https://dergipark.org.tr/tr/pub/ijhmt Doi Number: 10.31201/ijhmt.1172805

Int Journal Of Health Manag. And Tourism 2022, 7(3),305-316

JHMT Editorial

International Journal Of Health Management And Tourism

CALCULATION OF HEALTH SYSTEM SUCCESS INDEX OF COUNTRIES ACCORDING TO MORTALITY, HEALTH EXPENDITURE AND HEALTHY LIFE EXPECTANCY

Canser BOZ*, Haluk ÖZSARI**

*Assistant Prof., Faculty of Health Sciences, Istanbul University-Cerrahpasa Istanbul, Turkey
canser.boz@iuc.edu.tr
ORCID Number: 0000-0002-6136-4479
** Prof .Dr., Faculty of Health Sciences, Istanbul University-Cerrahpasa Istanbul, Turkey
hozsari@iuc.edu.tr
ORCID Number: 0000-0003-4057-2524

Received:08.09.2022
Accepted: 21.10.2022
Research Article

Abstract

Aim: The aim of this study is to measure the health system success of G10 countries according to the dimensions of death, expenditure and healthy life expectancy by creating an index and comparing it multidimensional for both 2005, 2015 and 2020.

Methods: In the study, the "health system success index" consisting of three dimensions and four indicators was created. Dimensions were determined as quality of life, spending success-financial success- and death-mortality. While calculating the success index, indicators were used for each dimension and “quality of life index” for quality of life, “spending success index” for spending success and “living index” for death were

Corresponding author: Canser Boz, Istanbul University-Cerrahpasa Health Sciences Faculty, Health Management, Istanbul, Turkey e-mail: canser.boz@iuc.edu.tr

formed. A general health system success index was obtained by taking the geometric average of the three indices created with the help of dimensions

Results: According to the 2005 health system success index, Japan was the most successful country among the G10 countries, while the USA was found to be the country with the lowest success index.

Conclusion: The country with the highest success index in 2020 was again Japan, while the Netherlands ranked 2nd as the country that made the most progress in this process. Similar to 2005, the USA was found to be the country that was relatively unsuccessful in 2020.

Keywords: Health System, Catastrophic Spending, G10, Quality of Life, Mortality

INTRODUCTION

The level of health of people in any country has a major impact on productivity, active participation in working life and well-being. When people are healthy, they can be productive at work and contribute to the country's economy. From a macro perspective, societies with good health produce more and are more prosperous (Zweifel et al., 2009). Therefore, health, together with education, is an important investment area for human capital as well as an important factor that determines the level of development of countries (Goldsmith, 1972). Health as one of the human capital investments; it directly concerns human and social life, on the other hand, it directly and indirectly affects the economic performance as a whole through investment, employment and production, as well as its contribution to the quality of the labor factor (Bayraktutan and Pehlivanoğlu, 2012).

Various socio-demographic and socio-economic indicators are used in the international comparison of countries and health systems (Dastan & Çetinkaya, 2015). These indicators provide the opportunity to compare countries and health systems according to different perspectives. For the comparison of health systems, the OECD has drawn a framework. According to the OECD health systems report, the main objectives of health systems are grouped under three headings. These; Good health status, which can be expressed as raising the health status of the society, is the ability of the health system to respond to the expectations of the society, that is, responsiveness, providing financial protection against the costs arising from the state of being sick, and a structure that will enable the society to participate in the financing of the health system in a fair way, in other words, fair financing. These three objectives draw a framework for the main objectives of health systems. The success of the health system implemented by the countries is measured by their success in achieving these three basic goals (OECD, 2008).

