the economic development of these states in terms of overall condition of health and determinants of health and illness does not look overly optimistic for countries of Central and Eastern Europe and shows significant differences between countries individually.

As Beaglehole and Bonita (1997) claim, countries of Central and Eastern Europe are in strong need of critical reflection in their healthcare systems, but the opportunities for such reflection have so far only developed slowly. On the other hand, individual V4 states are striving to use many methods of reform to improve results in their individual healthcare systems. The goal of this paper was to compare and evaluate the performance of healthcare systems in V4 countries via our own composite indicator. Three methods were designed to calculate the performance of health care systems in individual member states of the Visegrad Group. Data from OECD Health Policy Studies from a period spanning from 2005 to 2014 was used to create the composite indicators. Composite indicators were created from ten selected indicators that reflect the performance of healthcare systems; these indicators were divided into two Pillars (Pillar I and II) according to how positively or negatively they contributed to increasing the quality of the healthcare system.

Results show that the Czech Republic reached the best results in the performance of its healthcare system in comparison with other member states of the Visegrad Four. According to the results, the second highest performing healthcare system is Slovakia, while Hungary came out as worst.

All V4 countries must recognize that without the ability to measure the inputs and outputs of their healthcare systems, it is impossible to know whether their reforms have achieved their objectives.

We are aware that there are several approaches to measuring and evaluating the performance of healthcare systems, and have chosen our own for this paper. This topic also provides the space for other research studies about healthcare systems. For a more thorough analysis, it is possible to increase the number of evaluated indicators, increase the number of analyzed countries, use a longer time sequence, and compare the data set across more countries and in time.

References

Barták, M. (2010). Výzkum public health – 1. část: využití v praxi zdravotní politiky. *Zdravotnictví v České republice, 13*(3), 92-94.

Barták, M. (2012). *Mezinárodní srovnávání zdravotnických systémů.* Praha: Wolters Kluwer Česká republika.

Beaglehole, R., & Bonita, R. (1997). *Public Health at the Crossroads.* Cambridge: Cambridge University Press.

Booysen, F. (2002). An overview and evaluation of composite indices of development. *Social Indicators Research, 59*(2), 115-151. doi:10.1023/A:1016275505152.

Costa-Font, J., & Greer, S. (Eds.). (2016). *Federalism and decentralization in European health and social care.* Springer.

Dlouhý, M. (2009). Efficiency and productivity analysis in health services. *Prague Economic Paper, 18*(2), 176-184. doi:10.18267/j.pep.348.

Dlouhý, M. (2016a). Analysis and Evaluation of Health System Performance: Visegrad Group Countries. *Public Health Forum, 2*(2), 66-69.

Dlouhý, M. (2016b). Performance of the Czech Health System: An International Comparison with Health Systems of Four Neighboring Countries. In *Proceedings of the 21th International Conference „Theoretical and Practical Aspects of Public Finance 2016"* (pp. 212-218). Praha: Vysoká škola ekonomická v Praze, Katedra veřejných financí.

Donabenian, A. (1982). *Exploration in Quality Assesment and Monitoring. Vol II. The Criteria and Standards of Quality.* University of Michigan: Health Administration Press.

European Observatory on Health Systems and Policies. (2011). Hungary: Health System Review 2011. *Health Care Systems in Transition, 13*(5).

Gulliksen, H. (1950). *Theory of mental tests.* Hoboken, John Wiley & Sons Inc.

Hadad, S., Hadad, Y., & Simon-Tuval, T. (2013). Determinants of healthcare system's efficiency in OECD countries. *European Journal of Health Economics*, *14*(2), 253-265. doi:10.1007/s10198-011-0366-3.

Háva, P., & Mašková-Hanušová, P. (2009a). Zdravotní politika visegrádských zemí (1). *Zdravotnictví v ČR, 12*(1), 12-20.

Háva, P., & Mašková-Hanušová, P. (2009b). Zdravotní politika visegrádských zemí (II). *Zdravotnictví v ČR, 12*(2), 70-79.

Hejduková, P., & Kureková, L. (2016a). Performance of health systems – the evaluation of selected indicators at the level states of the Visegrad Group In *Proceedings of the 21th International Conference „Theoretical and Practical Aspects of Public Finance 2016"* (pp. 212-218). Praha: Vysoká škola ekonomická v Praze, Katedra veřejných financí.

Hejduková, P. (2015). Globalization and Health Markets. In *Globalization and its socio-economic consequences* (pp. 199-206). Žilina: Žilinská univerzita v Žilině, Katedra ekonomiky.

Hejduková, P., & Kureková, L. (2016b). National health systems' performance: evaluation WHO indicators. *Proceedia – Social and Behavioral Sciences*, *230,* 240-248. doi:10.1016/j.sbspro.2016.09.031.

