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## National health systems' performance: evaluation WHO indicators

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### Abstract

For the evaluation of performance at the national level are used the different indicators in comparison with business level. The paper is focused on evaluation of indicators of national health systems' performance at the level WHO "better health". The aim of paper is to define the specifics of selected health systems in European Union, analyze and evaluate the selected indicators of performance of these systems which are used by WHO, compare the results of the analysis in these health systems and determine the position of the Czech health system in the set of indicators "better health" in comparison with other countries. The indicators are evaluated in the time series.

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### 1. Introduction

Today, healthcare systems in all over the world play a prominent role in people's life than ever before. The main goal of health systems is to improve the health of the individuals. The current health systems have many highly skilled people and better technologies what give the health system the power and the potential to achieve further extraordinary improvements. On the other hand, the new possibilities in health care sector are not only positive. The many health systems cannot use all of their potential. The health system we can often name as poorly structured, badly led, inefficiently organized and inadequately funded. So it is necessary to manage these systems and evaluate their performance.

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The ultimate responsibility for the overall performance of a country's health system lies with government. By reason of this is the fact that health care has many impacts on economics and it is the very important determinant of economic growth. Providing the people's health has a national priority and government have permanent responsibility against them. Therefore, Health Ministry has a big part in the health system stewardship. Healthcare policies and strategies need to cover the private provision of services and private financing as well as state funding and activities.

There is continuous probe to improve our understanding of conditions that make the public health services effective. We know that public health plays an important role in social sciences and social praxes. How mentioned (Szreter & Woolcock, 2004) there are many discussions about relationship between social capital and public health.

Better health is unquestionably the primary goal of a healthcare system. It can be costly; therefore, the need for having unpredictable mechanisms for sharing risk and providing financial protection seems necessary. The second aim of providing such systems is fairness in financial contribution to the health system. responsiveness to people's expectations with regard to non-health matters – reflects the importance of respecting people's dignity, autonomy and the confidentiality of information (World Health Organization, 2000).

## **2. Methodology, research questions and data**

The aim of this paper is to define the specifics of selected health systems in European Union, analyze and evaluate the selected indicators of performance of these systems which are used by World Health Organization, compare the results of the analysis in these health systems and determine the position of the Czech health system in the set of indicators "better health" in comparison with other countries.

The paper answers mainly these questions: What is position of the Czech health system at the level WHO "better health" in comparison of other European health system? What results bring the selected indicators and how we can interpret these indicators? The answers to these questions are based on literature review, from results calculation of performance indicators and statistics methods, one of used method is Granger Causality Test. The data for this paper are used from WHO data, the OECD Health Data, Eurostat database of the health care expenditure and scientific papers. The indicators are evaluated in the time series. The selected countries were chosen by reason of their similar principles of health systems which are characteristic by the same main source of funding – health insurance. The paper is compared indicators of 10 countries.

## **3. Health systems**

Many research studies mentioned that the health is the important factor of the economic growth; see for example Lucas (1988), Sala-i-M. (1996). This fact is widely recognized public policy of all developed countries and by reason of this fact we have to solve problem of health on the level of national economies and after than we can speak about the term "health system". A good healthcare system provides qualified services to all people when and where they require them. The exact shape of services differs in various countries, but all cases needs a huge financing mechanism, well-trained workforce, and reliable information.

A healthcare system consists of different parts. In addition to patients, families, and communities, Ministries of Health, health providers, health services organizations, pharmaceutical companies, health financing bodies, and other organizations play prominent roles. The interconnections of the health system can be viewed as the functions including oversight, health service provision, financing, and managing resources. Describing the parts, interconnections, and purpose, Roemer (2002) defined a health system as "the combination of resources, organization, financing and management that culminate in the delivery of health services to the population." The World Health Organization (2000) redefined the main purpose in its definition of a health system as "all activities whose primary purpose is to promote, restore, and maintain health." In recent years, the definition of "purpose" has been further extended to include the prevention of household poverty due to illness (World Bank, 2007). How mentioned Plsek and Greenhalgh (2001) the health system is complex adaptive system which has important implications for approaches to influencing health systems to produce better health outcomes, or to do so in a more efficient or equitable manner.

From the perspective of the long-term sustainability and development the health system has to have a certain concept. According to Kelley and Hurst (2006) the conceptual framework of current health system has to include the following indicators: efficiency, security, ability to respond, availability, equity and effectiveness.

