RESEARCH ARTICLE

AVAILABILITY OF HEALTH RESOURCES: A COMPARISON OF TURKEY AND SELECTED OECD COUNTRIES

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ABSTRACT

Indicators of resources in a country's healthcare system can be considered as important determinants of access to health. This study makes a comparison between Turkey and selected OECD countries in terms of the "availability" dimension, which is one of the physical dimensions of access to healthcare. For this purpose, ten indicators of health resources (number of physicians, nurses, midwives, pharmacists, dentists, physiotherapists, hospitals and hospital beds per one thousand people, the number of Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) devices per one million people, and current health expenditures per capita (PPP,$) were used as measurement criteria. The study includes 29 OECD countries that shared data for 2018. For the countries that did not share data for 2018, data for the year of the last shared was used. The health statistics databases of OECD and the World Health Organization (WHO) were used to obtain data. The TOPSIS method, which is a multi-criteria decision-making method was used to analyze the data. According to the research findings, Japan (0.712) ranks first, and Turkey (0.084) ranks last among the 29 countries. Japan is followed by developed countries such as Germany (0.519) and United States (0.467). Compared to other countries of similar socio-economic status, Turkey has fewer resources per capita. As a result, comparisons with different countries are important in the health-related resource planning process.

Keywords: *Access to healthcare, health resources, availability, Turkey, OECD*

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ARAŞTIRMA MAKALESİ

SAĞLIK KAYNAKLARININ KULLANILABİLİRLİĞİ: TÜRKİYE VE SEÇİLİ OECD ÜLKELERİNİN KARŞILAŞTIRILMASI

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ÖZ

Bir ülkenin sağlık sistemindeki kaynakların göstergeleri, sağlığa erişimin önemli belirleyicileri olarak kabul edilebilir. Bu çalışma, sağlık hizmetlerine erişimin fiziksel boyutlarından biri olan "kullanılabilirlik" boyutu açısından Türkiye ile seçili OECD ülkeleri arasında bir karşılaştırma yapmaktadır. Bu amaçla on sağlık kaynağı göstergesi (her bin kişiye düşen hekim, hemşire, ebe, eczacı, diş hekimi, fizyoterapist, hastane ve hastane yatak sayısı, bir milyon kişiye düşen Bilgisayarlı Tomografi (BT) ve Manyetik Rezonans Görüntüleme (MRG) cihazı sayıları ve kişi başı cari sağlık harcaması (SGP, $)) ölçüm kriteri olarak kullanılmıştır. Çalışma, 2018 yılı için veri paylaşan 29 OECD ülkesini içermektedir. 2018 yılı için veri paylaşmayan ülkeler için son bildirimde bulunduğu yıla ait veriler kullanılmıştır. Veri elde etmek için OECD ve Dünya Sağlık Örgütü (WHO) sağlık istatistikleri veri tabanları kullanılmıştır. Verilerin analizinde çok kriterli bir karar verme yöntemi olan TOPSIS yöntemi kullanılmıştır. Araştırma bulgularına göre 29 ülke arasında ilk sırada Japonya (0,712), son sırada ise Türkiye (0,084) yer alıyor. Japonya'yı Almanya (0,519) ve ABD (0,467) gibi gelişmiş ülkeler takip etmektedir. Benzer sosyo-ekonomik statüye sahip diğer ülkelerle karşılaştırıldığında, Türkiye kişi başına daha az kaynağa sahiptir. Sonuç olarak, sağlıkla ilgili kaynak planlama sürecinde farklı ülkelerle yapılan karşılaştırmalar önemli görülmektedir..

Anahtar Kelimeler: *Sağlık hizmetlerine erişim, sağlık kaynakları, kullanılabilirlik, Türkiye, OECD*

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I. INTRODUCTION

Access to healthcare is one of the policy areas that maintains its importance on the agenda of health policy makers, planners, health managers and those who demand healthcare services. Access is considered an important developer of the health of the total population in a given region (Kanuganti et al., 2016). The planning, allocation and positioning of resources such as labor force, technology, finance and health facilities in a country's health system are at the heart of problems related to access. Lack of adequate resources has a negative impact on access to healthcare services in many countries (Aday and Andersen, 1974). Furthermore, the lack of a clear measure of resource adequacy is one of the difficulties that decision makers face while making policies. However, comparing the proportion of labor force, technology and financial resources per a particular population in one country with another or a particular group of countries can provide insight. These indicators, which allow us to comment on health system performance, may be an important measure of healthcare accessibility in cross-country benchmarks. However, the number of studies in this area is limited. To this end, this study compares the accessibility performance of OECD countries to healthcare services based on labor force, technology and financial resources per a specific population.

Although accessibility can be measured through existing sources with cross-country benchmarks, the diversity of these sources can make benchmarking difficult. For this reason, multi-criteria decision-making methods are used in cross-country benchmarking studies in different areas. These methods are generally preferred because they facilitate benchmarking by more than one criterion. The TOPSIS method, one of the multi-criteria decision-making methods, was preferred in this study for mathematical practice as it is simple, flexible and makes it easy to choose among alternatives.

