RESEARCH ARTICLE

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PERFORMANCE ANALYSIS OF OECD COUNTRIES BASED ON HEALTH OUTCOMES AND EXPENDITURE INDICATORS

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ABSTRACT

The aim of this study is to analyze the performance of OECD countries based on health expenditure and outcomes indicators by using TOPSIS method which is one of the multi criteria decision making techniques. Another aim of the study is to determine the level of Turkey among OECD countries in terms of health outcomes and expenditures.

The research universe of the study is composed of OECD countries. The research sample was not selected and all 35 OECD countries were included in this study. Research data were obtained from OECD database. MS office excel program was used in the analysis of the research data. Two health expenditures and four health outcome indicators were used to measure the performance of OECD countries. These variables are as follows; expenditure on health of gross domestic product (%), expenditure on health per capita (US$), life expectancy total population at birth (years), ınfant mortality deaths per 1 000 live births, potential years of life lost per 100 000 females, potential years of life lost per 100 000 males. TOPSIS method was used in the analysis of the research data. Also, multidimensional analysis of the health expenditure, life expectancy and ınfant mortality variables used in the research was carried out by 35 OECD countries.

With respect to the findings of the research data, the average performance score of OECD countries was found to as 0.6900. According to health expenditure and outcomes indicators, Solovenia (0.8250), Korea (0.8155) and Israel (0.8113) was found to have the highest performance scores, while the United States (0.3597), Mexico (0.4319) and Turkey (0.5481) was determined to have the lowest performance scores

When the performance of OECD countries is evaluated according TOPSIS, the reason for the difference in performance among countries is that some countries ' performance indicators are very low or very high compared to the average. For example, infant mortality rates are the two highest (Turkey and Mexico) in 35 OECD countries. Turkey in the last 10 years in the infant mortality rate significant gains have been achieved and infant mortality has been considerably reduced but has not yet reached the desired level. Health expenditure is one of the most important factors affecting health outcomes. In addition to health expenditure, many factors influence health outcomes, such as tobacco and alcohol use, access to health services, quality of health services, education, employment, income level, community safety, air and drinking water quality.

Keywords: Health, Outcome, Expenditure, Performance, TOPSIS

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1. INTRODUCTION

Health system performance measurement is very important to determine whether an effective, efficient and quality health service is provided. Because countries want to determine why countries with similar income and resources do not achieve similar outcomes. With health system performance measurement, will be able to make improvements by identifying their deficiencies of the health inputs and outcomes.

The issue of performance has been the focus of many countries' discussions on the health system. Health systems that exist all over the world are very different from each other because of their different components and combinations (Schütte, Acevedo, and Flahault 2018:1). The main purpose of a health system; to improve the health of the population and to increase the status of health, to provide health services in line with the expectations of people and to protect people from financial risk against disease costs (WHO, 2000: 8). In addition to, a health system of the main objectives are public health promotion, protection and support (Feo, 2008: 225). To achieve this goal, countries have to use their limited resources effectively and efficiently. For decades, countries around the world have been working on how to best configure and adapt health systems to improve the real and sustainable health status of their populations. Today, these countries are increasingly agreeing that better and stronger national health systems are needed to achieve better health outcomes (Ministry of Health, 2012:1-2).

There is an increase in health expenditures in relation to developing technology and economic development level. Even if the method of health financing adopted by the countries changes, the main purpose of health financing is to ensure equitable access among the people, protected from financial risk and to provide a quality service (Tatar, 2011:104). In all countries, especially developed and developing countries, the share of total expenditures allocated to the health sector is increasing (Şener and Yiğit, 2017:287). The average share of OECD countries in gross domestic product (GDP) to health is 8.8%. The highest share among OECD countries is USA (17.2%) and Turkey (4.2%) has the lowest share among these countries (OECD, 2018). Despite this increase in health resources, it is seen that health outcomes are not improving enough (Şener and Yiğit, 2017:287).

Evaluating and comparing the performance of countries' health care systems is often a methodologically difficult process (Asandului, Roman, Fatulescu, 2014:261). Whether or not resources are used efficiently despite this increase in health expenditures is one of the frequently discussed issues in the health sector. Income levels and other health problems of countries are among the important factors affecting health expenditures. For this reason, in order to examine the efficiency of health expenditures made by a country in the functioning of health systems, it is of great importance to make comparisons with the countries in the same income group or with similar countries in terms of geographical location (Çelik, 2011:303). In addition to health expenditures, it is revealed that other determinants of health, such as countries' cultures, people's lifestyles, health systems and health policies of politicians, can have a significant impact on health outcomes (Teleş, Çakmak, Konca, 2018). All over the world, governments are trying to improve their health systems both in the path of human development and in achieving justice in income distribution (Yalçın and Çakmak, 2016:705).

