ANKARA MEDICAL JOURNAL

Research Article

Ankara Med J, 2025;(3):271-286 // 10.5505/amj.2025.23682

EVALUATION OF HEALTH SYSTEM PERFORMANCE IN THE CONTEXT OF PUBLIC HEALTH; AN APPLICATION WITH THE ORGANIZATION OF TURKIC STATES

Memiş Karaca[1]

[1]Kayseri State Hospital, Kayseri, Türkiye

Memiş Karaca (e-mail: memis.karaca.38@gmail.com)

Submitted: 25.06.2025 // Accepted: 27.08.2025

Ankara Yıldırım Beyazıt University Faculty of Medicine
Department of Family Medicine

ANKARA MEDICAL JOURNAL

Abstract

Objectives: Based on the ultimate goals of health services and the importance of public health, health system performance evaluation should be carried out at the regional, national, or international level, the difference between expected health performance and desired health performance should be revealed, and necessary improvements should be provided. This study aims to evaluate the health system performance in the Organization of Turkic States.

Materials and Methods: The LOPCOW method, one of the multi-criteria decision-making techniques, was used in the study for weighting the criteria and ranking the countries, and the CoCoSo method was used to reveal the rankings on the basis of countries.

Results: When the LOPCOW results are analyzed, it is determined that the most important criterion is K6 (Under Five Mortality Rate) with a value of 0.1755, the least important criterion is K3 (Number of Physicians) with a value of 0.0836, while the country with the best health system performance with the integration of CoCoSo method is Hungary, Uzbekistan, Azerbaijan, Kazakhstan, Kyrgyzstan, Turkiye, Turkmenistan, respectively.

Conclusion: As a result of the results of the study, it is recommended that health policy makers, planners, managers, practitioners, researchers, and service demanders gain a different perspective and determine health policy and public health strategies for these situations.

Keywords: Health system performance, public health, LOPCOW, CoCoSo, MCDM

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Introduction

The World Health Organization (WHO) defines the term health as not only the absence of disease or disability but also a state of complete physical, mental, and social well-being.[1] The health status of individuals, social health indicators, directly affect the health status of countries. In recent years, it has been emphasized that significant progress has been made in human health in developed and developing countries.[2] It is very important to support this significant progress with statistical data. In this case, it would be more accurate to look at the situation of the world rather than countries. In this context, life expectancy at birth was 69.16 in 2005, 72.04 in 2015, and 72.93 in 2019. The under-5 mortality rate was 62.9 in 2005, 43.1 in 2015, and 37.1 in 2022. In 2005, the number of hospital beds per 1000 people was 2.73, in 2015 it was 2.86, and in 2020 it was 3.28.[3] However, despite these improvements, the health systems of countries have become increasingly complex. It is a very difficult process to compare health systems that include many elements such as public health, health management, health financing, health technology, health resources, health organizations, and health policies.[4]

Despite this complexity, one of the reasons why health indicators are so important is that economic, cultural, and social differences between countries vary, while periodic changes and policies can clearly reveal the current situation of a country.[5] In short, the multidimensional and complex structure of the health sector, the fact that it is under the influence of many factors and stakeholders, and that economic, social, and environmental factors also play a role, make it difficult to evaluate the health systems and performance of countries. However, if countries do not know their health performance and cannot make comparisons with similar countries, they may produce incomplete and wrong policies without fully understanding their current situation when formulating new policies and plans. To find solutions to such problems, multi-criteria decision-making (MCDM) methods can be used, which allow the evaluation of a large number of alternatives by considering multiple criteria. Thanks to these methods, countries can assess their health indicators, expenditures, equipment, etc., and make comparisons.

Health indicators help us understand public health, factors affecting health, effectiveness, efficiency, planning, monitoring of processes, and proper allocation of resources. Among the key health indicators included in the "Reference List of 100 Key Health Indicators" published by the World Health Organization (WHO) in 2018 and frequently used in academic studies such as[6-9] there are many indicators such as the share of gross domestic product allocated to health, infant mortality rate, newborn mortality rate, maternal mortality rate, life expectancy at birth, under-five mortality rate, adult mortality rate between the ages of 15-60, average length of stay and population per health personnel.