The most frequently used health indicators such as "life expectancy at birth", "infant mortality rate" and "maternal mortality rate" play a decisive role for good health status, which is one of the main goals of the health system. These indicators reflect the characteristics of the economic and social status of mothers and newborns, social environment, personal lifestyles, and therefore the health systems of countries (Daştan & Çetinkaya, 2015). The increase in catastrophic health expenditures has a threatening feature for fair financing and financial protection, which are one of the three main goals of the health system. Every year, millions of people in the world face financial problems in order to benefit from health services due to their weak ability to pay (Xu et al., 2007). This situation causes expenditures that jeopardize the usual expenditures and living standards of households and have a significant impact on the success of the health system of the countries. The ability of the health system to respond to the expectations of the society, that is, responsiveness, has been emphasized by the OECD as another indicator of success. The health system's infrastructure, service quality, technology, access to services, supportive services, etc. It is important that the health system is established in a way that meets the expectations of the society, together with all its elements. These affect the health level of the society. Undoubtedly, health is a highly complex value influenced by many factors. It is almost impossible to measure the effect of each of the factors affecting health. These elements are intertwined in daily life and it is very difficult to separate them. However, one of the important factors affecting health is health services, that is, the health system, as Dahlgren and Whitehead stated. With the developed methods, it is possible to measure the performance of the health system and to make an efficiency analysis. In this context, in the study, an achievement index was tried to be developed to measure the health system success of the countries in a relatively comparative way, taking into account the health indicators that affect the success of the countries' health systems and catastrophic health expenditures, and the health system achievements of the G10 countries were ranked with the help of the developed index and the results were interpreted.

A composite index is a mathematical combination of individual indicators or measures that represent different aspects of a single, larger concept. (Saisana and Tarantola, 2002). The overall goal of most of these indices is to rank countries and their comparisons by some aggregated dimension. (Cherchye, 2001; OECD, 2003). Although there are hundreds of indicators that measure specific aspects of health, health care utilization and health system performance, there is a lack of high-quality composite indexes in key strategic areas. Composite indices can be used to

summarize these complex or multidimensional issues to support a channel of communication for decision makers and the public. Population or system-wide, composite indices can be useful for strategic planning and reporting. On the other hand, these indices can provide opportunities to identify areas of intervention and action (MCHP, 2009). All major international organizations such as the OECD, the EU, the World Economic Forum or the IMF produce composite indicators in a wide variety of fields (Nardo et al, 2005).

Although there are not many studies in the literature, there are some preliminary studies on the establishment of a health system success index. For example; In a study, a composite index including seven indices, namely prevention and screening, beneficial behaviors, surgical waiting times, drug-related quality, primary care quality, chronic disease burden, and general health measures, was created in order to learn the success in the field of health. (MCHP, 2009). In addition, a composite index has been developed by the World Health Organization that summarizes the performance of health systems in 191 countries by giving equal weight to two dimensions in terms of both the overall level of success and the distribution of this success. If this composite index is; general health, distribution of good health, general responsiveness, distribution of responsiveness, and fair distribution of financial contributions (WHO, 2000).

1. RESEARCH METHODOLOGY

In the study, the relative success of the countries with the help of the index was measured separately with the data of 2005, 2015 and 2020. The universe of the study is Group of Ten countries. Group of Ten (G-10) is a group of developed countries that came together under the General Arrangements to Borrow agreement to provide loans to each other and to third states in special cases in case the IMF is insufficient. Since the population was limited in the study, no sample selection was made, and all countries whose data were reached were included in the scope of the study. During the analysis phase, France was excluded due to lack of data and the study was completed on 9 countries.

While determining the success dimensions, the OECD health systems report was taken into account and indicators for each dimension were used while calculating the success index. “quality of life index” for quality of life, “spending success index” for spending success and “living index” for mortality were created. The reason for choosing these variables in the health system success index in the study is the OECD health systems report. According to this report, the success of a

country in the health system is evaluated according to financial indicators, health status (health output) indicators and responsiveness to expectations. Variables such as catastrophic health expenditure, maternal-infant mortality rate, and life expectancy can be used for these indicators. This justification was also accepted in our study. Also, the index is similar to the Human Development Index (HDI). However, the difference between the two is that the HDI index includes education and income variables along with life expectancy, while the index we used in the study includes only health indicators.

