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EFFICIENCY ANALYSIS AND EVALUATION OF PRIMARY HEALTHCARE SERVICES: AN INTERPROVINCIAL COMPARISON

BİRİNCİ BASAMAK SAĞLIK HİZMETLERİNİN ETKİNLİK ANALİZİ VE DEĞERLENDİRİLMESİ: İLLER ARASI KIYASLAMA

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Abstract

The purpose of performance measurement in healthcare systems is to provide countries with the necessary information to enhance the quality and performance of their healthcare services. This study analyzes the efficiency of primary healthcare services in Türkiye from a province-based perspective using the Data Envelopment Analysis method, identifies inefficient provinces, and provides recommendations. Additionally, it aims to identify the input resources that need to be reduced for inefficient provinces to achieve efficiency after the analysis. The study utilized five input variables and three output variables. The data for these variables were compiled from the 2022 Health Statistics Yearbook published by the Republic of Türkiye Ministry of Health. The average score obtained from the analysis of the provinces' 2022 data using the CCR model was 0.723. Based on this result, 27.7% of the selected resources in Türkiye were not used efficiently in terms of the selected outputs. It was found that, in 2022, only 11 of the 81 provinces, including Adana, Denizli, Mardin, Uşak, Bayburt, Batman, Bartın, Iğdır, Yalova, Osmaniye, and Düzce operated efficiently in the provision of primary healthcare services. Since the efficiency scores of the other 70 provinces were below 1, these provinces were found inefficient in the provision of primary healthcare services.

Keywords: Primary Healthcare Services, Efficiency, Data Envelopment Analysis

Öz

Sağlık sistemlerinde performans ölçümünün amacı, ülkelerin kendi sağlık hizmetlerinin kalitesini ve performansını artırmak için ülkelere bilgi sağlamaktır. Bu çalışma Türkiye'de birinci basamak sağlık hizmetlerinin şehirler bazında Veri Zarflama Yöntemi ile etkinliklerini analiz etmek, etkin olmayan şehirleri tespit etmek ve öneriler geliştirmek amacıyla yapılmıştır. Ayrıca etkin olmayan şehirlerin analiz sonrası etkin konuma geçebilmeleri için azaltılması gereken girdi kaynaklarının miktarlarının tespit edilmesi de hedeflenmiştir. Çalışmada 5 girdi ve 3 çıktı değişkeni kullanılmıştır. Değişkenlere ilişkin veriler Sağlık Bakanlığı tarafından yayınlanan 2022 Sağlık İstatistikleri Yıllığından derlenmiştir. Şehirlerin 2022 yılındaki verilerinin CCR modeliyle analizi sonucunda elde edilen skor ortalaması 0,723 olarak belirlenmiştir. Bu sonuca göre Türkiye'de seçilen kaynakların %27,7'si seçilen çıktılar açısından etkin kullanılmamaktadır. 2022 yılında 81 ilin sadece 11'inin (Adana, Denizli, Mardin, Uşak, Bayburt, Batman, Bartın, Iğdır, Yalova ve Osmaniye) birinci basamak sağlık hizmetleri sunumunda etkin çalıştığı görülmektedir. Diğer 70 ilin etkinlik

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değerleri 1'in altında olduğundan bu illerin birinci basamak sağlık hizmeti sunumunda etkin olmadıkları görülmüştür.

Anahtar Kelimeler: Birinci Basamak Sağlık Hizmetleri, Etkinlik, Veri Zarflama Analizi

INTRODUCTION

Healthcare Services

According to the World Health Organization, healthcare services are a permanent, nationwide organized system that provides healthcare through various curative and preventive actions applied by health personnel in key healthcare institutions to offer healthcare to the community. In Türkiye, healthcare services are defined in Article 2 of Law No. 224 on the Socialization of Health Services, enacted on January 12, 1961. According to this law, healthcare services include medical activities focused on preventing health risks, protecting individuals from harmful factors, ensuring necessary treatment for patients, and supporting the rehabilitation and occupational integration of individuals with physical or mental impairments (Saatçi et al., 2006). All activities aimed at protecting and improving the health of individuals and communities, treating diseases, enabling individuals with disabilities to live independently, and enhancing public health levels fall within the scope of healthcare services.