Health systems strengthening is predominantly a national issue, but the commitment of global actors is worth monitoring since they influence financing, national priority and policy approaches. One of the first studies to assess the performance of countries' health systems was conducted in 2000 by the World Health Organization-WHO (Hafner and Shiffman, 2013:41-43). WHO aims to support the development of systematic approaches in order to monitor the performance of countries in a way that allows them to make comparisons between different

levels of the system and between different health systems within the systems (Ministry of Health, 2012:1). There are several factors that influence the performance of health structure. Improvement in the health system can be achieved by minimizing the costs that lead to an increase in outcomes (Adil, Abbas and Yaseen, 2016:83-84).

The aim of this study is to analyze the performance of OECD countries based on health expenditure and outcomes indicators by using TOPSIS method which is one of the multi criteria decision making techniques. Another aim of the study is to determine the level of Turkey among OECD countries in terms of health outcomes and expenditures.

2. METHOD

The research universe of the study is composed of OECD countries. The research sample was not selected and all 35 OECD countries were included in this study. Research data were obtained from OECD database. MS Office Excel Program was used in the analysis of the research data. The variables used in the research were selected as performance evaluation criteria. The following six health expenditure and outcome indicators are taken as performance evaluation criteria. The interpretation of the research findings was limited to these six variables.

C1: Current expenditure on health, % of gross domestic product
C2: Current expenditure on health, per capita, US$ purchasing power parities
C3: Life expectancy total population at birth, years
C4: Infant mortality deaths per 1 000 live births
C5: Potential years of life lost, all causes, years lost, /100 000 females, aged 0-69
C6: Potential years of life lost, all causes, years lost, /100 000 males, aged 0-69

TOPSIS (Technique for Order Preference by Similarity to Ideal Solutions) method was used in the analysis of the research data. Parametric and non-parametric productivity methods are generally used to evaluate the health system performance of countries (Şahin, Özcan ve Özgen, 2011:23). In recent years, there has been a lot of research in the literature regarding the use of multi-criteria decision making methods such as TOPSIS. TOPSIS method is based on the fact that the best alternative according to various criteria is the closest to the positive ideal solution and the farthest to the negative ideal solution (Chen, 2000:2; Shafii et al., 2016:141). The best alternative to be chosen should be close to the ideal solution and farthest from the negative ideal solution (Wang ve Elhag, 2006:310). In the case of gains, maximum benefits and minimum costs are to be expected which are closeness to the positive ideal solution, In the negative ideal solution, the opposite is the case (Cheng-Ru et al., 2008:256; Jadidi eta., 2008:763). The TOPSIS method has different processing steps in the decision-making process. These steps are described below (Jadidi et al., 2008:76; Alptekin ve Şıklar, 2009:189-191; Paksoy, 2017:23-26; Çelikbilek, 2018:177-180);

Step 1. Formation of Decision Matrix (A):
Step 2. Create a normalized decision matrix.
Step 3. Create weighted decision matrix.
Step 4. Creating positive Ideal (S^+) and Negative Ideal (S^-) Solutions:
Step 5. Calculation of relative proximity to the ideal solution.
Step 6. The ideal solution relative to the proximity (C_i^*) sorted by value.

As a result of the calculations made according to the method, the scores of OECD countries from each variable were translated into a single score and OECD countries were ranked according to their performance levels. Also, multidimensional analysis of the health

expenditure, life expectancy and ınfant mortality variables used in the research was carried out by 35 OECD countries.

3. RESULTS

Using the TOPSIS method implementation steps, countries' performance rankings were made according to health indicators. The first step in performance evaluation according to TOPSIS method is to form a decision matrix. In the research, 35 countries whose superiority is desired to be ranked in the lines of the decision matrix, while there are 6 performance criteria in the columns (Table 1).