While calculating the index, first of all, the data for each indicator was recorded completely. Then, first of all, negative indicators (such as mortality) were turned into positive using appropriate methodology. In this way, all the variables in the index were in the same direction. After this step, weighting was done by giving equal weight to each variable group. Two indicators in the mortality index have a weight of 50%, each indicator in the general index has a weight of 33.3%. Undoubtedly, giving equal weight to each variable in the success of the health system may create some problems. For example, it is not perfectly appropriate to take the "Catastrophic financial expenditure for Surgical Procedures" and "mortality" indicators with the same weight. However, since there is no weighting calculation for the variables used in the literature, the index calculation was continued with equal weighting. This is one of the limitations of the study. A general health system success index was obtained by taking the geometric average of the three indices created with the help of dimensions. Relative to the high value in the index, it shows that better results are obtained in the indicators. The structure of the health system success index and where the research data were compiled are presented in the Table 1.

Table 1. Health System Success Index Structure and Data

Dimension	Life quality	Spending Success	Mortality	
Used Indicator	Expected Healthy Life Years at Birth	Risk of financial catastrophic expenditure for Surgical Procedures (Percentage of Community)	Maternal mortality rate per 1000 live births	Infant mortality rate per 1000 live births
Indicator Modified and Used in	-	Risk of not incurring catastrophic financial expenditure for Surgical Procedures	Maternal Survival Ratio	Infant Survival Rate

Analysis				
Source	https://data.worldbank.org/indicator/SP.DYN.LE00.IN	https://data.worldbank.org/indicator/SH.SGR.CRSK.ZS	https://data.worldbank.org/indicator/SH.MMR.DTHS	

The risk of catastrophic health expenditure for surgical procedures, mortality rates and quality of life indicators were taken from the World Bank database. It is defined as out-of-pocket payments for surgery and anesthesia care where the risk of catastrophic expenditure exceeds 10% of total income when surgical care is required. Infant mortality rate is the number of infants who die before reaching the age of one per 1000 live births in a given year. The maternal mortality rate is the number of women who die while pregnant or within 42 days of termination of pregnancy from pregnancy-related causes per 100,000 live births. Although these two variables are also expressed as thousand units in the literature, their original source, the World Bank, was taken.

The indicators and dimensions used in the index calculation are as in the table. In order for the indicators in the health system success index to be in the same direction, first of all, the negative data were converted to positive format. The risk of financial catastrophic expenditure for surgical procedures, which is an indicator of financial success, was subtracted from 100 and turned into a positive risk of not doing it. The infant survival rate "ISR" (Infant Survival Rate) instead of the infant mortality rate "IMR", and the maternal survival rate "M" (Maternal Survival Rate) instead of the maternal mortality rate "MMR" were calculated with the help of the formula below. (Afonso ve Aubyn, 2006);

$$ISR=\frac{1000-IMR}{IMR} \quad MSR=\frac{100.000-MMR}{MMR}$$

Thus, the increases in each indicator were transformed into positive developments. The minimum and maximum values within the series were determined to convert the indicators in each dimension to values between 0 and 1. After determining the minimum and maximum values, the quality of life, financial success and mortality indices for each indicator were calculated as follows. In the study, this was used to normalize the data and index.

$$index = \frac{X_i - X_{min}}{X_{max} - X_{min}}$$

Here, X_i is the observed value, X_{min} is the minimum value in the relevant indicator series, X_{max} is the maximum value in the relevant indicator number. For the mortality index, a single mortality

index was obtained by taking the average of the maternal survival rate and infant survival rate indices. The health system success index was calculated by taking the geometric mean of the indices in three dimensions, as follows.

$$Health\ System\ Success\ Index = (\ Quality\ of\ Life^{1/3} \times Expenditure\ Success^{/3} \times Mortality^{1/3}\ )$$

Health system success index takes values between 0 and 1. An index value approaching 1 indicates that the success of the health system has increased, while a value approaching 0 indicates that the success of the health system is not relatively good.

2.FINDINGS

In the study, with the help of the index created, the relative success of the G10 countries was measured three times separately with the data of 2005, 2015 and 2020. Thus, it is aimed to see the success order of the countries and the change within the G10 countries with the help of up-to-date data, and to monitor the changes in the elapsed time by comparing it with 2005.