As mentioned Physicians for a National Health Program (2010) there are four basic models of the health system from the perspective of type of finance and manage of health care: Beveridge model (the health care is provided and financed by the government through tax payments), Bismarck model (this model is based on social insurance), National Health Insurance (model has elements of both Beveridge and Bismarck models) and Out-of-Pocket model (this model could be called “market driven” health care; the most expensive activities are paid by consumer of health care).

There are many differences in the allocation of resources from the perspective of public and private payments in European countries. It is necessary to point out the fact that nowadays costs of health care funding are influenced by demographic change, pressure for higher quality care and increased costs by reason of emergence of new diseases (Hejdukova, 2015). So many health care systems in Europe can be identified as the mix health care models with some dominant source of funding.

#### 4. Selected countries and indicators for performance evaluation of their health system

##### 4.1. Selected countries

Across all OECD countries, health care is financed by a mix of public and private spending. In some countries, public health spending is mostly confined to spending by the government using general revenues. In other cases, social insurance funds finance the bulk of health expenditure. Private financing of health care consists mainly of payments by households (either as standalone payments or as part of co-payment arrangements) as well as various forms of private health insurance (OECD, 2015).

How mentioned (Xu et al., 2011) the OECD study recognized that health expenses per capita income was higher in countries which have a social health insurance mechanism. There are a few empirical studies about financing structures which determine the healthcare expenses was financed by the government has a relationship with levels of healthcare system’s expenses (Culyer, 1988; Hitiris & Posnett, 1992; Leu, 1986; van der Gaag & Stimac, 2008). There are differences between tax-based and social-insurance based systems which were used in OECD countries and eastern European and central Asian countries (Wagstaff, 2009; Wagstaff & Moreno-Serra, 2009).

We have chosen for our analysis these 10 countries: Belgium, Czech Republic, Estonia, France, Luxembourg, Germany, Nederland, Poland, Slovakia and Slovenia. The reason of this selection is the fact that these countries have the same main source of the health care funding. The public insurance is contributed in the total health expenditure between 60 – 80 % in these countries – see Table 1 (OECD, 2015).

Table 1. The share of the social insurance in the total health expenditure in selected countries in 2015.

Country	The share of social insurance of health expenditure
Belgium	66%
Czech Republic	78%
Estonia	67%
France	75%
Luxembourg	74%
Germany	70%
Nederland	80%
Poland	61%
Slovakia	68%
Slovenia	68%

Although these selected countries show the same main source of health care funding, we can see the differences in health expenditure in relation to GDP – see Table 2 (Eurostat, 2016).

Table 2. The health care expenditure as the share of GDP in selected countries in 2005 – 2010 (in %).

Country	2005	2006	2007	2008	2009	2010
Belgium	9,65	9,58	9,62	9,94	10,65	10,56
Czech Republic	6,69	6,49	6,31	6,65	7,63	7,24
Estonia	4,99	4,97	5,08	5,81	6,65	6,27
France	10,50	10,41	10,35	10,48	11,17	11,13
Luxembourg	10,40	10,26	10,12	10,33	11,33	11,15
Germany	7,13	6,69	6,18	6,67	7,63	7,19
Nederland	10,09	9,97	9,96	10,20	11,01	11,20
Poland	5,85	5,85	5,93	6,43	6,72	6,55
Slovakia	6,75	7,02	7,38	7,63	8,61	8,48
Slovenia	7,96	7,79	7,49	7,88	8,59	8,58

#### 4.2. Definition of concrete selected indicators

For the definition and evaluation of performance were chosen the following indicators including life expectancy at birth, potential years of life lost, disability-adjusted life expectancy, and healthcare expenditure or expenses.

### 5. Analysis and results

Four indicators and their evaluation over time were chosen for the further analysis. The selected indicators are: (i) Life expectancy at birth ("LE"), (ii) Potential years of life lost ("PYLL"), (iii) Disability-adjusted life expectancy ("DALE") and (iv) Health care expenditure („EXP“). These indicators were used to compare and to describe their developments over time and within selected Europe countries. Then it is examined the statistical hypothesis test for determining whether health care expenditure is useful in forecasting two indicators: „LE“ and „PYLL“. The Granger causality test is used for this examination. The period from 2000 to 2013 was selected as a reference period for further analysis, but unfortunately not all data were complete, that is why we had to reduce examined period for Granger causality test. So the period for testing Granger causality contains years from 2005 to 2010. As a data source were used European Health for All Database (HFA-DB), OECD Health statistics (Health status) and Eurostat database (hlth\_sha\_hp).