II. CONCEPTUAL FRAMEWORK

Access to healthcare services, which is the main objective of health policy and planning (Andersen et al., 1983), is based on meeting health needs of individuals and it has an important place within political goals at national and international levels (McGrail, 2012). For example, the eighth global objective set in the "health for all" policy of the World Health Organization is providing access to comprehensive, essential, healthcare services (WHO, 1999). The third basic component out of the eight components determined for the health system objectives in the Health Transformation Program that was put into practice by the Ministry of Health in 2003 in Turkey indicates the importance of access to healthcare services within the scope of an comprehensive, easily accessible and gentle health system (Akdağ, 2007). On the other hand, the main objectives of the health policies in OECD countries include encouragement of access to healthcare services (Docteur and Oxley, 2003). Therefore, access to healthcare services is an important component of all health systems and has a direct impact on the disease burden of many countries in the developing world (Black et al., 2004).

The fact that the concept of access is often used in conjunction with concepts such as "fairness" and "equality" shows its importance. In this context, fairness in healthcare can be measured by access to healthcare, along with other indicators (Waters, 2000), and the concept of fairness constitutes the main purpose of access to healthcare services for most healthcare systems (Goddard and Smith, 2001). It is also suggested that according to the basic principle of fairness in healthcare, people should have equal access to healthcare services (Ursulica, 2016).

Measuring access to healthcare services contributes to a more comprehensive understanding of health system performance and facilitates development of evidence-based health policies among countries (Black et al., 2004). Furthermore, it is possible to comment on the health system performance of a particular region by measuring access (Kanuganti et al., 2016). However, this may differ depending on how access is defined and what dimensions are addressed.

There are different definitions of access, and there is not a single and common definition. In this context, different definitions of access as follows: presence of appropriate, affordable and high quality healthcare facilities for the current population and the basic necessity for a healthcare system in a country

(Kanuganti et al., 2015), providing health care services needed by the society or individuals in an equal, qualified manner and free of charge (Kurt, 2007), opportunities of individuals to access the healthcare services they may need at anytime, anywhere and at a satisfactory level under the current conditions for offering healthcare services (Gözlü and Tatlıdil, 2015), beyond pure existence or availability of resources, qualities of such resources that facilitate use by potential customers (Frenk, 1992), the presence of a complicated relationship between the spatial distribution of population and supply of healthcare facilities, which refers to spatial and physical accessibility (Kanuganti et al., 2016) and presence of resources in the finance and healthcare system of a region (Aday and Andersen, 1974). Based on these definitions, it is possible to say that the desired level of access can be achieved by meeting supply and demand under appropriate conditions (such as appropriate place and time, sufficient quantity and quality, and low cost) and this depends on the existence of resources.

The dimensions of access within the framework of healthcare supply and demand focus on two main themes. Access may be related to qualities of the population (household income, insurance coverage, attitudes towards medical care etc.) in terms of demand, and the service delivery system (distribution and organization of health manpower and health facilities) in terms of supply while it may also be related to the outcomes resulting from the interaction of these two elements, i.e., service usage and patient satisfaction (Aday and Andersen, 1974; Andersen et al., 1983; Frenk, 1992; Levesque et al., 2013). What these approaches have in common can be seen as their presentation of access in the form of features of a patient-oriented service delivery system in general.

There are some dimensions used for measurement of access such as "geographic distribution", "affordability", "suitability", "timeliness", "acceptability", and "availability" are reported as characteristics of patient-oriented service delivery systems in the literature. "Geographic distribution", i.e. the geographic accessibility, refers to the fact that factors such as distance of suppliers to the population, transportation opportunities of the population and transportation time do not prevent reception of services (Aday and Andersen, 1974; Black et al., 2004; Dursun et al., 2011; Onega et al., 2008; Peters et al., 2008; Russell et al., 2013); "affordability" refers to the fact that patients are not deprived of services due to high prices or do not incur alternative expenses due to the time spent apart from the fact that patients can pay for direct and indirect expenses (Levesque et al., 2013; Russell et al., 2013); "suitability" refers to the organization of supply resources enabling patients to enter and move within the healthcare system (Russell et al., 2013); "timeliness" refers to delivery of services in the time of need, i.e. enabling patients to enter the healthcare system and receive services in a timely manner, and to ensure its continuity (Onega et al., 2008; Peters et al., 2008; Russell et al., 2013); "acceptability" refers to social and cultural characteristics shaping the attitudes and beliefs of service suppliers and patients towards health, and the aspects of these characteristics that affect delivery and reception of services (Aday and Andersen, 1974; Liao et al., 2011; Peters et al., 2008; Russell et al., 2013); "availability" refers to fulfillment of consumer requirements through the physical entity of sufficient amount of healthcare facilities and suppliers (Aday and Andersen, 1974; Russell et al., 2013).