The index ranking of the countries for 2005 is as in the table below.

Table 2. Index Ranking for 2005

RANK	COUNTRY	INDEX
1	Japan	0.8093156
2	Italy	0.8007159
3	Sweden	0.7928254
4	Germany	0.703791
5	Belgium	0.6776607
6	England	0.6036463
7	Canada	0.6016707
8	Holland	0.5514915
9	USA	0.443509
France is not included due to lack of data.		

According to the 2005 health system success index, the most successful country was found to be Japan. For 2005, the USA was found to have the lowest achievement index among the G10 countries. The main reason for this situation is that the USA has relatively worse values in expected

healthy life years, mortality and expenditure indices. The USA is known as the country that spends the most on health in the world and allocates the highest share to health in its income. Despite this, it lagged behind other G10 countries in terms of health system success index. After the EU, the country with the lowest success index in 2005 was the Netherlands.

The index ranking of the countries for 2015 is as in the table below.

Table 3. Index Ranking for 2015

RANK	COUNTRY	INDEX
1	Japan	0.749578
2	Canada	0.682095
3	Sweden	0.634781
4	Italy	0.588909
5	Belgium	0.546446
6	Holland	0.534579
7	Germany	0.515232
8	England	0.486276
9	USA	0.302496

According to the health system success index of 2015, the country with the most success was found to be Japan. For 2015, the USA was found as the country with the lowest success index among the G10 countries. The UK, on the other hand, has an index value above only the USA in 2015. The main reason for this situation is that the UK's indicators are relatively worse compared to 2005. Canada is the most successful country after Japan in 2015. The index ranking of the countries for 2020 is as in the table below.

Table 4. Index Ranking for 2020

RANK	COUNTRY	INDEX
1	Japan	0,9808224
2	Holland	0,8904592
3	Italy	0,8656139
4	Germany	0,7269645
5	Sweden	0,7190474
6	Belgium	0,7035094
7	England	0,6473415
8	Canada	0,6247026
9	USA	0,4257685

According to the health system success index of 2020, the country with the most success was again found to be Japan. For 2020, the USA is the country with the lowest success index among the G10 countries. This situation is similar to the results of 2000 and 2015. Canada, on the other hand, has an index value above the USA in 2020, but is positioned in the penultimate rank among the G10 countries, excluding France. On the other hand, as in 2015, England was among the three relatively unsuccessful countries.

When the years 2000 and 2020 are compared, the changes in the rankings of the countries are presented in the table below.

Table 5. Comparison of 2005 and 2020 Index Rankings

COUNTRY	2005	2020	Change
Belgium	5	6	-1
Canada	7	8	-1
Germany	4	4	0
Italy	2	3	-1
Japan	1	1	0
Holland	8	2	6
Sweden	3	5	-2
England	6	7	-1
USA	9	9	0

When 2005 and 2020 are compared, the country with the highest rise in the ranking is the Netherlands. While the Netherlands was in the 8th place among the G10 countries in terms of health index in 2005, it rose 6 places in 2020 to the 2nd place after Japan. The Netherlands is the country that affects the rankings the most among the G10 countries. The change in the indicators in the health index in the Netherlands in this process can be seen as the main reason for the decline in the rankings of other countries. Because, apart from the Netherlands, there is no country that goes 2 places up or down.

Compared to the index ranking in 2005, the country that fell behind the most in 2020 is Sweden (-2). This situation is remarkable for Sweden, which is one of the G10 countries. When the results of the index rankings of 2005 and 2020 are compared, the countries that have regressed

in terms of success except Sweden are Belgium, Canada, Italy and England. One of the remarkable points in the analysis results is; The USA's ranking has remained unchanged from 2005 to 2020, and the USA is consistently ranked last among the G10 countries.