The study aims to evaluate the performance of the health system in the organization of the Turkish States by making comparisons over the health data of the countries due to the multidimensional and complex structure of the health sector, the fact that it is under the influence of many factors and stakeholders, and that economic, social, and environmental factors also play a role. The LOPCOW (Logarithmic Percentage Change-driven Objective Weighting) method, one of the multi-criteria decision-making techniques, was used in the study in order to realize the purpose of weighting and ranking the criteria, and the CoCoSo (Combined Compromise Solution) method was used to reveal the rankings on the basis of countries.

In this study, the inclusion or exclusion of the family medicine system in the selection of countries within the Turkish states was also taken into consideration. In this context, although family medicine is a main branch of medical faculties, the health system adopted in countries is effective. Countries in Asia do not have a family medicine system due to the adoption of the semasko model. The criteria in question were selected within this scope in terms of public health.

To the best of our knowledge, this study is the first study using the LOPCOW-CoCoSo method, which is one of the CCS techniques, to evaluate the performance of the health system in the Organization of the Turkic States, and the originality of the study is emphasized.

Literature Review

In this section, both the studies conducted using multi-criteria decision-making methods, the studies conducted using the methods used in our study, and the studies conducted in the field of health, especially in the field of health service delivery performance evaluation studies, will be mentioned in Table 1.

Table 1. Studies in the literature

AUTHOR	SUBJECT	METHOD
Kahreman[10]	It is about measuring the economic performance of the G20 countries, which cover about 85% of the world economy, during the 2008 crisis period.	LOPCOW-CoCoSo
Nisel and Nisel[11]	They presented a new approach to assessing and ranking nations according to their innovation capabilities.	LOPCOW-CoCoSo
Dhruva[12]	Provides a decision framework for cloud computing vendor selection in healthcare centers that addresses the challenges of uncertainty, expert hesitation, and conflicting criteria	LOPCOW-CoCoSo
Kar and Özer[13]	It is stated that the health service performances of the geographical regions in TURKİYE are evaluated with the VIKOR method, and the Health Statistics Yearbook 2016 data are used as a data source.	VIKOR
Aydin[14]	It is stated that the performances of geographical regions in TURKİYE between 2012 and 2018 were evaluated using the statistics of the Ministry of Health and CRITIC and TOPSIS methods.	CRITIC and TOPSIS
Başdeğirmen and Çal[15]	They evaluated the performance of city hospitals.	ENTROPY and MAUT
Erkilic[16]	Based on 15 health criteria for 2020, the performance of TURKİYE's Statistical Regional Units Classification Level 1 regions was evaluated.	CRITIC and TOPSIS
Murat and Güzel[17]	Health performance of SAARC and OECD countries They have been evaluated.	ARAS and WASPAS
Altintas[18]	They assessed the marine health performance of Mediterranean countries.	CRITIC and MARCOS
Rod[19]	The health tourism potentials of metropolitan cities in TURKİYE have been evaluated.	CRITIC and WASPAS
Ortíz-Barrios et al.[20]	They used a fuzzy hybrid FCDM approach to evaluate emergency department performance during the COVID-19 pandemic.	AHP-DEMATEL-CoCoSo
Selamzade et al.[21]	Efficiency levels in combating the COVID-19 pandemic in different periods in OECD countries, DEA, and CRM	TOPSIS, EDAS, CODAS
Pan et al.[22]	Countries were ranked to determine their public health performance.	AHP and TOPSIS
Erdogan and Ayyildiz[23]	In the study evaluating the performance of hospitals, they conducted research using quality criteria taken from SERVPERF.	CRITIC-TOPSIS
Hasani and Mokhtari[24]	The sustainability factors for the management and success of the health system among the identified hospitals in Iran were addressed and evaluated with the relevant methodology.	DEMATEL

Materials and Methods

LOPCOW Management

The LOPCOW method is an innovative method that determines the criteria weights objectively without the need for subjective opinions of the decision maker. This method has the advantage of being able to utilize the negative performance values of alternatives and to work efficiently with a large number of criteria and alternatives. LOPCOW was developed to deal with large variations in the performance of alternatives, especially in large decision matrices and in the presence of negative values.[25]

This method, developed by Ecer and Pamucar [26], calculates the standard deviation of each criterion and its percentage value with a logarithmic function depending on the number of alternatives. In this way, it presents the importance levels of the criteria in a more balanced way, showing the differences between the most important and less important criteria at a more reasonable level. The solution stages of the LOPCOW method used in the study are shown below: [25,26]