The "availability" dimension is frequently discussed as one of the features of access and for measurement of access. Typically, this measurement is performed using indicators such as the number of physicians, hospitals, and hospital beds etc. per population in a region (Andersen et al., 1983; Black et al., 2004; Kanuganti et al., 2016; Levesque et al., 2013; Peters et al., 2008; Russell et al., 2013; Shengelia et al., 2003; Wang and Luo, 2005). For example, Andersen et al. defined availability as the number and distribution of medical resources in a region and determined indicators such as the number of physicians per population, the number of beds per population and the number of dentists per population etc. for measurement of access. Peters et al. (2008) compared the access performance of countries using the data of the number of hospital beds for 10,000 people, the number of physicians for 1,000 people, the number of nurses for 1,000 people and classified these data as available (Peters et al., 2008). Onega et al. used the number of oncologists per 100,000 people to measure the accessibility of cancer care centers by cancer patients in the United States (Onega et al., 2008). Wang and Pan used the number of doctors, health workers and hospital beds per a certain population to measure spatial accessibility in a region in China (Wang and Pan, 2016). Similarly, Kanuganti et al. (2016) used physician and hospital numbers per a certain population for measurement of spatial accessibility (Kanuganti et al., 2016).

As can be seen, health resources in a particular region are used to measure the access or accessibility of that region. The aim of this study is to demonstrate the performance of Turkey and selected OECD countries in access to health services within the context of the “availability” dimension. The TOPSIS method we used for this purpose is explained below.

III. METHOD

3.1. Study design and sampling

A cross-sectional data set was used based on the 2018 health statistics data of OECD and World Health Organization (WHO). The study was limited to 29 countries because the data from seven OECD countries (Belgium, Denmark, Mexico, Norway, Portugal, Sweden, Switzerland, Columbia) was incomplete.

3.2. The aim of the study

The aim of this study is to make a comparison between Turkey and selected OECD countries in terms of per capita health resources and provide policy recommendations by evaluating the results in the context of access to health services.

3.3. Dataset

The dataset includes ten indicators: the numbers of physicians, nurses and midwives, pharmacists, dentists, physiotherapists, and hospital beds per one thousand people, the numbers of hospitals, computed tomography (CT), and magnetic resonance imaging (MRI) devices per one million people, and current health expenditures per capita (PPP,$). In this context, we obtained data about 29 countries that shared all available actual data.

3.4. The TOPSIS Method

We used the TOPSIS Method for selecting the country with the best resource structure. There are many multi-criteria decision-making techniques used in different fields such as TOPSIS, ELECTRE, Fuzzy TOPSIS, AHP, Fuzzy AHP, the Point-Factor method, and ANP etc. The TOPSIS method which was preferred in this study as it enables the use of qualitative and quantitative data together was developed by Hwang and Yoon as an alternative to other multi-criteria decision-making methods. The method is based on the principle that the alternatives are in minimum distance to the positive ideal solution and maximum distance to the negative ideal solution in geometric terms (Uzun and Kazan, 2016). This method can be applied directly on data without a qualitative cycle (Eleren and Karagül, 2008). The TOPSIS method, which is usually used to list the alternatives in cases where a decision is needed, determines a solution closest to the ideal solution and furthest from the negative ideal solution while considering the relative importance of these distances (Cristóbal, 2012). The TOPSIS method is one of the most widely used techniques in the literature due to its advantages such as rationality, comprehensibility, ease of calculation, and its ability to enable weighting of evaluation criteria (Amiri et al., 2011; Çakır and Perçin, 2013).

The TOPSIS method is used for different purposes in both national and international literature regarding the health sector. In this context, it is possible to come across studies that have completely production-oriented purposes such as doing research for selection of a total production strategy suitable for hospital supply chain management (Liao et al., 2011), evaluating medical device suppliers (Tadić et al., 2014), proposing models for optimal city selection for health facilities (Lin and Tsai, 2010), proposing models for alternatives for disposal of medical waste (Tadić et al., 2014) etc. Similarly, there are studies conducted with the TOPSIS method in areas such as determining the appropriate strategy for

Iranian Health Tourism (Asadi and Daryaei, 2011) and evaluating Turkey's health tourism performance (Bulut and Durur, 2017). In addition, this method has been used in many areas such as selecting the most appropriate website for electronic patient registration and healthcare services (Ahmadi et al., 2013; Büyükozkan et al., 2011), evaluating the service quality based on the process of healthcare service delivery (Akdağ et al., 2014), the problems of the elderly patients in the outpatient admission process (Kuo et al., 2012) and listing the indicators of access to healthcare among cities (Hossein et al., 2012) etc.

The TOPSIS Method notations used in stages are described below (Özdemir, 2015).