#### 5.1. Comparison of indicators over time and within countries

The simple indexes of time series dynamics were calculated for examination and evolution. Two indexes were used for description of the development of indicators over time: (i) relative change and (ii) the geometric mean. Furthermore it was graphically demonstrated the absolute trend of individual indicators (see Fig. 1 and Fig. 2).

	Life expectancy at birth (years)			Potential years of life lost		
	Relative change 2010/2000	Growth 2000 - 2010	Trend 2000 - 2013'	Relative change 2010/2000	Growth 2000 - 2010	Trend 2000 - 2013'
<b>Belgium</b>	3.01% ↓	0.28%		-21.37% ↓	2.09%	
<b>Czech Republic</b>	3.46% ↓	0.34%		-23.47% ↓	2.56%	
<b>Estonia</b>	7.16% ↑	0.68%		-41.27% ↑	5.05%	
<b>France</b>	3.31% ↓	0.33%		-20.18% ↓	2.20%	
<b>Germany</b>	2.83% ↓	0.29%		-22.32% ↓	2.48%	
<b>Luxembourg</b>	3.06% ↓	0.29%		-28.52% ↓	2.67%	
<b>Netherlands</b>	3.65% ↓	0.35%		-26.46% ↓	2.88%	
<b>Poland</b>	3.68% →	0.41%		-20.43% ↓	2.64%	
<b>Slovakia</b>	3.01% ↓	0.30%		-21.07% ↓	2.42%	
<b>Slovenia</b>	4.84% →	0.49%		-33.08% →	3.94%	
<i>Source</i>	HFA-DB			Health status		
<i>* Note:</i>	data for BE available only till 2012 data for EE and FR available only till 2011. data for SK and SL available only till 2010.			data for BE available only till 2012 data for FR available only till 2011. data for SK and SL available only till 2010.		
<b>Legend</b>	<0-33)	↓	<33-67)	→	<67-100>	↑

Fig. 1. Development of selected indicators in time.

	Disability-adjusted life expectancy		Health care expenditure		
	Relative change 2013/2000	Growth 2000 - 2010	Relative change 2010/2005	Growth 2005 - 2010	Trend 2003 - 2012'
<b>Belgium</b>	2.92%	NA	23.66% ↓	4.18%	
<b>Czech Republic</b>	3.93%	NA	51.30% →	9.52%	
<b>Estonia</b>	8.06%	NA	21.34% ↓	3.73%	
<b>France</b>	3.31%	NA	64.46% →	10.96%	
<b>Germany</b>	3.19%	NA	16.01% ↓	3.07%	
<b>Luxembourg</b>	4.22%	NA	20.28% ↓	3.75%	
<b>Netherlands</b>	3.48%	NA	24.78% ↓	6.31%	
<b>Poland</b>	3.72%	NA	62.46% →	11.50%	
<b>Slovakia</b>	4.22%	NA	114.56% ↑	16.50%	
<b>Slovenia</b>	5.15%	NA	29.94% ↓	5.39%	
<i>Source</i>	HFA-DB		Eurostat		
<i>* Note:</i>	data available only for years 2000, 2012 and 2013		data for SI available only till 2011. data for SK available only from 2005 till 2011.		
<b>Legend</b>	<0-33) ↓		<33-67) →		
	<67-100> ↑				

Fig. 2. Development of selected indicators in time.

Relative change expresses the absolute change as a percentage of the value of the indicator in the earlier period. Relative change also refers to the change in the indicator in percentage terms, i.e. absolute change as a percentage of the value of the indicator in period one. The geometric mean is a measure of mean that indicates the typical value of a set of numbers. The geometric mean is referred to as compounded annual growth rate or time-weighted rate of return and it is the average rate of return of a set of values calculated using the products of the terms (see more Arlt & Arltova, 2009).

We expected that indexes of first LE were positive; it is mean that life expectancy grew over time. The highest increased was in Estonia and it raised by almost 7.16 % between 2000 and 2010. The supreme LE was in France and reached the amount of 81.98 years, in Estonia it was 76.03 years. In the Czech Republic LE was 77.81 years and compared to selected countries only Poland and Slovakia were lower LE. If we look at the average growth over time and, of course, the highest average growth was in Estonia and then Slovakia, the smallest average growth was in Belgium. It can be seen that the countries with already quite high LE, then the LE were growing more slowly over time.