Stage 1: For the solution of the decision problem, the Decision Matrix should be formed according to Equation 1 for m alternatives and n criteria.

$$IDM = \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{22} & \dots & X_{2n} \\ \dots & \dots & \vdots & \vdots \\ X_{m1} & X_{m2} & \dots & X_{mn} \end{bmatrix} \quad (1)$$

Stage 2: Using the linear normalization technique, the IDM matrix is normalized according to the maximum and minimum values of the criteria. If the criterion is cost-oriented, i.e., if the value of this criterion is to be reduced to the lowest possible level, the formula determined by Equation 2 is applied. On the other hand, if the criterion is benefit-oriented, i.e., the value of this criterion should be maximized, the formula of Equation 3 is used. There are different normalization methods for these two cases, and the conditions for using each of them are determined by the characteristics of the criterion.

$$r_{ij} = \frac{X_{max} - X_{ij}}{X_{max} - X_{min}} \quad (2)$$

$$r_{ij} = \frac{X_{ij} - X_{min}}{X_{max} - X_{min}} \quad (3)$$

Stage 3: In this stage of the analysis, the percentage value for each criterion is determined using Equation 4. In this process, the percentage of the standard deviations of each criterion is calculated, and the mean square

value is used to calculate a calculation that eliminates gaps due to the size of the series. This method more accurately reflects the variability in the data and ensures an accurate evaluation of the criteria.

$$PV_{ij}= \left| In \left(\frac{\sqrt{\frac{\sum_{i=1}^{m} r_{ij}^2 \pi}{\mathrm{m}}}}{\sigma} \right) .100 \right| \quad (4)$$

Stage 4: Finally, the objective weights for each criterion are determined with the help of Equation 5.

$$W_j= \frac{PV_{ij}}{\sum_{i=1}^{n} PV_{ij}} \quad (5)$$

CoCoSo Method

The CoCoSo (Combined Compromise Solution) method is one of the multi-criteria decision-making methods introduced to the literature by Yazdani et al. This approach is an integrated method that combines exponentially weighted product and simple additive weighted product models to produce a combined compromise solution. The method proposes to reconcile the simple additive weighting (SAW) and the exponential weighted.

Sum (EWP) model. [28] CoCoSo first determines the utility values of the decision alternatives from various perspectives using different combinations and aggregation operators. Then, the utility values of each alternative are combined using the aggregation function to obtain a compromise solution, and the optimal solution is found. In this context, the solution stages of the method are shown below: [27,28]

Step 1: First, the decision matrix needs to be created. This step is done with the help of equation 6.

$$\mathrm{D} = X_{ij} = \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1j} \\ X_{21} & X_{12} & \dots & X_{2j} \\ \vdots & \vdots & \vdots & \vdots \\ X_{i1} & X_{i2} & \dots & X_{ij} \end{bmatrix} \quad (6)$$

Step 2: Normalization of the decision matrix is performed. Equations 7 and 8 are used in this context.

$$r_{ij} = \frac{X_{ij} - minx_{ij}}{makx_{ij} - minx_{ij}} \quad (7)$$

$$r_{ij} = \frac{makx_{ij} - X_{ij}}{makx_{ij} - minx_{ij}} \quad (8)$$

Step 3: The weighted sum of comparability $S_{(i)}$ is calculated with the help of equation 9, and the sum of the power weights of the comparability sequences for each alternative P_i is calculated with the help of equation 10.

$$S_i = \sum_{j=1}^{n}(w_i r_{ij}) \quad (9)$$

$$P_i = \sum_{j=1}^{n}(r_{ij})^{wj} \quad (10)$$

Step 4: In this step, the relative weights of the alternatives need to be calculated. This calculation is calculated using equations 11, 12, and 13.

$$k_{ia} = \frac{P_i + S_i}{\sum_{i=1}^{m}(P_i + S_i)} \quad (11)$$

$$k_{ib} = \frac{S_i}{\min S_i} + \frac{P_i}{min P_i} \quad (12)$$

$$k_{ic} = \frac{\lambda(S_i)+(1-\lambda)(P_i)}{\lambda(\text{mak}S_i)+ (1-\lambda)(\text{mak}P_i)}; 0 \leq \lambda \leq 1 \quad (13)$$

The value of λ is a value that the decision maker can take, provided that $0 \leq \lambda \leq 1$.