Step 1, Creating the Decision Matrix: The decision maker creates an mxp-sized matrix in this step. Decision points (alternatives) are shown in the rows of the matrix while the columns contain the factors (criteria) used to list the decision points.

$$A_{ij} = \begin{vmatrix} a_{11} & a_{12} & \cdots & a_{1p} \\ a_{21} & a_{22} & \cdots & a_{2p} \\ \cdot & \cdot & \cdots & \cdot \\ \cdot & \cdot & \cdots & \cdot \\ a_{m1} & a_{m2} & \cdots & a_{mp} \end{vmatrix} \tag{1}$$

Step 2, Normalization of The Decision Matrix: The squares of each a_{ij} value in the decision matrix are added together to obtain the total column values in this step. Then, the normalization process is performed by dividing each a_{ij} value by the square root of the sum of the columns in which it is located.

$$N_{ij} = \frac{a_{ij}}{\sqrt{\sum_{i=1}^{m} a_{ij}^2}} \ (\mathbf{i = 1, \ldots, m \text{ and } j = 1, \ldots, n}) \ \rightarrow \ N_{ij} = \begin{vmatrix} n_{11} & n_{12} & \cdots & n_{1p} \\ n_{21} & n_{22} & \cdots & n_{2p} \\ \cdot & \cdot & \cdots & \cdot \\ \cdot & \cdot & \cdots & \cdot \\ n_{m1} & n_{m2} & \cdots & n_{mp} \end{vmatrix} \tag{2}$$

Step 3, Calculating the Weighted Normalized Decision Matrix: In this stage, the "*V*" matrix is created by multiplying each "n_{ij}" value in the normalized matrix by a weight like "w_i". It must be made sure that the sum of the "w_i" values equals "1".

$$N_{ij} = \begin{vmatrix} w_1 n_{11} & w_2 n_{12} & \cdots & w_n n_{1p} \\ w_1 n_{21} & w_2 n_{22} & \cdots & w_n n_{2p} \\ \cdot & \cdot & \cdots & \cdot \\ \cdot & \cdot & \cdots & \cdot \\ w_1 n_{m1} & w_2 n_{m2} & \cdots & w_n n_{mp} \end{vmatrix} \rightarrow V_{ij} = \begin{vmatrix} v_{11} & v_{12} & \cdots & v_{1p} \\ v_{21} & v_{22} & \cdots & v_{2p} \\ \cdot & \cdot & \cdots & \cdot \\ \cdot & \cdot & \cdots & \cdot \\ v_{m1} & v_{m2} & \cdots & v_{mp} \end{vmatrix} \tag{3}$$

Step 4, Determining the Positive and Negative Ideal Solution Values: The point that must be considered while determining the ideal solution values is that the maximization (maximum) or minimization (minimum) objective determined for each criterion is taken into account. For example, the maximization objective determined for a criterion requires that the positive ideal value in the column of that criterion be the highest value. In this case, the negative ideal value will be the smallest value in the column. In a reverse situation, the minimization objective determined for the criterion requires the selection of the smallest value for the positive ideal value and the highest value for the negative ideal value.

$$A^* = \left\{\max v_{jj} \mid j = 1, \ldots, p \,;\, i = 1, \ldots, m\right\} \quad \rightarrow A^* = \{v_1^*, v_2^*, v_3^*, \ldots, v_n^*\} \tag{4}$$

$$A^- = \{\min vij \mid j = 1, \ldots, p \,;\, i = 1, \ldots, m\} \quad \rightarrow A^- = \{v_1^-, v_2^-, v_3^-, \ldots, v_n^-\} \tag{5}$$

Step 5, Calculating the Distances to Positive and Negative Ideal Solution Values: The equation used in Euclidean distance calculation is used while calculating the distance to positive and negative ideal points. Euclidean distance is used to determine the distance between two points in the coordinate plane. This calculation is made according to Equation (6).

$$d_{ij} = \sqrt{\sum_{k=1}^{p} \left(x_{ik} - x_{jk}\right)^2} \rightarrow (\textbf{Euclidean dist.})$$

$$S_i^* = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^*\right)^2} \ (positive\ dist.) \ \ \& \ \ S_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^-\right)^2} \ (negative\ dist.) \quad (6)$$

Step 6, Calculating the Relative Proximity to the Ideal Solution: Distances to ideal and non-ideal points are used to calculate the relative proximity of each decision point to the ideal solution. This proximity is indicated by "C_i^*". The "C_i^*" value is between 0 and 1. If this value is equal to 1, it shows absolute closeness to the ideal solution whereas if it is equal to 0, it shows absolute closeness to the negative ideal solution. In this stage, the relative proximity to the ideal solution value is calculated by dividing the negative ideal distances by the sum of the ideal and negative ideal distances.

$$C_i^* = \frac{S_i^-}{S_i^- + S_i^*} \quad (7)$$

IV. RESULTS

4.1. Implementation of TOPSIS Method

This section contains the steps for the implementation of the method. Only some tables that are considered important are included so as not to take up too much space.

Step 1: Table 1 was used for the decision matrix according to Equation (1). The columns of the table show the decision criteria. These criteria include ten health resource indicators related to health workforces (physicians, nurses-midwives, pharmacists, dentists, physiotherapists per thousand people), medical technologies (MR and CT devices per million people), health facilities (hospitals per million people and hospitals per thousand people) and health expenditures (current health expenditure per capita (PPP, $)) dimensions. The rows of the table show the decision points (countries) that are ranked based on the decision criteria.