For PYLL indicator, we should expect negative values for calculated indexes, our expectations are demonstrated in Table 3 (note Growth 2000 - 2010 is expressed in absolute terms). Again, we can see that the biggest relative change was in Estonia. In 2010 the absolute value of the PYLL was lowest in the Netherlands: 2737.6 and the highest was one in Estonia: 5,623.7. The Czech Republic was doing better than Slovakia in terms of comparison of absolute value (CZE: 3942.2 and SK: 5113.9). The indicator DALE is measured in years as well as LE and again we expected that should grow over time. The most rapid growth was observed in Estonia and in Slovenia. The same relative change was in Slovakia and Luxembourg. The absolute value of DALE was in France, it is same for LE, and the lowest absolute value of DALE was again in Slovakia (66.7 years).

The last but not the least important indicator is health care expenditure per inhabitant and it is used for more complex depicting of the performance of health care system (see Granger causality test). The data of selected countries were available for period since 2003 and the latest published data for international comparisons were for the year 2012. The data for reference time period unfortunately are not complete for all analyzed countries. The absolute values of variable EXP in 2011 were highest in the countries of Benelux (LUX: 5 661 Euro per inhabitant, NED: 4 037 Euro per inhabitant, BEL 3 562 Euro per inhabitant). The lowest absolute value of EXP were surprisingly pursued in France 702 Euro per inhabitant, in the Czech Republic EXP amounted 1 091 Euro per inhabitant. Dynamics indexes were calculated for the years 2005-2010, this period was also used for testing Granger causality. The highest relative change of EXP were in the Slovakia namely by 115%, and quite high increase in expenditure was in France and Poland. The smallest increase was in Germany. Quite surprisingly EXP did not grow much in Estonia.

## 5.2. Granger causality test

As we mentioned above, for creating a balanced panel data set was chosen period from 2005 to 2010, this data set contains 60 observations. It was necessary to find out whether the time series is stationary. It was used the augmented Dickey–Fuller test (ADF test), unfortunately at 5% significance level was not possible to reject the null hypothesis. It means that time series variables are non-stationary; hence it was necessary to adjust the time series to be stationary. For stationarizing time series variables were used first differences and then logarithmic transformation. This transformed time series were finally stationary and two tests of Granger causality were applied. Granger causality test helped us to find out whether expenditures on health care EXP explain the development of selected indicators (PYLL and LE). Two null hypotheses were tested: H0: Percentage change of EXP did not cause percentage change of PYLL and H0: Percentage change of EXP did not cause percentage change of LE.

Table 3. Results of Granger causality tests.

Equation	Excluded	F	df	df_r	Prob > F
LE	Exp	2.3684	2	43	0.1057
PYLL	Exp	0.67184	2	43	0.516

According results in Table 3, it is clear that the at the 5% significance level we are not able to reject both null hypothesis. Thus we are able to claim according these data that the percentage change in EXP did not cause percentage change in the indicators LE and PYLL.

## 6. Conclusion

There are many variants of the health care systems in the world. Many differences we can found also in Europe. In some countries, public health spending is mostly confined to spending by the government using general revenues. In other cases, social insurance funds finance the bulk of health expenditure. Private financing of health care consists mainly of payments by households (either as standalone payments or as part of co-payment arrangements) as well as various forms of private health insurance (OECD, 2015).

There were chosen countries with health systems for which are typical the social health insurance. However these health systems represented by these indicators show quite huge differences in dynamic changes over time. From the

perspective of the share of social insurance in the total health expenditure, the Czech Republic has the second highest the share of social insurance in total health expenditure in comparison with other analyzed countries. The health care expenditure as a percentage of GDP were 7,24 % in 2010 in the Czech Republic it means that the Czech Republic can be classified like the country with quite small share of health expenditure of GDP. On the other hand, from the perspective of the health expenditure per habitant, the Czech Republic shows one of the greatest growth between 2005 – 2010.

The growth of indicator “Life expectancy at birth” was quite small in the Czech Republic in comparison with other analyzed countries. The same results we can see for indicator “Potential years of life lost” which is declined over time and this decrease was also the one of the smallest. The relative change of indicator “Disability-adjusted life expectancy” was 3.93 % in the Czech Republic and this value is similar for France, Luxembourg and Slovakia.

There was set the question in the paper, if health care expenditure can cause the changes in the indicators PYLL and LE. Granger causality test helped us to find out whether expenditures on health care EXP explain the development of selected indicators (PYLL and LE). According results, we are able to claim that the percentage change in expenditure did not cause percentage change in the indicators LE and PYLL.