Step 5: The last step is the ranking of the alternatives. It is revealed with the help of Equation 14.

$$k_{ia} = (k_{ia}\, k_{ib} k_{ic})^{1/3} + \frac{1}{3}(k_{ia}\, k_{ib} k_{ic}) \quad (14)$$

With Equation 14, sensitivity (k_i) results are obtained, and these results are ranked from largest to smallest. Thus, the ranking is performed from best to worst.

Criteria and Data to be Used in the Study

The criteria to be used in the study are the number of hospital beds, life expectancy at birth, number of doctors per capita, number of nurses per capita, number of midwives per capita, health expenditures, under-five infant mortality rate, maternal mortality rate, suicide rates, among the basic health indicators included in the Reference List of 100 Key Health Indicators published by the World Health Organization (WHO) in 2018 and frequently used in most academic studies such as. [6-9]

Data on countries under the specified criteria were obtained from the World Bank.[3]

The data on the criteria mentioned above by the World Bank are used in the model based on the average of the last ten years since the most recent year of publication. The criteria to be used in the study are shown below in Table 2.

Table 2. Criteria to be used in the study

Sequence No.	***Code***	***Criteria Name***	***Criterion Direction***
1	**K1**	Number of Hospital Beds (per 1000 inhabitants)	Maximum
2	**K2**	Life Expectancy at Birth	Maximum
3	**K3**	Number of Physicians Per Capita (1000 Persons)	Maximum
4	**K4**	Number of Nurse Midwives Per Capita 1000	Maximum
5	**K5**	Health Expenditures	Maximum
6	**K6**	Under Five Infant Mortality Rate (1000)	Minimum
7	**K7**	Maternal Mortality Rate (100,000)	Minimum
8	**K8**	Suicide Rates (100,000)	Minimum

K: Abbreviation for the selected criterion.

This study did not require ethics committee approval as it did not involve human participants or sensitive personal data and used secondary data.

Results

In this section, the findings obtained by using LOPCOW and CoCoSo methods are presented with their stages. Firstly, the LOPCOW method is used to determine the weights of the criteria used in our study. The results of this method are calculated separately using equations 1-5 shown in the previous sections, and the decision matrix is shown in Table 1 below.

Implementation with LOPCOW

The decision matrix is shown in Table 3.

Table 3. Decision Matrix

Criteria Aspects	max	max	max	max	max	min	min	min
Countries	K1	K2	K3	K4	K5	K6	K7	K8
AZERBAIJAN	4,053	71,328	3,267	6,468	4,138	23,270	29,500	4,220
HUNGARY	6,949	75,691	3,256	6,683	6,980	4,550	14,800	20,830
KAZAKHSTAN	5,852	72,176	3,945	7,511	3,146	11,130	13,700	23,900
KYRGYZSTAN	4,485	71,216	2,229	5,892	6,401	20,120	57,200	9,680
TURKMENISTAN	4,036	68,899	2,147	4,301	5,104	42,280	6,000	6,680
TURKİYE	2,739	76,906	1,823	2,750	4,340	11,960	19,000	2,300
UZBEKISTAN	4,512	70,782	2,405	11,320	5,500	17,440	32,100	8,710
Mak	6,949	76,906	3,945	11,320	6,980	42,280	57,200	23,900
Min	2,739	68,899	1,823	2,750	3,146	4,550	6,000	2,300

Then, using Equations 2 and 3, a normalized decision matrix was created. The normalized decision matrix is shown in Table 4.

Table 4. Normalized Decision Matrix

Criteria Aspects	max	max	max	max	max	min	min	min
Countries	K1	K2	K3	K4	K5	K6	K7	K8
AZERBAIJAN	0,3120	0,5771	0,3430	0,8831	0,2356	0,5038	0,5410	0,9111
HUNGARY	1,0000	1,6134	0,3404	0,9341	0,9107	1,0000	0,8281	0,1421
KAZAKHSTAN	0,7395	0,7784	0,5040	1,1309	0,0000	0,8256	0,8496	0,0000
KYRGYZSTAN	0,4147	0,5503	0,0965	0,7463	0,7731	0,5873	0,0000	0,6583
TURKMENISTAN	0,3081	0,0000	0,0770	0,3683	0,4652	0,0000	1,0000	0,7972
TURKİYE	0,0000	1,9019	0,0000	0,0000	0,2836	0,8036	0,7461	1,0000
UZBEKISTAN	0,4212	0,4474	0,1383	2,0356	0,5591	0,6584	0,4902	0,7032

After the normalized decision matrix, using Equations 4 and 5, the percentage value matrix (PV), standard deviation values$\sigma\sigma$, percentage values (Pvij), and weight degrees of the criteria, in short, Wj values showing how effective they are on health system performance, are shown in Table 5.