Table 1. Decision Matrix Table

	Countries	k1	k2	k3	k4	k5	k6	k7	k8	k9	k10
a1	Australia	3.87 (2017)	12.55 (2017) *	1 (2017)	0.61 (2017)	0.95 (2017)	55.89 (2016)	3.84 (2016)	67.2 (2018)	14.07 (2018)	5005.316 (2018)
a2	Austria	5.17 (2017) *	7.09 (2017) *	0.71 (2016) *	0.57 (2016) *	0.44 (2017)	30.8 (2017)	7.37 (2017)	28.64 (2017)	22.96 (2017)	5395.106 (2018)
a3	Canada	2.76 (2018)	9.95 (2017) *	1.08 (2017)	0.64 (2017)	0.61 (2017)	19.67 (2017)	2.5 (2018)	15.51 (2018)	10.18 (2017)	4974.33 (2018)
a4	Chile	2.59 (2018) *	12.14 (2017) *	0.47 (2016) *	0.16 (2016) *	1.54 (2018)	19.48 (2017)	2.11 (2017)	24.27 (2017)	12.3 (2017)	2181.726 (2018)
a5	Czech Republic	4.12 (2018) *	8.4 (2017) *	0.68 (2016) *	0.75 (2016) *	0.86 (2017)	24.35 (2017)	6.63 (2017)	15.76 (2017)	9.44 (2017)	3057.615 (2018)
a6	Estonia	4.48 (2018) *	6.53 (2017) *	0.73 (2016) *	0.96 (2016) *	0.36 (2017)	22.77 (2017)	4.69 (2017)	18.22 (2017)	13.66 (2017)	2231.406 (2018)
a7	Finland	3.81 (2016) *	14.74 (2016) *	1.09 (2014) *	0.72 (2014) *	2.07 (2014)	44.84 (2017)	3.28 (2017)	24.51 (2017)	27.39 (2018)	4228.211 (2018)
a8	France	3.37 (2018)	11.16 (2017) *	1.1 (2018)	0.65 (2018)	1.32 (2016)	45.55 (2017)	5.98 (2017)	17.69 (2018)	14.78 (2018)	4964.71 (2018)
a9	Germany	4.64 (2017)	13.24 (2017) *	0.78 (2017)	0.89 (2017)	2.27 (2017)	37.31 (2017)	8 (2017)	35.13 (2017)	34.71 (2017)	5986.43 (2018)
a10	Greece	5.48 (2017) *	3.63 (2017) *	1.05 (2017)	1.22 (2014) *	0.75 (2017)	25.76 (2017)	4.21 (2017)	34.22 (2017)	26.5 (2017)	2238.171 (2018)
a11	Hungary	3.41 (2018) *	6.8 (2017) *	0.75 (2016) *	0.62 (2016) *	0.51 (2017)	16.86 (2017)	7.02 (2017)	9.19 (2017)	4.7 (2017)	2046.777 (2018)
a12	Iceland	3.94 (2018)	15.71 (2017) *	1.09 (2017)	0.83 (2018)	1.75 (2018)	22.96 (2018)	2.91 (2018)	48.79 (2018)	20.09 (2018)	4349.094 (2018)
a13	Ireland	3.3 (2018)	16.1 (2017) *	1.15 (2016) *	0.6 (2015) *	0.65 (2017)	17.89 (2017)	2.96 (2017)	20.5 (2018)	15.18 (2017)	4915.493 (2018)
a14	Israel	3.33 (2018)	5.7 (2017) *	0.92 (2018)	1.08 (2018)	1.24 (2017)	9.58 (2018)	2.99 (2018)	9.69 (2018)	5.18 (2018)	2779.656 (2018)
a15	Italy	4.1 (2017)	6.06 (2017) *	1.2 (2017)	0.83 (2018)	1.01 (2017)	17.56 (2017)	3.18 (2017)	34.71 (2017)	28.61 (2017)	3427.807 (2018)
a16	Japan	2.41 (2016) *	11.95 (2016) *	1.8 (2016) *	0.81 (2016)	1 (2018) [a]	66.39 (2017)	13.05 (2017)	111.49 (2017)	55.21 (2017)	4766.071 (2018)
a17	Korea	2.36 (2017) *	7.12 (2017) *	0.67 (2016) *	0.48 (2016) *	0.69 (2017)	75.55 (2017)	12.27 (2017)	38.18 (2017)	29.08 (2017)	3191.554 (2018)
a18	Latvia	3.44 (2017)	4.75 (2017) *	0.96 (2017)	0.72 (2017)	0.38 (2017)	32.44 (2017)	5.57 (2017)	39.13 (2017)	13.9 (2017)	1748.537 (2018)
a19	Lithuania	4.85 (2017)	7.98 (2017) *	1.04 (2017)	1.03 (2017)	1.19 (2017)	32.88 (2017)	6.56 (2017)	24.21 (2018)	12.37 (2017)	2415.823 (2018)
a20	Luxemburg	3.31 (2017)	12.17 (2017) *	0.86 (2017)	1 (2017)	2.01 (2017)	16.45 (2018)	4.51 (2018)	16.45 (2018)	11.51 (2018)	5070.172 (2018)
a21	Netherland	3.61 (2017) *	11.18 (2017) *	0.29 (2017)	0.57 (2016)	1.92 (2017)	31.81 (2017)	3.32 (2017)	13.48 (2017)	13.02 (2017)	5288.436 (2018)
a22	New Zealand	3.35 (2018)	12.32 (2017) *	0.78 (2018)	0.68 (2016) *	1.07 (2017)	33.92 (2018)	2.61 (2018)	15.62 (2018)	14.8 (2018)	3922.635 (2018)
a23	Poland	2.58 (2017)	5.7 (2017) *	0.8 (2017)	0.38 (2017)	0.7 (2017)	27.86 (2017)	6.62 (2017)	16.88 (2017)	7.93 (2017)	2056.358 (2018)
a24	Slovakia	3.42 (2017)	6.07 (2016) *	0.78 (2017)	0.5 (2017)	0.34 (2017)	24.08 (2017)	5.82 (2017)	17.28 (2017)	9.56 (2017)	2290.33 (2018)
a25	Slovenia	3.16 (2017)	9.97 (2017) *	0.74 (2017)	0.72 (2017)	0.64 (2017)	14.03 (2018)	4.5 (2017)	15.97 (2018)	12.1 (2018)	2859.446 (2018)
a26	Spain	4.17 (2017)	5.73 (2017) *	1.3 (2017)	0.72 (2014) *	1.1 (2017)	16.68 (2017)	2.97 (2017)	18.59 (2017)	16.31 (2017)	3322.619 (2018)
a27	Turkey	1.87 (2017)	2.71 (2017) *	0.36 (2017)	0.35 (2017)	0.05 (2017)	18.9 (2017)	2.81 (2017)	14.77 (2017)	11.01 (2017)	1226.585 (2018)
a28	United Kingdom	2.81 (2018) *	8.22 (2017) *	0.85 (2016) *	0.53 (2016) *	0.42 (2017)	28.82 (2018)	2.54 (2017)	9.46 (2014)	7.23 (2014)	4069.569 (2018)
a29	United States	2.74 (2017)	14.55 (2017) *	0.96 (2017)	0.61 (2018)	0.69 (2017)	17.11 (2016)	2.77 (2016)	44.39 (2018)	39.1 (2018)	10586.084 (2018)