Table 1. Decision Matrix Table

No	Country	C1	C2	C3	C4	C5	C6
1	Australia	9,1	4.543	82,5	3,1	2.013	3.421
2	Austria	10,3	5.440	81,7	3,1	1.914	3.402
3	Belgium	10,0	4.774	81,5	3,2	2.267	3.732
4	Canada	10,4	4.826	81,9	4,7	2.369	3.670
5	Chile	8,1	1.915	79,9	6,9	2.815	5.099
6	Czech Republic	7,1	2.616	79,1	2,8	2.236	4.470
7	Denmark	10,2	5.183	80,9	3,1	2.141	3.319
8	Estonia	6,7	2.125	77,8	2,3	2.687	6.933
9	Finland	9,2	4.173	81,5	1,9	1.786	3.789
10	France	11,5	4.902	82,4	3,7	2.039	4.019
11	Germany	11,3	5.728	81,1	3,4	2.130	3.758
12	Greece	8,4	2.325	81,5	4,2	2.061	4.258
13	Hungary	7,2	2.045	76,2	3,9	3.136	6.595
14	Iceland	8,5	4.581	82,3	0,7	1.487	2.876
15	Ireland	7,1	5.449	81,8	3,0	1.976	3.404
16	Israel	7,4	2.834	82,5	3,1	1.744	3.072
17	Italy	8,9	3.542	83,3	2,8	1.690	2.965
18	Japan	10,7	4.717	84,1	2,0	1.601	2.923
19	Korea	7,6	2.897	82,4	2,8	1.682	3.488
20	Latvia	6,3	1.722	74,7	3,7	3.471	9.571
21	Luxembourg	6,1	6.475	82,8	3,8	1.255	2.881
22	Mexico	5,4	1.034	75,2	12,1	4.604	8.297
23	Netherlands	10,1	5.386	81,6	3,5	2.140	2.846
24	New Zealand	9,0	3.683	81,7	5,7	2.429	3.756
25	Norway	10,4	6.351	82,5	2,2	1.711	2.782
26	Poland	6,7	1.955	78,0	4,0	2.685	6.749
27	Portugal	9,0	2.888	81,2	3,2	1.890	4.296
28	Slovak Republic	7,1	2.269	77,3	5,4	2.855	6.397
29	Slovenia	8,0	2.775	81,3	2,0	1.827	3.994
30	Spain	8,8	3.371	83,4	2,7	1.620	3.112
31	Sweden	10,9	5.511	82,4	2,5	1.775	2.856
32	Switzerland	12,3	8.009	83,7	3,6	1.777	3.047
33	Turkey	4,2	1.194	78,0	10,0	2.985	5.013
34	United Kingdom	9,6	4.246	81,2	3,8	2.324	3.677
35	United States	17,2	10.209	78,6	5,9	3.524	5.909
Mean		8,9	4.048	80,8	3,9	2.247	4.296
Standard Deviation		2,353	1983,451	2,405	2,186	686,194	1671,220
Minimum		4,2	1.034	74,7	0,7	1.255	2.782
Maximum		17,2	10.209	84,1	12,1	4.604	9.571
Goal		Min	Min	Max	Min	Min	Min

C1: Current expenditure on health, % of gross domestic product; **C2:** Current expenditure on health, per capita, US$ purchasing power parities, **C3:** Life expectancy total population at birth, years, **C4:** Infant mortality deaths per 1 000 live births; **C5:** Potential years of life lost, all causes, years lost, /100 000 females, aged 0-69; **C6:** Potential years of life lost, all causes, years lost, /100 000 males, aged 0-69

In this context, multidimensional analysis of the health expenditure and outcome variables used in the research was carried out by 35 OECD countries. As clearly shown in Figure 1, Japan has the highest life expectancy and the lowest infant mortality rate by spending $ 4717 per person. However, although the US spends $ 10,209 per person in health, life expectancy is below the OECD average and infant mortality rate is above the OECD average. Mexico and Turkey are the lowest per capita health expenditures in the OECD countries. When the health outcomes of these two countries are examined, life expectancy is below the OECD average.