Table 5. Percentile Matrix, Other Values, and Weight Values of Criteria

Decision Matrix								
Criteria	**max**	**max**	**max**	**max**	**max**	**min**	**min**	**min**
Countries	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**K7**	**K8**
AZERBAIJAN	0,097	0,333	0,1177	0,7799	0,0555	0,2539	0,2927	0,8301
HUNGARY	1,000	2,602	0,1159	0,8726	0,8293	1,0000	0,6858	0,0202
KAZAKHSTA	0,546	0,605	0,2540	1,2790	0,0000	0,6816	0,7218	0,0000
KYRGYZSTAN	0,172	0,302	0,0093	0,5570	0,5977	0,3450	0,0000	0,4334
TURKMENIST	0,094	0,000	0,0059	0,1357	0,2164	0,0000	1,0000	0,6356
TURKİYE	0,000	3,617	0,0000	0,0000	0,0804	0,6458	0,5567	1,0000
UZBEKISTAN	0,177	0,200	0,0191	4,1437	0,3126	0,4334	0,2403	0,4945
Total	2,088	7,662	0,5219	7,7679	2,0920	3,3597	3,4973	3,4138
M(number of	8	8	8	8	8	8	8	8
Total/m	0,261	0,957	0,0652	0,9710	0,2615	0,4200	0,4372	0,4267
roottotal/m	0,510	0,978	0,2554	0,9854	0,5114	0,6480	0,6612	0,6532
Std. deviation	0,324	0,676	0,1830	0,6396	0,3173	0,3216	0,3321	0,3828
Roottotalmm	1,577	1,447	1,3961	1,5405	1,6117	2,0150	1,9906	1,7063
Pvij	45,55	36,99	33,3658	43,212	47,7264	70,0613	68,8460	53,4351
Wj	0,114	0,092	0,0836	0,1082	0,1196	0,1755	0,1725	0,1339
Sorting	5	7	8	6	4	1	2	3

When Table 5 is analyzed, it is determined that the most important criterion is K6 (Under Five Mortality Rate) with a value of 0.1755 and the least important criterion is K3 (Number of Physicians) with a value of 0.0836.

Application with CoCoSo

The process of ranking the alternatives in the evaluation of the health system performance of the countries in the specific case of the organization of Turkic states was applied using the CoCoSo method. Table 3 decision matrix and Table 4 normalized decision matrix in the application part of the LOPCOW method were used in the solution of this method since they are the same equality formulas.

By using the weights obtained in the LOPCOW method in this method, weighted comparability Si and Pi values were obtained with the help of Equations 9 and 10. The obtained Si value is presented in Table 6 and Pi value is presented in Table 7.

Table 6. Weighted Comparability Si Value

Countries	K1	K2	K3	K4	K5	K6	K7	K8	Si
AZERBAIJAN	0,036	0,028	0,057	0,047	0,031	0,088	0,093	0,122	0,502
HUNGARY	0,114	0,079	0,056	0,050	0,120	0,176	0,143	0,019	0,756
KAZAKHSTAN	0,084	0,038	0,084	0,060	0,000	0,145	0,147	0,000	0,557
KYRGYZSTAN	0,047	0,027	0,016	0,040	0,102	0,103	0,000	0,088	0,423
TURKMENISTAN	0,035	0,000	0,013	0,020	0,061	0,000	0,173	0,107	0,408
TURKİYE	0,000	0,093	0,000	0,000	0,037	0,141	0,129	0,134	0,534
UZBEKISTAN	0,048	0,022	0,023	0,108	0,073	0,116	0,085	0,094	0,569