(*) *World Health Organization (WHO) health statistics data repository. (cited 2020 April 10). Available from: http://apps.who.int/gho/data/node.main.HWF. ([a]) World Confederation for Physical Therapy (WCPT). Country Profile Report 2018. (cited 2020 April 10). Available from: https://www.wcpt.org/node/25563. (Others) OECD health statistics database. (cited 2020 April 10). Available from: http://stats.oecd.org/index.aspx?DataSetCode=HEALTH_STAT.*

(**) *Criteria: k1= Physicians per 1000 people, k2= Nurses and midwives per 1000 people, k3= Pharmacists per 1000 people, k4= Dentists per 1000 people, k5= Physiotherapists per 1000 people, k6= Hospitals per 1,000,000 people, k7= Hospital beds per 1000 people, k8= CT devices per 1,000,000 people, k9= MRI devices per 1,000,000 people, k10= Current health expenditure per capita (PPP, $)*

Step 2: The normalization process is performed according to Equation (2) in this step. The normalized decision matrix table is shown in Table 2.

Table 2. **Normalized Decision Matrix Table**

	Countries	k1	k2	k3	k4	k5	k6	k7	k8	k9	k10
a1	Australia	0.198	0.233	0.197	0.155	0.155	0.314	0.127	0.362	0.125	0.220
a2	Austria	0.264	0.131	0.140	0.144	0.072	0.173	0.243	0.154	0.204	0.237
a3	Canada	0.141	0.184	0.213	0.162	0.100	0.111	0.082	0.084	0.090	0.219
a4	Chile	0.132	0.225	0.093	0.041	0.251	0.110	0.070	0.131	0.109	0.096
a5	Czech Republic	0.211	0.156	0.134	0.190	0.140	0.137	0.218	0.085	0.084	0.134
a6	Estonia	0.229	0.121	0.144	0.243	0.059	0.128	0.155	0.098	0.121	0.098
a7	Finland	0.195	0.273	0.215	0.182	0.338	0.252	0.108	0.132	0.243	0.186
a8	France	0.172	0.207	0.217	0.165	0.215	0.256	0.197	0.095	0.131	0.218
a9	Germany	0.237	0.245	0.154	0.225	0.370	0.210	0.264	0.189	0.308	0.263
a10	Greece	0.280	0.067	0.207	0.309	0.122	0.145	0.139	0.184	0.235	0.098
a11	Hungary	0.174	0.126	0.148	0.157	0.083	0.095	0.231	0.050	0.042	0.090
a12	Iceland	0.201	0.291	0.215	0.210	0.286	0.129	0.096	0.263	0.179	0.191
a13	Ireland	0.169	0.298	0.227	0.152	0.106	0.101	0.098	0.111	0.135	0.216
a14	Israel	0.170	0.106	0.181	0.274	0.202	0.054	0.099	0.052	0.046	0.122
a15	Italy	0.209	0.112	0.237	0.210	0.165	0.099	0.105	0.187	0.254	0.151
a16	Japan	0.123	0.221	0.355	0.205	0.163	0.373	0.430	0.601	0.491	0.209
a17	Korea	0.121	0.132	0.132	0.122	0.113	0.425	0.404	0.206	0.258	0.140
a18	Latvia	0.176	0.088	0.189	0.182	0.062	0.182	0.183	0.211	0.124	0.077
a19	Lithuania	0.248	0.148	0.205	0.261	0.194	0.185	0.216	0.131	0.110	0.106
a20	Luxemburg	0.169	0.226	0.170	0.253	0.328	0.093	0.149	0.089	0.102	0.223
a21	Netherland	0.184	0.207	0.057	0.144	0.313	0.179	0.109	0.073	0.116	0.232
a22	New Zealand	0.171	0.228	0.154	0.172	0.175	0.191	0.086	0.084	0.132	0.172
a23	Poland	0.132	0.106	0.158	0.096	0.114	0.157	0.218	0.091	0.070	0.090
a24	Slovakia	0.175	0.112	0.154	0.127	0.055	0.135	0.192	0.093	0.085	0.101
a25	Slovenia	0.161	0.185	0.146	0.182	0.104	0.079	0.148	0.086	0.108	0.126
a26	Spain	0.213	0.106	0.256	0.182	0.180	0.094	0.098	0.100	0.145	0.146
a27	Turkey	0.096	0.050	0.071	0.089	0.008	0.106	0.093	0.080	0.098	0.054
a28	United Kingdom	0.144	0.152	0.168	0.134	0.069	0.162	0.084	0.051	0.064	0.179
a29	United States	0.140	0.270	0.189	0.155	0.113	0.096	0.091	0.239	0.347	0.465