Hood, C. (1991). A public management for all seasons? *Public administration, 69*(1), 3-19. doi:10.1111/j.1467-9299.1991.tb00779.x.

Hopkins, M. (1991). Human development revisited: A new UNDP report. *World Development*, *19*(10), 1469-1473. doi:10.1016/0305-750X(91)90089-Z.

Jencks, S. F., Huff, E. D., & Cuerdon, T. (2003). Change in the quality of care delivered to Medicare beneficiaries, 1998-1999 to 2000-2001. *JAMA: The journal of the American Medical Association, 289*(3), 305-312. doi:10.1001/jama.289.3.305.

Kacíř, P. (2010). Proč potřebujeme ve zdravotnictví měřit kvalitu? *Pharm Business Magazine, Management, 2010*(4), 14-15.

Kelley, E., & Hurst, J. (2006a). *Health Care Quality Indicators Project: Conceptual Framework Paper* [OECD Health Working Papers, No. 23].

Kelley, E., & Hurst, J. (2006b). *Health Working Paper. Health Care Quality Project Initial Indicators Report* [OECD Health Working Papers, No. 22].

Krechovská, M. (2014). Business Performance Management Considering Intellectual Capital. In *Proceedings of the 6th European Conference on Intellectual Capital* (pp. 100-105). Reading: Academic Conferences and Publishing International Limited.

Kuszewski, K., & Gericke, C. (2005). *Health Systems in Transition: Poland.* Copenhagen, WHO Regional Office for Europe on Behalf of the European Observatory on health Systems and Policies.

Lawson, C., Nemec, J., & Šagát, V. (2012). Health Care Reforms in the Slovak and Czech Republics 1989-2011: The same or different tracks? *E&M Ekonomie a Management*, *15*(4), 19-33.

Martin, E. (2016). Financing Healthy Living in the Czech Republic. In *Perspectives on*

Business and Economics, 34 - Post-Communist Reform in the Czech Republic: Progress and Problems (pp. 57-67).

OECD. (2002). *Developing Composite Indicators for Assessing Health System Efficiency. Measuring Up: Improving Health System Performance in OECD Countries.* Paris: OECD.

OECD. (2004). *Health Project. Towards High – Peforming Health Systems*. Paris: OECD.

OECD. (2008a). *Growing Unequal? Income distribution and poverty in OECD countries.* Paris: OECD.

OECD. (2008b). *Economic Review – The Czech Republic.* Paris: OECD.

OECD. (2008c). *Reforms for Stability and Sustainable Growth. An OECD perspective on Hungary*. Paris: OECD.

OECD. (2015). *Health at a Glance 2015: OECD Indicators*. Paris: OECD Publishing. doi:10.1787/health_glance-2015-en.

OECD. (2016a). *OECD Health Statistics.* Retrieved August 5, 2016, from http://stats. oecd.org/#.

OECD. (2016b). *Health at a Glance: Europe 2016: State of Health in the EU Cycle*. Paris: OECD Publishing. doi:10.1787/9789264265592-en.

Pavolini, E., & Guillén, A. (Eds.). (2013). *Health Care Systems in Europe Under Austerity: Institutional Reforms and Performance.* Springer. doi:10.1057/9780230369627.

Piotrowicz, W. (2015). Information technology and systems in the Visegrád group of countries (Czech Republic, Hungary, Poland, and Slovakia): a literature review. *Journal of Global Information Technology Management, 18*(2), 77-93. doi:10.1080/1097198X.2015.1052684.

Plsek, P. E., & Greenhalgh, T. (2001). The challenge of complexity in health care. *BMJ: British Medical Journal, 323*(7313), 625-628. doi:10.1136/bmj.323.7313.625.

Preker, A. S., & Harding, A. (2004). The economics of hospital reform from hierarchical to market-based incentives. World hospitals and health services. *The Official Journal of the International Hospital Federation, 41*(2), 25-29.

Preker, A. S., Harding, A., & Travis, P. (2000). Make or buy decisions in the production of health care goods and services: new insights from institutional economics and organizational theory. *Bulletin of the World Health Organization, 78*(6), 779-790.

Preker, A. S., & Harding, A. (2007). *Innovations in health service delivery. The corporatization of public hospitals.* Washington, DC: The World Bank.

Raju, N. S., Bilgic, R., Edwards, J. E., & Fleer, P. F. (1999). Accuracy of population validity and cross-validity estimation: An empirical comparison of formula-based, traditional empirical, and equal weights procedures. *Applied Psychological Measurement, 23*(2), 99-115. doi:10.1177/01466219922031220.

Roberts, M., Hsiao, W., Berman, P., & Reich, M. (2003). *Getting health reform right: a guide to improving performance and equity.* Oxford: Oxford university Press.

Roemer, M. I. (2002). *National Health Systems. Encyclopedia of Public Health.* Retrieved May 5, 2016, from http://www. encyclopedia.com/doc/1G2-3404000573.html.