Table 7. Weighted Comparability Pi Value

Country/Criteria	K1	K2	K3	K4	K5	K6	K7	K8	Pi
AZERBAIJAN	0,876	0,895	0,968	0,914	0,851	0,887	0,899	0,988	7,277
HUNGARY	1,000	0,985	0,968	0,919	1,000	1,000	0,968	0,770	7,610
KAZAKHSTAN	0,966	0,921	1,000	0,938	0,000	0,967	0,972	0,000	5,764
KYRGYZSTAN	0,904	0,891	0,871	0,897	0,981	0,911	0,000	0,946	6,401
TURKMENISTAN	0,874	0,000	0,855	0,831	0,923	0,000	1,000	0,970	5,453
TÜRKİYE	0,000	1,000	0,000	0,000	0,870	0,962	0,951	1,000	4,783
UZBEKISTAN	0,906	0,874	0,898	1,000	0,943	0,929	0,884	0,954	7,389

The weighted comparability Si and Pi values of the countries are used in Equations (11), (12), and (13) to calculate the relative weights of the alternatives (Kia, Kib, and Kic). The calculated weighted comparability Kia, Kib, and Kic values are used in Equation (14) to obtain the ki value indicating the health system performance ranking of the countries. The relative weights (Kia, Kib, and Kic) and country performance rankings are presented in Table 8.

Table 8. Results of the Relative Performance of Alternatives

Country/Criteria	kia	kib	kic	which	Sorting
AZERBAIJAN	0,161	2,753	0,930	1,704	3
HUNGARY	0,173	3,444	1,000	1,863	1
KAZAKHSTAN	0,131	2,572	0,756	1,597	4
KYRGYZSTAN	0,141	2,374	0,816	1,584	5
TURKMENISTAN	0,121	2,140	0,701	1,497	7
TÜRKİYE	0,110	2,308	0,636	1,504	6
UZBEKISTAN	0,164	2,939	0,951	1,748	2

Discussion

As health systems are dynamic and open to change and development, it is not correct to make a statement as the best or the most accurate health system, and it may not be appropriate to serve with the same health system all the time. It varies according to the culture, economic structure, historical development, ideological thinking, and lifestyles of each country. Therefore, the responses of health systems, which change and adapt to different circumstances, to the crises they face also differ. Likewise, the World Health Organization has also mentioned that the health systems of countries are shaped according to the norms and values adopted by society. For these reasons, health systems around the world vary. Therefore, countries generally do not consider a single financing style and a fixed health service provider as ideal, and may tend to change policies as time progresses.

Due to the multidimensional and complex structure of the health sector, the fact that it is under the influence of many factors and stakeholders, and the fact that economic, social and environmental factors also play a role, in our study on the evaluation of the health system performance in the organization of the Turkish states by making comparisons over the health data of the countries; LOPCOW method, one of the multi-criteria decision-making techniques, was used in the study to realize the purpose of weighting and ranking the criteria, and CoCoSo method was used in an integrated manner to reveal the rankings based on countries. When the LOPCOW results are analyzed, it is determined that the most important criterion is K6 (Under Five Mortality Rate) with a value of 0.1755, the least important criterion is K3 (Number of Physicians) with a value of 0.0836, and with the integration of CoCoSo method, it is understood that the country with the best health system performance is Hungary, Uzbekistan, Azerbaijan, Kazakhstan, Kyrgyzstan, Turkiye, Turkmenistan, respectively.

In the studies in the literature, [6,8,29,30] studies have been conducted by comparing the organization of Turkish states. However, we are not aware of any study based on objective methods from multi-criteria decision-making techniques. In addition, there is no study evaluating health system performance with the integration of the LOPCOW-CoCoSo method.

This study evaluates the most important criteria and the criteria with the least importance identified in the Turkish states' organizations, and by determining the ratios of these concrete criteria and the maximum and minimum directions of the criteria, it will enable the formulation of health policies and the strengthening of health systems. The study enables Turkish states to identify deficiencies in the concrete criteria within their health systems and plays a significant role in determining their level of development compared to other countries. The best way to prove the level of deficiencies in specific areas is through scientific studies. The study has the characteristic of shedding light on health systems and public health performance.

As a result of the results of the study, health policy makers, planners, managers, practitioners, researchers, and service demanders will gain a different perspective and should determine health policies and strategies for these situations. Future studies can evaluate the performance of the health system in strategic economic communities or regional groupings of countries. In addition, the use of studies that can be updated from multi-criteria decision-making techniques over time will contribute to the literature.