Step 3: The weighting was performed according to Equation (3) in this step. Weighting is the only subjective aspect of the TOPSIS method. As the literature does not include clear information on the importance of resources in the health system for access, each criterion is weighted equally in this step.

Step 4: The positive and negative ideal solution values were determined according to Equation (4) and Equation (5) respectively in this step. Each criterion used in the study is required to be maximum. Therefore, the highest value of each column represents the positive ideal value, while the smallest value represents the negative ideal value. Positive and negative ideal solution values are shown in Table 3.

Table 3. Positive and Negative Ideal Solution Values

	k1	k2	k3	k4	k5	k6	k7	k8	k9	k10
A^*	0.028001	0.029836	0.035479	0.030902	0.037048	0.042489	0.042992	0.060101	0.049062	0.046522
A^-	0.009555	0.005022	0.005716	0.004053	0.000816	0.005388	0.006951	0.004954	0.004177	0.005390

Step 5: The distances to positive and negative ideal values are calculated according to Equation (6) in this step.

Step 6: The ranking of alternatives according to Equation (7) by relative proximity values to the ideal solution is also shown in Table 4. According to the study results, Japan has the best performance among the 29 countries, and it is followed by developed countries such as Germany, United States, Korea, Australia and Finland etc. Turkey, on the other hand, ranks last among the 29 countries with a very low performance value. There is a huge difference between Turkey (0,084) and Japan (0,712) in relative proximity to the ideal solution.

Table 4. Ranking of Alternatives by Relative Proximity Values to the Ideal Solution

Alternatives		Si^-	Si^*	Ci^*	Ranking
a16	Japan	0.097	0.039	0.712	1
a9	Germany	0.066	0.061	0.519	2
a29	United States	0.063	0.072	0.467	3
a17	Korea	0.060	0.072	0.454	4
a1	Australia	0.055	0.068	0.447	5
a7	Finland	0.056	0.073	0.435	6
a12	Iceland	0.054	0.073	0.425	7
a8	France	0.046	0.078	0.369	8
a20	Luxembourg	0.049	0.085	0.365	9
a10	Greece	0.046	0.082	0.360	10
a19	Lithuania	0.044	0.082	0.346	11
a15	Italy	0.042	0.080	0.345	12
a2	Austria	0.041	0.079	0.344	13
a21	Netherlands	0.044	0.088	0.332	14
a13	Ireland	0.040	0.088	0.313	15
a22	New Zealand	0.037	0.088	0.295	16
a26	Spain	0.036	0.089	0.288	17
a18	Latvia	0.033	0.087	0.278	18
a5	Czech Republic	0.033	0.090	0.268	19
a14	Israel	0.035	0.099	0.261	20
a3	Canada	0.032	0.093	0.256	21
a4	Chile	0.033	0.096	0.256	22
a6	Estonia	0.031	0.093	0.251	23
a25	Slovenia	0.028	0.094	0.228	24
a23	Poland	0.026	0.095	0.212	25
a11	Hungary	0.026	0.099	0.209	26
a28	United Kingdom	0.026	0.098	0.208	27
a24	Slovak Republic	0.024	0.096	0.199	28
a27	Turkey	0.010	0.108	0.084	29

V. DISCUSSION AND CONCLUSION

It is possible to consider the health workforce as an important determinant and indicator of access to health (Kanuganti et al., 2016; Levesque et al., 2013; Russell et al., 2013). Some studies performed by focusing on the relationship between the health workforce and health access indicate that the increase in the workforce has been associated with more patient visits (Jin et al., 2017; Jin et al., 2019; Yao et al., 2020).