Sassi, F., Archard, L., & McDaid, D. (2002). Searching literature databases for health care economic evaluations: how systematic can we afford to be? *Medical care, 40*(5), 387-394.

Smith, P. C., Mossialos, E., & Papanicolas, I. (2008). *Performance measurement for health system improvement: experiences, challenges and prospects. Background document WHO European Ministerial Conference on Health Systems: Health Systems*. Tallin: Health and Wealth.

Son, H. (2016). Trust, economic growth and importance of the institution. *International Journal of Economic Sciences, 5*(4), 32-50. doi:10.20472/ES.2016.5.4.003.

Stroukal, D. (2016). A longitual analysis of the effect of unemployment on health. *International Journal of Economoc Sciences, 5*(2), 55-68. doi:10.20472/ES.2016.5.2.004.

University of Ljubljana. Medicinska fakulta. (2015). *Measuring the Burden of Disease*. Retrieved November 23, 2015, from http:// www.mf.uni-lj.si/dokumenti/6b695fc9385e3 e2ab8fb41ec7d34660d.pdf.

Van Dooren, W., Bouckaert, G., & Halligan, J. (2010). *Performance management in the Public Sector.* New York: Routledge.

Verhoeven, M., Gunnarsson, V., & Lugaresi, S. (2007). *The Health Sector in the Slovak Republic: Efficiency and Reform* [IMF Working Paper WP/07/226].

Watson, P. (2006). Unequalizing Citiezenship: The Politics of Poland's Health Care Change. *Sociology, 2006*(40), 1079-1096.

WHO. (2000). *World health report 2000 – Health systems: improving performance.* Retrieved November 23, 2015, from http://www.who.int/whr/2000/en/whr00_en.pdf?ua=1.

WHO. (2006). Engaging for health. Eleventh General Programme of Work 2006-2015. Retrieved October 10, 2016, from http://whqlibdoc.who.int/publications/2006/GPW_eng.pdf.

World Bank. (2007). *Healthy Development. The World Bank Strategy for Health. Nutrition & Population Results*. Washington DC: World Bank.

Wóycicka, I., & Grabowski, M. (2007). Poland, redefining social policies. In Kvist, J., & Saari, J. (Eds.), *The Europeization of Social Protection* (pp. 99-116). Bristol: The Policy Press.

Zdravotnický deník. (2016, July 28). Slovensko podle analýzy zaostává ve zdravotnictví. *Zdravotnický deník.* Retrieved November 11, 2016, from http://www.zdravotnickydenik.cz/2016/07/slovensko-podle-analyzy-zaostava-ve-zdravotnictvi/.

Ing. Pavlína Hejduková, Ph.D.
University of West Bohemia
Faculty of Economics
Department of Finance and Accounting
pahejdu@kfu.zcu.cz

Ing. Lucie Kureková
University of Economics in Prague
Faculty of Economics
Department of Economics
xkurl06@vse.cz

Abstract

HEALTHCARE SYSTEMS AND PERFORMANCE EVALUATION: COMPARISON OF PERFORMANCE INDICATORS IN V4 COUNTRIES USING MODELS OF COMPOSITE INDICATORS

Pavlína Hejduková, Lucie Kureková

Healthcare systems play a very important role in society and their role is becoming increasingly important in regard to the phenomenon of population ageing. The issue of the performance of healthcare systems should be at the forefront in terms of the interest of academic research studies and discussions among the scientific community. The proper functioning of the healthcare system should also be a priority in regard to public policy. These facts should encourage governments to regularly evaluate the performance of their healthcare systems and create international comparisons. Many indicators are used to measure and evaluate performance of healthcare systems – e.g. those created by the WHO, Eurostat, or OECD Health Statistics and OECD Health Policy Studies. For our paper, data from the OECD Health Policy Studies was used as a primary source. V4 states were chosen for the evaluation of the performance of healthcare systems. The reasons for this are as follows: V4 countries are transitive economies of the CEE with a poorer state of health of their populations than in more developed countries of the OECD or EU; the given systems have long been underfinanced; and reforms are focused exclusively on economic goals and lack a broader concept in terms of long-term sustainability. For the purposes of this paper, a composite indicator of the performance of healthcare systems was designed and includes ten variables for the studied ten-year period. In order to establish a comparison of the performance of healthcare systems, three methods were used to model them: (i) using the area of a radar chart, (ii) determining performance based on order, and (iii) determining performance based on distance from the reference unit. These three methods for determining the performance of healthcare systems allow us to compare the performance of healthcare systems in V4 countries specifically. The goals of this paper are as follows: compare and evaluate the performance of healthcare systems among V4 countries using selected indicators from the field of healthcare and establish what position the Czech Republic's healthcare system holds in comparison with other V4 countries.