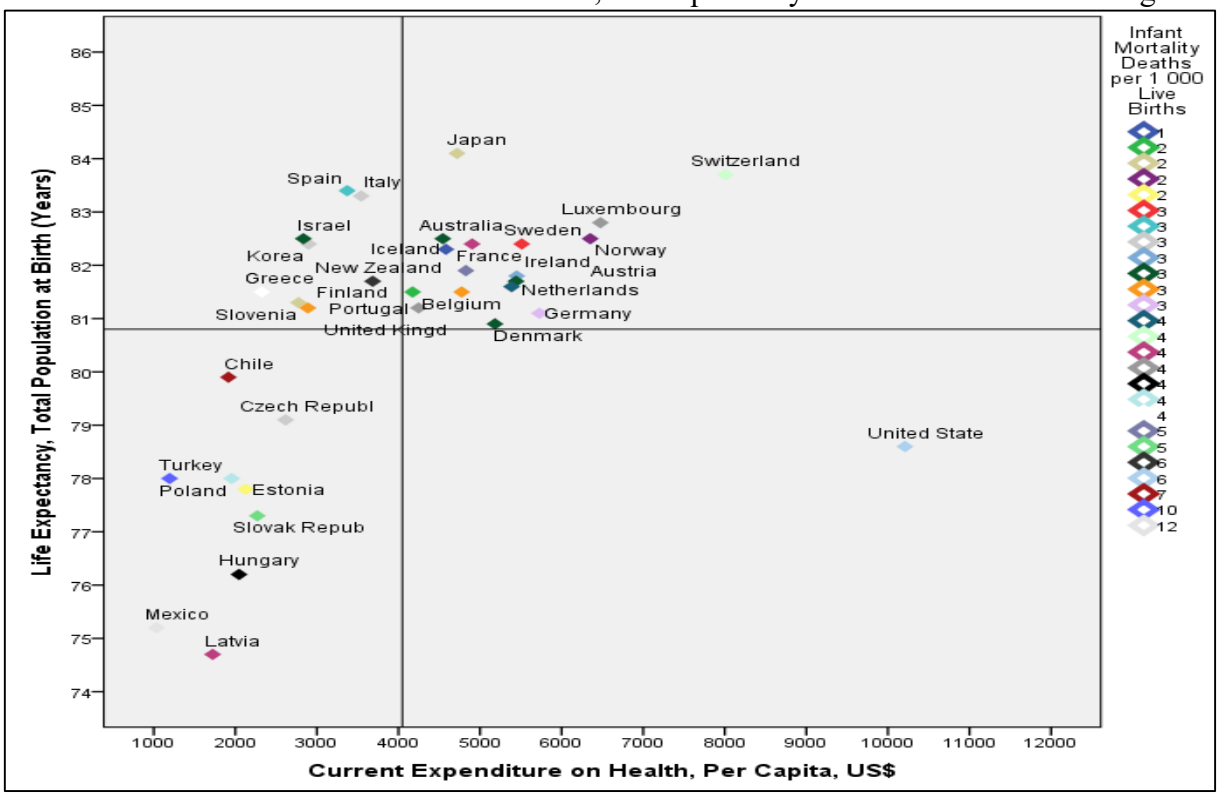

Figure 1. Multidimensional Analysis of Life Expectancy and Expenditure Indicators

Health levels of societies; health indicators such as life expectancy at birth, infant mortality rate and year of life lost are measured. In this context, the results of the multidimensional analysis of the health outcomes of OECD countries by research variables are shown in Figure 2. The countries where infant mortality rates and the year of life lost are high and life expectancy is low have been identified as Mexico, Latvia, Hungary, Poland, Turkey, Chile, United States and Slovak Republic.