Primary Healthcare Services

Primary healthcare services (PHCS) refer to an easily accessible, free service delivery model that includes not only diagnosis, treatment, and rehabilitation but also preventive healthcare. In Türkiye, primary healthcare services have continuously evolved from the Republican era to the present, including the socialization of healthcare services, the Health Transformation Program, and the transition to the family medicine model. After the establishment of the Republic of Türkiye, Dr Refik Saydam, appointed as the first Minister of Health, prioritized primary healthcare and preventive health services, implementing a policy that provided general budget resources directly undertaken by the central government. However, he did not consider treatment services as a direct government responsibility; instead, they were largely carried out in collaboration with municipalities and special provincial administrations (Akdur, 2000; Altındağ and Yıldız, 2020). Physicians in preventive healthcare services were offered higher salaries to make employment in these units more appealing. In the organization of healthcare services, a "vertical organization" approach was adopted for combating specific diseases, while "government physician units" were assigned to hospital duties and all other healthcare services not covered by the vertical organization. Government physician units, which offered services such as preventive healthcare, environmental and school health, and free medical examinations for impoverished patients, were the first examples of primary healthcare services of the period (Öztek, 2017). After Saydam's tenure, the Social Security Institution (SSI) was established in 1952, and Maternal and Child Health Services (MCHS) were incorporated into the vertical organization. Between 1950 and 1960, with the transfer of inpatient treatment services to the Ministry of Health, hospital services increased, while the focus on preventive healthcare services decreased. As specialist physicians began receiving higher salaries than general practitioners, doctors providing preventive healthcare services in rural areas were drawn to hospitals in urban centers (Akdur, 2000; Öztek, 2017). Along with these developments, Dr. Behçet Uz, who served as the Minister of Health from 1946 to 1947, prepared a health plan. According to this plan, a "health center" was envisioned for approximately 20,000 people in villages, marking the first primary healthcare facility with "health" in its name, and it also aimed to provide both preventive and curative services within these centers (Çağlayaner

and Saatçi, 2007). Although the plan was not implemented, it marked the first introduction of the principle of population-based organization in Türkiye (Öztek, 2017). Following the 1960 military coup, under the leadership of Dr Nusret Fişek, the Undersecretary of the Ministry of Health, the Law on the Socialization of Health Services (Law No. 224) was drafted on January 5, 1961, and this law led to the restructuring of healthcare services, with implementation beginning in 1963 in the province of Muş (Ministry of Health, 2003). The law aimed to establish 300 health houses within one year and 1,500 within five years in Türkiye; however, only 561 became operational (Akalın, 2011). Accordingly, midwives were to reside in the health houses and provide services by visiting villages and homes (Çağlayaner and Saatçi, 2007). Over time, the goal was set to increase the number of health centers and health houses to ensure the community could access healthcare services in the best possible way. The socialization of healthcare services was implemented across Türkiye beginning in early 1984 (Öztek, 2017). The main objectives were outlined in the Emergency Action Plan, announced on November 6, 2002, under the heading "Health for All", which proposed actions to be implemented in healthcare. These objectives included the implementation of family medicine, increasing preventive healthcare, encouraging private sector investment in healthcare, and transitioning to these practices. Following these, the "Health Transformation Program" was prepared and announced to the public by the Ministry of Health at the beginning of 2003 (İleri et al., 2016). One of the key components of the Health Transformation Program, the transformation of primary healthcare services, was discussed at the Ministry of Health's First National Health Congress, and in 2004, the Law on the Pilot Implementation of Family Medicine was adopted and put into practice (Belek, 2012).

Healthcare services are delivered through two units: Family Health Centers (FHCs) and Community Health Centers (CHCs). Since 2003, the implementation of the family medicine system has been a key component of the Health Transformation Program. Since the nationwide implementation of the family medicine system in 2010, family physicians and other healthcare professionals in FHCs have provided individual-oriented healthcare services, including diagnosis, treatment, rehabilitation, and preventive care. CHCs, another component of primary healthcare services, aim to identify health risks and issues in their designated regions and to address or prevent them. As part of the family medicine system's implementation, the standards of primary healthcare units have been enhanced, making healthcare services more accessible and enhancing both the quality and quantity of the services provided. Under the family medicine system, each family physician was assigned responsibility for an average of 3,000 individuals, and FHCs were established with one or more family physicians. For settlements with a population of fewer than 3,000 but facing challenges in accessing healthcare facilities and transportation, single-physician Family Health Centers were established. In order to address staffing challenges, an additional payment system was introduced for personnel working in family medicine.