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## References

- Arlt, J., & Arltová, M. (2009). *Ekonomické časové řady*. Praha, Professional Publishing.
- Culyer, A.J. (1988). *Health care expenditures in Canada: myth and reality, past and future*. Canadian Tax Foundation, Toronto, Ont.
- European Health for All Database (HFA-DB). (2016, March 29). *Metrics: Disability-Adjusted Life Year (DALY)*. Retrieved from [http://www.who.int/healthinfo/global\\_burden\\_disease/metrics\\_daly/en/](http://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/)
- Eurostat. (2016, May 4). *Health care expenditure*. Retrieved from [http://ec.europa.eu/eurostat/cache/metadata/en/hlth\\_sha\\_esms.htm](http://ec.europa.eu/eurostat/cache/metadata/en/hlth_sha_esms.htm)
- Hejduková, P. The Trends of Globalization in the Health Care Markets. In *Innovation Management and Sustainable Economic Competitive Advantage: From Regional Development to Global Growth*, I - VI, 2015. Norristown: Int Business Information Management Assoc-IBIMA, 2015, 3197-3208.
- Hitiris, T., & Posnett, J. (1992). The determinants and effects of health expenditure in developed countries. *Journal of health Economics*, 11(2), 173-181.
- Kelley, E., & Hurst, J. (2006). *Health Care Quality Indicators Project: Conceptual Framework Paper*. OECD Health Working Papers, 23.,DOI: <http://dx.doi.org/10.1787/440134737301>
- Leu, R. E. (1986). Public and private health services: complementarities and conflicts. In A.J. Culyer & B. Jönsson, eds. *Public and private health services: complementarities and conflicts*. Oxford: Blackwell.
- Lucas, R. E. (1988). On the mechanics of economic development. *Journal of monetary economics*, 22(1), 3-42.
- OECD. (2016, March 29). *Health status: Potential years of life lost (indicator)*. Retrieved from <https://data.oecd.org/healthstat/potential-years-of-life-lost.htm>
- OECD. (2015). *Health at a Glance 2015: OECD Indicators*, OECD Publishing, Paris. DOI: [http://dx.doi.org/10.1787/health\\_glance-2015-en](http://dx.doi.org/10.1787/health_glance-2015-en)
- Physicians for a National Health Program. (2010). *Health Care Systems - Four Basic Models*. Retrieved May 5, 2016 from Physicians for a National Health Program: [http://www.pnhp.org/single\\_payer\\_resources/health\\_care\\_systems\\_four\\_basic\\_models.php](http://www.pnhp.org/single_payer_resources/health_care_systems_four_basic_models.php)
- Plsek, P. E., & Greenhalgh, T. (2001). The challenge of complexity in health care. *BMJ: British Medical Journal*, 323 (7313), 625–628.
- Roemer, M. I. (2002). *National Health Systems*. *Encyclopedia of Public Health*. Retrieved May 05, 2016 from Encyclopedia.com: <http://www.encyclopedia.com/doc/1G2-3404000573.html>.
- Sala-i-M. (1996). Regional cohesion: evidence and theories of regional growth and convergence. *European Economic Review*, 40(6), 1325-1352.
- Szreter, S., & Wollcock, M. (2004). Health by Association? Social capital, social theory, and the political economy of public health. *International Epidemiological Association*, 33, 650-667. DOI:10.1093/ije/dyh013
- Van der Gaag, J., & Stimac, V. (2008). *Towards a new paradigm for health sector development*. Amsterdam: Amsterdam Institute for National development.
- Wagstaff, A., & Moreno-Serra, R. (2009). Europe and central Asia’s great post-communist social health insurance experiment. Aggregate impacts on health sector outcomes. *Journal of health Economics*, 28(2), 22-340.
- Wagstaff, A. (2009). Social Health Insurance Vs. Tax-financed Health Systems: Evidence from the OECD. *Policy Research Working Paper 482*. The World Bank: Washington DC.



- World Bank. (2007). *Healthy Development. The World Bank Strategy for Health, Nutrition, & Population Results*. Washington DC: World Bank.
- World Health Organization. (2000). Health Systems: Improving Performance. *The World Health Report 2000*. Paris: World Health Organization.
- World Health Organization. (2016). *Health topics. Health systems*. Retrieved from: [http://www.who.int/topics/health\\_systems/en/](http://www.who.int/topics/health_systems/en/).
- Xu, K., Saksenna, P., & Hollyb, A. (2011). *The determinants of health expenditures: a country-level panel data analysis*. Geneva: World Health Organization.