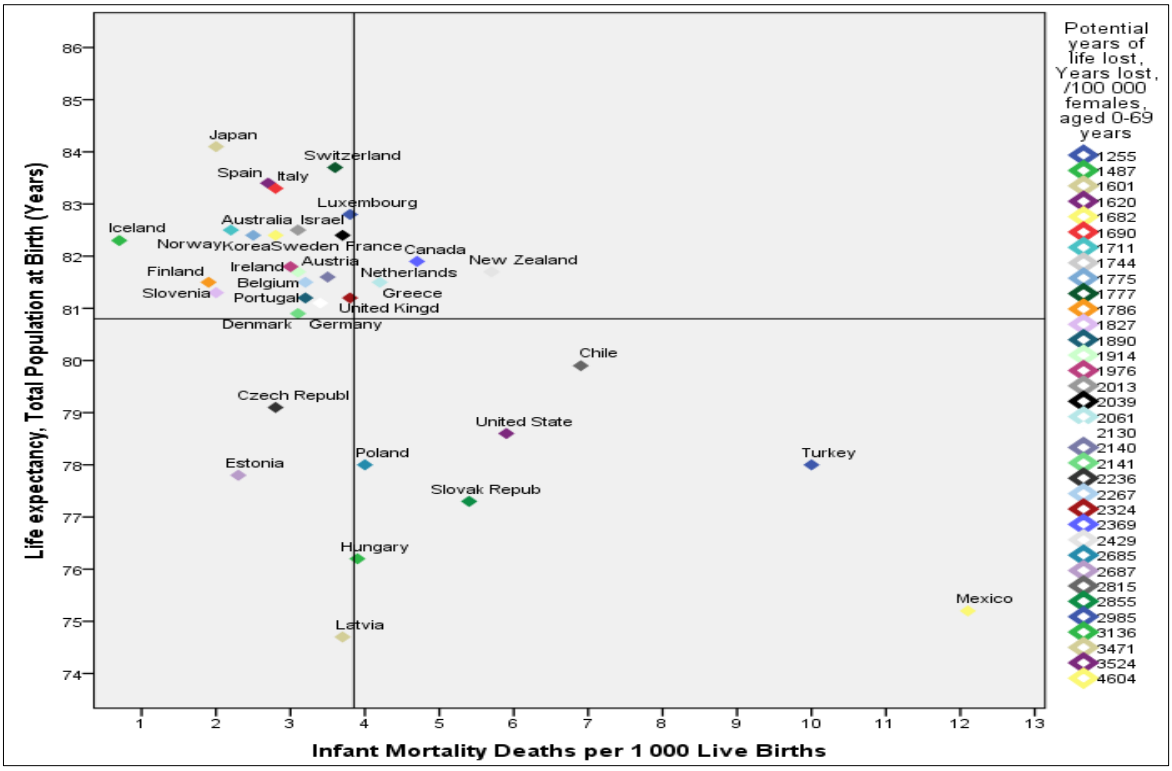

Figure 2. Multidimensional Analysis of Life Expectancy and Infant Mortality Deaths

In the second step, a normalized decision matrix was created according to the formulas mentioned in the literature. In the third step, weighting was made in the decision matrix. Equal weight was given to each of the evaluation criteria used in the analysis. In the fourth step after weighting, ideal and negative ideal solution values were calculated. According to the characteristics of health indicators, C3 criterion was maximum and the other criteria were minimum values. As a result of the calculations, both ideal distances and negative ideal distances were calculated based on the solution values. In the research, the calculation tab les made in steps 2-3-4 are given as an additional table at the end of the article.

In the fifth step, after calculating the ideal and negative ideal distances for each decision unit, Ci ideal solution relative proximity values were calculated. In the sixth step, performance ranking of OECD countries according to TOPSIS method was performed (Table 2). According to this method, the value which is close to 1 in C_i^* represents the country with the best performance, while the scores close to 0 represent the country with the worst performance.

With respect to the findings of the research data, the average performance score of OECD countries was found to as 0.6900. According to health expenditure and outcomes indicators, Solovenia (0.8250), Korea (0.8155) and Israel (0.8113) was found to have the highest performance scores, while the United States (0.3597), Mexico (0.4319) and Turkey (0.5481) was determined to have the lowest performance scores (Table 2).

Health spending is the lowest in Turkey and the highest in United States. Since these countries' health outcome values were not at the desired level, the country scored the lowest in the performance rankings.

Table 2. Ranking of OECD Countries by TOPSIS Analysis Results

No	Country	Si+	Si-	Ci	Rank
1	Australia	0,03230	0,08695	0,7291	12
2	Austria	0,03774	0,08432	0,6908	21
3	Belgium	0,03609	0,08330	0,6977	17
4	Canada	0,04226	0,07635	0,6437	28
5	Chile	0,04787	0,07610	0,6139	30
6	Czech Republic	0,02456	0,09236	0,7900	6
7	Denmark	0,03707	0,08420	0,6943	18
8	Estonia	0,03399	0,09109	0,7282	13
9	Finland	0,02756	0,09310	0,7716	8
10	France	0,03992	0,07998	0,6671	25
11	Germany	0,04216	0,07970	0,6541	26
12	Greece	0,03004	0,08779	0,7451	10
13	Hungary	0,04005	0,08325	0,6752	24
14	Iceland	0,02595	0,10167	0,7967	4
15	Ireland	0,03389	0,08743	0,7207	14
16	Israel	0,02220	0,09544	0,8113	3
17	Italy	0,02571	0,09371	0,7847	7
18	Japan	0,03194	0,09325	0,7449	11
19	Korea	0,02160	0,09547	0,8155	2
20	Latvia	0,05358	0,08370	0,6097	31
21	Luxembourg	0,03983	0,08839	0,6893	22
22	Mexico	0,08986	0,06832	0,4319	34
23	Netherlands	0,03882	0,08347	0,6826	23
24	New Zealand	0,04176	0,07696	0,6482	27
25	Norway	0,03985	0,08918	0,6912	20
26	Poland	0,03772	0,08494	0,6925	19
27	Portugal	0,02735	0,08984	0,7666	9
28	Slovak Republic	0,04359	0,07800	0,6415	29
29	Slovenia	0,02057	0,09698	0,8250	1
30	Spain	0,02452	0,09458	0,7941	5
31	Sweden	0,03715	0,08854	0,7044	15
32	Switzerland	0,05388	0,07821	0,5921	32
33	Turkey	0,06440	0,07813	0,5481	33
34	United Kingdom	0,03562	0,08241	0,6982	16
35	United States	0,08422	0,04732	0,3597	35