Performance and Performance Measurement in Healthcare Services

Performance is defined as "the amount of goods or services produced in a particular process". In the literature, performance is functionally associated with concepts such as efficiency, productivity, and output, and is considered a result of the interaction between an individual's ability and motivation (Torrington and Hall, 1995). Another definition describes performance as the production of goods, services, or ideas in accordance with predefined criteria within a task, ensuring the fulfillment of objectives (Pugh, 1991). Performance management is a systematic tool that involves goal setting, evaluation, feedback, and reward processes to help employees realize their potential and achieve more effective results in pursuit of a common objective. Performance management aims to improve the efficiency of organizations, teams, and individuals through strategic planning and execution. Based on these goals and plans, performance management

focuses on continuously monitoring performance, emphasizing the evaluation of employees' performance in relation to organizational objectives, as well as the importance of feedback and goal setting (Helvacı, 2002). Performance measurement is the process of systematically collecting, analyzing, and reporting data to track the resources used, products and services produced, and results achieved by an organization. This definition also emphasizes that performance measurement is a critical indicator in healthcare services (Yenice, 2006). Performance measurement is the method of objectively assessing how tasks are executed within a program during the delivery of healthcare services or procedures (Demirkaya, 2000). According to the World Health Organization, the purpose of performance measurement is to provide countries with data for developing health policies and to establish a solid framework for understanding the relationship between healthcare system organization and outcomes (WHO, 2001; Uğurluoğlu and Çelik, 2005). There are two main reasons for measuring the performance of healthcare systems:

The first reason is to identify deficiencies in healthcare systems and analyze their shortcomings in financial equity, responsiveness to people's expectations, and the achievement of comparable health outcomes; The second is to establish indicators for assessing healthcare systems over time (Silva, 2000). The primary goal of performance measurement in healthcare systems is to equip countries with information to improve the quality and efficiency of their healthcare services (PAHO, 2001). The latest strategy of the WHO for assessing healthcare system performance focuses on three key objectives: enhancing health outcomes, ensuring efficiency, and promoting equity in financing (Murray and Frenk, 2000). Successfully achieving these three objectives requires fulfilling the key functions of service delivery, resource generation, financing, and administration (Uğurluoğlu and Çelik, 2005).

Efficiency

Efficiency analysis, as a key aspect of performance, plays a paramount role within an organizational system. Measuring efficiency indicators at any level is essential for ensuring the effective distribution of resources, fostering technological advancements, enhancing management effectiveness, and supporting continuous improvement and analysis. While efficiency is defined by economists as the capacity to achieve maximum results with minimal effort or cost, in an organizational context, it can also be described as "performing tasks in the most accurate way through any input-output mechanism" (Temür and Bakırcı, 2008). Efficiency assesses whether tasks in businesses align with predetermined objectives, are completed on time, meet quality standards, and are produced in the desired quantity. In other words, it is the process of maximizing efficiency by transforming inputs into outputs to achieve a specific goal (Demir, 2004). The concept of efficiency, which generally refers to being active, effective, and performing a task successfully, also involves comparing production outputs by analyzing the inputs used and the outputs generated by decision-making units within a specific field (Yoluk, 2010).

Data Envelopment Analysis

Data Envelopment Analysis (DEA), a non-parametric, linear mathematical approach, is one of the methods used to assess the relative efficiency of non-profit institutions, organizations, and enterprises. This method enables efficiency measurement in production environments that utilize multiple inputs to generate multiple outputs, without the need for a predefined analytical production function, as required in parametric methods. Unlike classical efficiency analysis, which relies on a single input-output framework, DEA operates on a multiple input-output basis and has been rapidly adopted in both institutional development and practical applications. Research has shown that DEA has been applied across various fields, including hospitals, finance, healthcare, education, sports, courts, police institutions, R&D studies, and telecommunications (Yoluk, 2010).

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By using DEA, the inefficiency levels of decision-making units can be identified, along with the specific resources contributing to inefficiency. This helps managers determine the necessary input reductions or output increases required to improve the efficiency of decision-making units (Behdioğlu and Özcan, 2009).