The criteria used in the study were selected from the basic health indicators frequently used in many academic studies, which are included in the "Reference List of 100 Basic Health Indicators" published by the World Health Organization (WHO) in 2018. As recommendations for future studies, it is suggested that the criteria included in the Reference List of 100 Essential Health Indicators be expanded, within the scope of feasibility, to enhance the applicability of the study. Additionally, it is recommended that the study be repeated using methods such as LOPCOW and CoCoSo, which are among the most up-to-date methods in the literature, as well as newer methods that have recently been introduced to the field, alongside more established traditional methods like AHP and TOPSIS.

Ethical Considerations: This study did not require ethics committee approval as it did not involve human participants or sensitive personal data and used secondary data.

Conflict of Interest: The authors declare no conflict of interest.

References

1. WHO. (2020). WHO remains firmly committed to the principles set out in the preamble to the constitution. https: //www.who.int/about/governance/constitution Added on August 2, 2024.
2. Mehta, N. K., Abrams, L. R. ve Myrskylä, M. US life expectancy stalls due to cardiovascular disease, not drug deaths. Proceedings of the National Academy of Sciences, 2020; 117(13), 6998-7000
3. The World Bank. World bank open data. 2024; https: //data.worldbank.org/ Retrieved from on 13.01.2025.
4. Papanicolas, I., Kringos, D., Klazinga, N. S. ve Smith, P. C. Health system performance comparison: New directions in research and policy. Health Policy, 2013; 112(1-2), 1-3.
5. Saygin, Z. ve Kundakci, N. Saglik gostergeleri acisindan OECD ulkelerinin EDAS ve ARAS yontemleri ile degerlendirilmesi. Alanya Akademik Bakis, 2020; 4(3), 911-38.
6. Sener, M., Yesilyurt, O. ve Salamov, F., Turk Devletleri Saglik Sistemlerinin ve Harcamalarinin Karsilastirilarak Degerlendirilmesi. The Journal of Academic Social Science Studies, 2017; 8(61), 511-23.
7. Keles, N. (2023). Turkiye'nin 81 ilinin saglik performansinin guncel karar verme yontemleriyle degerlendirilmesi. Dumlupinar Universitesi Sosyal Bilimler Dergisi, (75), 120-141.
8. Doner, N., & Bulut, S. (2024) Turk Cumhuriyetlerinin Saglik Ekonomisi Kapsaminda Karsilastirmali Analizi. Turkuaz Uluslararasi Turk Dunyasi Bilimsel Arastirmalar Dergisi, 5(2), 74-88.
9. Cam, D., Koca, G., & Egilmez, O. (2025). Turkiye'de Bolgesel Saglik Hizmetlerinin Bazi Saglik Gostergeleri Cercevesinde Aras Yontemi Ile Degerlendirilmesi. Saglik ve Sosyal Refah Arastirmalari Dergisi, 7(1), 12-27.
10. Kahreman, Y. (2023). G20 Ulkelerinin Ekonomik Performanslarinin 2008 Kriz Doneminde LOPCOW-COCOSO Yontemi Ile Degerlendirilmesi. Izmir Iktisat Dergisi, 38 (3), 786-803.
11. Nisel, R., & Nisel, S. (2024). Advancing Global Innovation Metrics: A Comprehensive Country Ranking Using the Novel LOPCOW-CoCoSo Model. In Ethics and Sustainability in Accounting and Finance, Volume IV (pp. 99-118). Singapore: Springer Nature Singapore.
12. Dhruva, S., Krishankumar, R., Zavadskas, E. K., Ravichandran, K. S., & Gandomi, A. H. (2024). Selection of suitable cloud vendors for health centre: a personalized decision framework with fermatean fuzzy set, LOPCOW, and CoCoSo. Informatica, 35(1), 65-98.