3. CONCLUSIONS AND RECOMMENDATIONS

Health is an important output used when evaluating both human capital investment and the development level of countries. Although there are many factors that determine the health of countries, the health system is an important determinant. Health systems have three important purposes. These are to improve the health of the population, to respond to people's expectations, and to provide financial protection against the costs of illness or health. The success of the health system of the countries directly determines the level of health and the level of development in the long term. For this reason, various benchmarking, ranking, effectiveness, performance and cause-effect analyzes have an extremely important place in the evaluation of the success of health reforms and health systems of countries. It is hoped that these analyzes will guide future interventions and provide an opportunity for comparison in terms of time/space. When compared to 2005, when the countries that declined in the ranking in 2020 are taken into account, the expected healthy life years at birth increased, the infant mortality rate per 1000 live births decreased, the maternal mortality rate per 1000 live births decreased again, and the risk of financial catastrophic expenditure for surgical procedures decreased. However, although there are improvements in the variable focus in general, there may be two reasons why some countries are relatively low in the ranking. Firstly, the developments in the health system success indicators in these countries are below the rate of progress in other countries, and secondly, rather than the rate of progress, the difference with other countries is high at the beginning. Considering the progress rates in the indicators, the Dutch infant mortality rate rose from 4.9 to 3.6; maternal mortality rate and maternal mortality rate also decreased from 8.5 to 1.2. The risk of financial catastrophic spending on surgical procedures has also been significantly reduced. When these development rates are compared with other countries, it has been seen that the Netherlands is among the countries with the highest rate of improvement in indicators. It even ranks first in the G10. On the other hand, from the point of view of the USA, which is in the last place in all three years in the ranking, although the infant mortality rate decreased from 6.9 to 5.4'in in 2020 compared to 2005, the risk of financial catastrophic expenditure for surgical procedures increased in 2020 compared to 2005. For this reason, although the success of the USA in some health indicators is important, the relative decline

in other indicators in the health system success index can be considered as the main reason why it is still behind other G10 countries.

It is extremely important whether the health system is effective or not. It is difficult to determine an absolute value in the effectiveness and success of health systems. For this reason, it is important to compare countries and systems with similar structures with the help of relatively various models. Therefore, it is necessary to increase the number of comparative studies to determine the effectiveness of the health system. Each work to be done will deal with the subject from a different perspective. In order to have a relatively effective health system, it is extremely important for countries to develop their own models as well as benefit from the positive experiences of other countries.

Conflict of Interest: The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding: This research was not supported by any institution.

References

Afonso A. and Aubyn M. (2006). Relative Efficiency of Health Provision: a DEA Approach with Non-discretionary Inputs, ISEG-UTL Economics Working Paper No. 33/2006/DE/UECE. Retrieved 01 September 2022 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=952629

Cherchye, L. (2001). Using Data Envelopment Analysis to Assess Macroeconomic Policy Performance, *Applied Economics*, 33, 407-416.

Daşdan, İ. ve Çetinkaya, V. (2015). OECD Ülkeleri ve Türkiye'nin Sağlık Sistemleri, Sağlık Harcamaları ve Sağlık Göstergeleri Karşılaştırması. *Sosyal Güvenlik Dergisi (SGD), 5*(1), 104-134.

Manitoba Centre for Health Policy (MCHP) (2009). Composıte Measures/Indices of Health And Health System Performance. Retrieved 01 September 2022 http://mchpappserv.cpe.umanitoba.ca/deliverablesList.html

Nardo M., Saisana M., Saltelli A., Tarantola S., Hoffman A. ve Giovannini E. (2005). Handbook on constructing composite indicators: methodology and user guide, OECD Statistics Working Paper, Paris.

OECD (2003). Composite indicators of country performance: a critical assessment, DSTI/DOC(2003)16, Paris.

OECD (2008). Health System Reviews: Turkey. OECD and World Bank Publications.

Saisana M. and Tarantola S. (2002). State-of-the-art report on current methodologies and practices for composite indicator development. EUR 20408 EN Report, European Commission, JRC, Ispra, Italy.

WHO (2000). Overall Health System attainment for 191 countries. WHO Publications.

Xu, K., Evans, D., Carrin, G., Aguilar-Rivera, A., Musgrove, P., ve Evans, T. (2007). Protecting households from catastrophic health spending. *Health Aff (Millwood), 26*(4), 972-983.