Input-Oriented CCR Model

CCR models were initially defined based on fractional programming. In a production environment with "m" inputs and "s" outputs, the fractional programming-based CCR model (Charnes, Cooper and Rhodes) is designed to maximize the ratio of weighted inputs to weighted outputs. In the DEA method, all decision-making units (DMUs) have the flexibility to assign weights to inputs and outputs based on their own operational characteristics. However, to prevent DMUs from selecting weights that would make them appear efficient and result in biased outcomes, a constraint has been incorporated into the model, ensuring that the total weighted outputs do not exceed the total weighted inputs, thereby preventing the efficiency score from exceeding 100%. Additionally, all weights must be positive to ensure meaningful and valid efficiency calculations (Özçelik and Öztürk, 2019: 1018). Utilizing the duality property of linear programming, the linear model in Equation (1) is formulated as follows (Cooper, Seiford and Zhu, 2004: 11):

$$F_k=\min Q_k- \{ \sum_{i=1}^{m} S_i^- + \sum_{r=1}^{n} S_r^+ \}$$

$$\sum_{r=1}^{s} [\lambda_j x_{ij} + s_i^- - Q_k X_{ik} = 0] \qquad i = 1, \ldots\ldots\ldots\ldots, m$$

$$\sum_{r=1}^{s} [\lambda_{jk} y_{rj} - s_r^+ - y_{rk} = 0] \qquad r = 1, \ldots\ldots\ldots, s$$

$$\lambda j , si- , sr+ \geq 0 \qquad (1)$$

Super Efficiency Model

In the Super-Efficiency Model developed by Andersen and Petersen in 1993, an efficient DMU is excluded from the efficiency frontier, and its distance from the newly determined efficiency frontier is measured. Among the values obtained from the Super-Efficiency Model, the DMU with the highest efficiency score is regarded as the most efficient unit. The super-efficiency scores calculated for the efficient units are ranked in descending order, creating an efficiency hierarchy among them based on their scores. Since the super-efficiency scores and relative efficiency scores of inefficient decision-making units are equal, their efficiency ranking remains unchanged (Özden, 2008: 178). The super-efficiency model, as formulated in equation (2), is constructed as follows (Andersen and Petersen, 1993: 1262):

$$F_k=\min Q_k$$

$$\sum_{j=1}^{s} [\lambda_j x_{ij} + s_i^- - Q_k X_{ik} = 0] \qquad j \neq k \qquad i = 1, \ldots\ldots\ldots\ldots, m$$

$$\sum_{j=1}^{s} [\lambda_{jk} y_{rj} - s_r^+ - y_{rk} = 0] \qquad j \neq k \qquad r = 1, \ldots\ldots\ldots, s$$

$$\lambda j , si- , sr+ \geq 0 \qquad (2)$$

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METHODOLOGY

This study analyzes the efficiency of primary healthcare services in Türkiye at the province level using the DEA method, identifies inefficient provinces, and provides recommendations for improvement. Additionally, the study aims to identify the input resources that need to be reduced for inefficient provinces to achieve efficiency after the analysis. The efficiency measurement is based on 2022 data from the Ministry of Health's Health Statistics Yearbook.

Determining Input-Output Variables And The DEA Model

The selection of input and output variables that best represent the process is essential for accurately evaluating the efficiency of healthcare services in provinces. In this context, commonly used variables have been identified through a literature review. Additionally, determining the appropriate number of input and output variables is a key consideration in the analysis process. This can directly impact the discriminatory power of the analysis and, consequently, the accuracy of the results. In DEA models, the presence of multiple input and output variables may reduce the ability to differentiate between efficient and inefficient DMUs. In this context, the input-output quantity principle proposed by Banker et al. (1989) and Vassiloglou and Giokas (1990) has been implemented. This principle stipulates that the number of DMUs (n) should be at least three times the total number of outputs (s) and inputs (m), which helps enhance the accuracy and reliability of the analysis. In this study, accordingly, the principle was applied by selecting three output variables and five input variables critical for performance (n=81, s=3, m=5, 81≥3x8). The data for these variables were sourced from the 2022 Health Statistics Yearbook published by the Ministry of Health (Ministry of Health, 2023). The selected input and output variables and their corresponding codes are given in Table 1.

Table 1: Input and Output Variables

Inputs	Input Code
Number of Family Medicine Units	IN1
Number of Doctors	IN2
Number of Nurses	IN3
Number of Emergency Ambulances	IN4
Number of Emergency Stations	IN5
Outputs	**Output Code**
Number of Primary Care Applications	OUT1
Population per Emergency Station	OUT2
Population per Emergency Ambulance	OUT3

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Data Analysis

This study aimed to determine the lowest possible input levels for the given outputs; therefore, the input-oriented CCR super-efficiency model was employed. The results were obtained using the Efficiency Measurement System (EMS 1.3), an Excel-based software package designed for efficiency evaluations. The EMS 1.3 software is a valuable tool for implementing DEA, providing both analytical calculations and visual presentations of the results.