13. Kar, A. & Ozer, O. (2020). Turkiye'de Saglik Hizmetleri Altyapi Kaynaklarinin, Hizmet Kullanim Duzeylerinin ve Saglik Sonuclarinin Bolgesel Duzeyde Karsilastirilmasi. Dicle Universitesi Iktisadi ve Idari Bilimler Fakultesi Dergisi, 10(20), 331-50.
14. Aydin, G. Z. (2021). Critic ve Topsis Yontemleriyle Turkiye'de Bolgesel Saglik Hizmetlerinin Degerlendirilmesi. Uluslararasi Saglik Yonetimi Ve Stratejileri Arastirma Dergisi, 7(2), 412-33
15. Basdegirmen, A., & Cal, D. Y. (2021). Sehir hastanelerinin entropi temelli maut yontemi ile kapasite degerlendirmesi. Oguzhan Sosyal Bilimler Dergisi, 3(1), 78-90.
16. Erkilic, C. E. (2022). Kamu Saglik Hizmeti Altyapi Ve Insan Kaynagi Gostergeleri Acisindan Turkiye Istatistiki Bolge Birimleri Siniflandirmasina Gore Duzey 1 Bolgelerinin Karsilastirilmasi. Erciyes Akademi, 36(4), 2006-31.
17. Murat, D., & Guzel, S. (2023). SAARC ve OECD ulkelerinde saglik gostergeleri yeterliliginin ARAS ve WASPAS ile analizi. Afyon Kocatepe Universitesi Iktisadi ve Idari Bilimler Fakultesi Dergisi, 25(1), 53-75.
18. Altintas, F. F. (2023). Akdeniz Ulkelerinin Deniz Sagligi Performanslarinin Analizi: CRITIC Tabanli MARCOS Yontemi Ile Bir Uygulama. Acta Aquatica Turcica, 19(1), 1-20.
19. Cubuk, M. (2022). Turkiye'de buyuksehirlerin saglik turizmi potansiyellerinin CRITIC ve WASPAS yontemleri ile karsilastirilmasi. Bingol Universitesi Iktisadi ve Idari Bilimler Fakultesi Dergisi, 6(2), 147-74.
20. Ortíz-Barrios, M., Jaramillo-Rueda, N., Gul, M., Yucesan, M., Jiménez-Delgado, G., & Alfaro-Saíz, J. J. (2023). A fuzzy hybrid MCDM approach for assessing the emergency department performance during the COVID-19 outbreak. International Journal of Environmental Research and Public Health, 20(5), 4591.
21. Selamzade, F., Ersoy, Y., Ozdemir, Y., & Celik, M. Y. (2023). Health efficiency measurement of OECD countries against the COVID-19 pandemic by using DEA and MCDM methods. Arabian Journal for Science and Engineering, 48(11), 15695-712.
22. Pan, J., Fan, R., Zhang, H., Gao, Y., Shu, Z., & Chen, Z. (2022). Investigating the effectiveness of Government Public Health Systems against COVID-19 by Hybrid MCDM approaches. Mathematics, 10(15), 2678.
23. Erdogan, M., & Ayyildiz, E. (2022). Comparison of hospital service performances under COVID-19 pandemics for pilot regions with low vaccination rates. Expert Systems with Applications, 206, 117773.

24. Hasani, A. A., & Mokhtari, H. (2020). Self-efficiency assessment of sustainable dynamic network healthcare service system under uncertainty: hybrid fuzzy DEA-MCDM method. Sci. Iran.
25. Biswas, S., Bandyopadhyay, G., & Mukhopadhyaya, J. N. (2022a). A multi-criteria framework for comparing dividend pay capabilities: Evidence from Indian FMCG and consumer durable sector. Decision Making: Applications in Management and Engineering, 5(2), 140-75.
26. Ecer, F., & Pamucar, D. (2022). A novel LOPCOW-DOBI multi-criteria sustainability performance assessment methodology: An application in developing country banking sector.Omega,(112), 102690
27. Yazdani, M., Wen, Z., Liao, H., Banaitis, A., & Turskis, Z. (2019). A grey combined compromise solution (CoCoSo-G) method for supplier selection in construction. Management. Journal of Civil Engineering and Management, 25(8), 858-74.
28. Peng, X., & Huang, H. (2020). Fuzzy decision making method based on Cocoso with Critic for financial risk evaluation. Technological and Economic Development of Economy, 26(4), 695-724.
29. Demirtas, Z., & Metintas, S. (2017). Turk Cumhuriyetlerinde Anne Cocuk Sagligi Gostergelerinin Ekonomik ve Dogurganlik Ozellikleri Acisindan Degerlendirilmesi. ESTUDAM Halk Sagligi Dergisi, 2(1), 16-25.
30. Kazanci, B. A., & Luy, B. (2023). Turk Cumhuriyetlerinin Saglik Sektoru Acisindan Rekabet Gucu: Aciklanmis Karsilastirmali Ustunlukler Teorisi (AKU). Politik Ekonomik Kuram, 7(2), 116-27.