According to the study results Turkey has a poor performance in terms of health labor force compared to other countries, especially Japan and Germany. There are studies in the national literature supporting the results of this research. Analyzes revealed that the health workforce capacity in Turkey is below the average of many European Union (EU) and OECD member countries (Balçık and Nangır, 2016; Ersöz 2008).

By consideration of the importance of the labor force in healthcare, it is clear that this is one of the issues that need to be resolved rapidly. As a matter of fact, one of the important shortcomings related to the facilitation of access to health services is expressed as the lack of human resources in the 2023 vision of Turkey's Human Resources in Health program (SB, 2011). In order to solve this problem, policies towards health workforce training capacity (such as opening undergraduate programs, student capacity planning) should be reviewed. On the other hand, burnout syndrome is witnessed among health workers in Turkey due to factors such as heavy workload and problems experienced in the working environment (negligence, violence, mobbing) (Akbolat and Işık, 2008). This may have negative effects on the society's view of the profession. For this reason, it is recommended that measures should be taken in order to improve working conditions in hospitals.

The number of hospitals and hospital beds per a given population can be attributed to a social preference aimed at providing more access to hospitals. Generally, the number of hospitals and beds is related to access to health services. The increase in the number of general hospitals and beds can be considered as a sign of a decrease in waiting times and better access to health services (Kumar and Schoenstein, 2013). On the other hand, there is a close relationship between hospital transportation, which is an important access problem, and hospital volumes. The reduction in hospital volume can result in an accessibility problem for some patients because the distance between the patients and hospitals increases. (Hentschker and Mennicken, 2015). Hospital allocation between regions may differ depending on each country. Therefore, the number of general hospitals in each country is accepted as a significant indicator of access to health services for patients, namely resource availability, as measuring the differences in hospital allocation between regions is out of the scope of this study. The findings of this research found out that the number of hospitals and hospital beds in Turkey is lower than most of the OECD countries. These findings are similar to the countries such as Hungary, Ireland, Luxembourg and the United Kingdom, whose countries adopt the central government authority for opening new hospitals and hospital capacity planning (Paris et al., 2010).

MRI and CT devices, replacing old devices such as ultrasound and radiography used for the diagnosis and treatment of disease, are important high-cost hardware tools for health systems (Abedini et al., 2018). Although the use of such equipment is quite convenient in most developed countries, accessing high-technology devices is limited in developing or underdeveloped countries due to purchasing costs, lack of infrastructure or highly specialized personnel (Khaing et al., 2020; Ogbole et al., 2018; Abedini et al., 2018). Such expensive hardware tools are closely dependent on regulatory processes in health systems, quality of service and access to health (Gavurova et al., 2017; Khaing et al., 2020). According to the findings of this study, Turkey has fewer MR and CT devices than most OECD countries. The limited number of such equipment indicates that there may be significant deficiencies in Turkey in effective diagnosis and treatment, which refers to poor access to the health services in Turkey. By considering the decisions taken at the central level about the health investments in Turkey, this study can suggest for the decision-makers to focus on different alternatives. For example, investments in health equipment are generally provided by the hospitals using their own income in Japan, which is ranking at the top in terms of the number of MR and CT devices (Matsumoto et al., 2015).

Inclusive access to health is vital for sustainable social development. Health expenditures can be seen as an important source of information about universal health coverage, thus health access. (Mcintyre et al., 2017). Studies reveal the importance of increasing public expenditures for universal health coverage (Moreno-Serra and Smith, 2015; Reeves et al., 2015). Some studies also suggest that the financial resources allocated to health are related to the income level of the country (Behera and Dash, 2018; Lai, 2018). Health expenditures in high-income countries can provide better health access with a higher level and amount of health technology and more health workforce (Yetim et al., 2020). The findings of this study confirm that most high-income countries (such as Germany, Australia, and Japan) make higher health expenditures but low-income countries such as Turkey (such as Mexico, Chile) have relatively low health expenditures. Moreover, Turkey is at the bottom of ranking within such countries. The performed studies about heath access in Turkey also supports the findings of this study (Ersöz, 2008; Sığırlı et al., 2006; Sungur, 2016). The resources allocated to health in Turkey are generally at a lower level compared to the other OECD countries. This indicates that there may be a problem in the resource-need balance in the country. Therefore, capacity planning and investment policies in health resources in Turkey need to be reviewed based on evidence.

This study evaluates the general resource levels of 29 OECD countries, which complicates of the evaluation the level of access to health for countries. In order to make a better comparison, it is recommended that future studies should comprehensively examine the regional distribution of resources and their impact on health outcomes. However, the comparison of countries is very important in terms of producing evidence-based policies on health. For this purpose, Turkey and OECD countries were compared using the multi-criteria decision-making method in this study. It is possible to conduct very different analyses in very different areas of the health sector with multi-criteria decision-making methods such as TOPSIS. This study was limited to 29 OECD countries and 10 criteria. In the future, researchers can conduct studies using this method in many fields such as service delivery, patient planning, financial assessments, investment location determination, etc. and the results obtained from these studies can be used to make decisions regarding health policies.

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