Ethical considerations

Since this study relied on secondary data, ethical approval was not required.

RESULTS

While not mandatory in DEA, conducting a positive correlation analysis between input and output variables is recommended, as it strengthens the reliability of the data envelopment analysis (Bal, 2010: 60). Therefore, Pearson Correlation Analysis was performed on the input and output resource quantities of primary healthcare services in provinces to assess their relationships. The correlation between input and output resource quantities for the provinces is shown in Table 2. As seen in the correlation analysis, a positive relationship exists between input and output resources, which suggests that the DEA results are reliable.

Table 2: Correlation Analysis Results between Variables

Variables	1	2	3	4	5	6	7	8
Number of Family Medicine Units	1	0,997	1	0,996	0,997	0,999	0,2	0,19
Number of Doctors	0,997	1	0,0998	0,987	0,990	0,994	0,221	0,21
Number of Nurses	1	0,998	1	0,995	0,996	0,998	0,2	0,19
Number of Emergency	0,996	0,987	0,995	1	1	0,998	0,139	0,13
Number of Emergency Stations	0,997	0,99	0,996	1	1	0,999	0,153	0,14
Number of Primary Care Admissions	0,999	0,994	0,998	0,998	0,999	1	0,192	0,187
Population per Emergency Station	0,2	0,221	0,2	0,139	0,153	0,192	1	0,97
Population per Emergency Ambulance	0,195	0,218	0,196	0,131	0,148	0,187	0,97	1

The DEA method evaluates efficiency by comparing provinces and determining the most efficient among them. A province with an efficiency score of 1 is classified as efficient, while a province with a score below 1 is classified as inefficient (Cummins, Weiss, Xie and Zi, 2010: 1526). Scale efficiency scores range between 0 and 1. Provinces with an efficiency score of 1 are considered efficient, indicating their effectiveness.

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Table 3: Efficiency Scores of Provinces Based on the Input-Oriented CCR Model

No.	Provinces	Efficiency Scores	No.	Provinces	Efficiency Scores
1	Adana	1	**42**	Konya	0,767675758
2	Adıyaman	0,683160132	**43**	Kütahya	0,941923849
3	Afyonkarahisar	0,854814821	**44**	Malatya	0,808253607
4	Ağrı	0,715847484	**45**	Manisa	0,855350532
5	Amasya	0,918109102	**46**	Kahramanmaraş	0,714929115
6	Ankara	0,712108501	**47**	Mardin	1
7	Antalya	0,83391623	**48**	Muğla	0,839942906
8	Artvin	0,710280842	**49**	Muş	0,951029944
9	Aydın	0,920496422	**50**	Nevşehir	0,963625655
10	Balıkesir	0,903802494	**51**	Niğde	0,935592357
11	Bilecik	0,885599057	**52**	Ordu	0,7462624
12	Bingöl	0,727614995	**53**	Rize	0,766841236
13	Bitlis	0,792820028	**54**	Sakarya	0,907238288
14	Bolu	0,863784909	**55**	Samsun	0,885121165
15	Burdur	0,798522152	**56**	Siirt	0,713989989
16	Bursa	0,818095907	**57**	Sinop	0,798015669
17	Çanakkale	0,877019486	**58**	Sivas	0,733006632
18	Çankırı	0,818623452	**59**	Tekirdağ	0,918644715
19	Çorum	0,770133967	**60**	Tokat	0,866491385
20	Denizli	1	**61**	Trabzon	0,877544623
21	Diyarbakır	0,727456228	**62**	Tunceli	0,893329325
22	Edirne	0,944050905	**63**	Şanlıurfa	0,765308189
23	Elazığ	0,705712229	**64**	Uşak	1
24	Erzincan	0,763073394	**65**	Van	0,615151895
25	Erzurum	0,693634563	**66**	Yozgat	0,697029541
26	Eskişehir	0,777877007	**67**	Zonguldak	0,80363404
27	Gaziantep	0,92408082	**68**	Aksaray	0,907179516
28	Giresun	0,844741829	**69**	Bayburt	1
29	Gümüşhane	0,794742106	**70**	Karaman	0,79336541
30	Hakkari	0,628177534	**71**	Kırıkkale	0,941055612
31	Hatay	0,831172392	**72**	Batman	1
32	Isparta	0,825018693	**73**	Şırnak	0,966117569
33	Mersin	0,980482164	**74**	Bartın	1
34	İstanbul	0,64845666	**75**	Ardahan	0,87373444
35	İzmir	0,878940189	**76**	Iğdır	1
36	Kars	0,809642314	**77**	Yalova	1
37	Kastamonu	0,828923416	**78**	Karabük	0,824732629
38	Kayseri	0,934236991	**79**	Kilis	0,902521471
39	Kırklareli	0,834876543	**80**	Osmaniye	1
40	Kırşehir	0,909526064	**81**	Düzce	1
41	Kocaeli	0,983636881	**82**	Türkiye	0,723499716