S^+: Creating positive ideal solutions; S^-: Negative ideal solutions; C_i^* : Alternatives to the ideal solution relative to the proximity.

4. DISCUSSION

One of the most discussed issues in measuring performance in the health system is why countries with similar income levels have different health outcomes (De Silva, 2000:1). In the same way, the health outcomes of countries that spend a lot of health may be lower than those that spend less (Blendon et al., 2001: 10). It is argued that there is a strong link between health and economic development worldwide. Having a strong economy brings with it high health outcomes (Adil et al., 2016: 83–84).

With respect to the findings of the research data, the average performance score of OECD countries was found to as 0.6900. According to health expenditure and outcomes indicators, Solovenia (0.8250), Korea (0.8155) and Israel (0.8113) was found to have the highest performance scores, while the United States (0.3597), Mexico (0.4319) and Turkey (0.5481) was determined to have the lowest performance scores. The reason for the difference in

performance among countries is that some countries' performance indicators are very low or very high compared to the average.

In a study conducted by Portafke (2010), health expenditures increased by 0.4% for a 1% increase in GDP per capita. Payne et al. (2007) found that increasing life expectancy had a significant effect on health expenditures. In this case, if the morbidity does not decrease, the increased life expectancy may constitute a pressure factor for health expenditures (Asandului et al., 2014:261). Rivera (2010) emphasizes that investing in preventive treatments may be an important factor in terms of health expenditures. Like investments in all other sectors, spending on health care and health is future-focused (Tüylüoğlu and Tekin, 2009:10). Health expenditures provide for the improvement of the workforce by reducing early death, disability and disease, and are therefore considered investment expenditures (Paglin, 1974:432).

The performance evaluation of the OECD country health system was analyzed by Çelik et al. (2017:279). In the study, it was found that countries' achieving better health outcomes were associated with higher productivity. Although the marginal productivity of inputs on health outcomes decreased, some developed countries and developing countries found that inefficiencies in the use of health inputs were reduced. There is no systematic relationship between the political system of countries and the effectiveness of the health system. Countries' goals on social and health policy and the way to achieve them are a factor that increases the efficiency of health systems(Çelik, Khan, Hikmet, 2017:279-280).

One of the country's health system performance indicators is the disability-adjusted life years (DALY). DALYs is a measure of the burden of disability-causing disease and injury. DALY consists of two components, years lived with disability and years of lost lived (Yiğit and Yiğit, 2019: 228). In this research, YL was used to measure the performance of OECD countries. The health system performance of the countries with low YLL was found to be higher than the other countries.

5. CONCLUSION

When the performance of OECD countries is evaluated according TOPSIS, the reason for the difference in performance among countries is that some countries ' performance indicators are very low or very high compared to the average. For example, infant mortality rates are the two highest (Turkey and Mexico) in 35 OECD countries. Turkey in the last 10 years in the infant mortality rate significant gains have been achieved and infant mortality has been considerably reduced but has not yet reached the desired level.

Improving performance of health sector is of particular importance in all countries. As a result of the improvements in health services, life expectancy at birth increases and infant mortality rate decreases. Financing is one of the basic elements determining the structure of health services in health systems. In terms of health expenditure is one of the most important factors affecting health outcomes. In addition to health expenditure, many factors influence health outcomes, such as tobacco and alcohol use, access to health services, quality of health services, education, employment, income level, community safety, air and drinking water quality. The health level of the individual and the society is also an indicator of the level of development of the country. It is also accepted that the health of the individual and society is a function of the environment. One of the factors affecting the health system performance of the countries is the policies that the governments will set for improving the health system.

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