Table 3 presents the efficiency scores of the provinces based on the input-oriented CCR model. The average score derived from the CCR model analysis of the provinces' 2022 data was found to be 0.723. According to this result, 27.7% of the selected resources in Türkiye were not used efficiently in terms of the chosen outputs. Table 3 shows that only 11 provinces (1, 20, 47, 64, 69, 72, 74, 76, 77, 80, 81) operated efficiently in providing primary healthcare services in 2022. It was observed that the efficiency scores of the remaining 70 provinces were below 1, indicating that these provinces were inefficient in providing primary healthcare services. It was found that Van had the lowest efficiency score at 0.615, while Kocaeli, with a score of 0.984, was the most efficient

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among the inefficient provinces. Finally, it was determined that 6 provinces had scores between 0.61 and 0.70, 21 provinces had scores between 0.71 and 0.80, 24 provinces had scores between 0.81 and 0.90, and 19 provinces had scores above 0.91. In other words, the majority of provinces (29.63%) had efficiency scores between 0.81 and 0.90.

Table 4: Super-Efficiency Model Values of the Provinces

No.	Provinces	Super-efficiency values
1	Adana	1,3047
20	Denizli	1,0506
47	Mardin	1,1201
64	Uşak	1,0788
69	Bayburt	1,2037
72	Batman	1,0194
74	Bartın	1,1239
76	Iğdır	1,3555
77	Yalova	1,2254
80	Osmaniye	1,2238
81	Düzce	1,0072

According to the results of the DEA, Table 4 presents the efficiency model values of the provinces that were identified as efficient in the super-efficiency model analysis. The super-efficiency scores exceeding "1" for each province in the table indicate that even if these efficient provinces increase their input resource amounts by the specified proportion, their efficiency will not be affected. For example, a super-efficiency score of 1.355 for the province of Iğdır indicates that even if its input usage increases by 35.5%, it will still be classified as an efficient province.

Table 5: Reference Sets of Inefficient Provinces

No.	Provinces	References	No.	Provinces	References
1	Adana		**42**	Konya	1, 20
2	Adıyaman	20, 64, 80	**43**	Kütahya	1, 64, 77, 80
3	Afyonkarahisar	20, 64, 80	**44**	Malatya	20, 64
4	Ağrı	76, 77, 80	**45**	Manisa	1, 20, 64, 80
5	Amasya	64, 74, 80	**46**	Kahramanmaraş	1, 64, 80
6	Ankara	1, 20	**47**	Mardin	
7	Antalya	1, 20, 47	**48**	Muğla	20, 80
8	Artvin	64, 77, 80	**49**	Muş	76, 77
9	Aydın	1, 64, 77,	**50**	Nevşehir	64, 74, 76
10	Balıkesir	1, 64, 80	**51**	Niğde	64, 74, 77,
11	Bilecik	69, 74, 76,	**52**	Ordu	20, 64
12	Bingöl	74, 76, 77	**53**	Rize	64, 77
13	Bitlis	76, 77	**54**	Sakarya	1, 47, 77
14	Bolu	20, 64	**55**	Samsun	1, 20, 77
15	Burdur	64, 74, 77	**56**	Siirt	74, 76, 77
16	Bursa	1, 80	**57**	Sinop	64, 77
17	Çanakkale	20, 64, 77	**58**	Sivas	20, 64
18	Çankırı	74, 76, 77,	**59**	Tekirdağ	1, 47, 64, 77
19	Çorum	20, 64	**60**	Tokat	1, 47, 77, 80
20	Denizli		**61**	Trabzon	20
21	Diyarbakır	1, 64, 80	**62**	Tunceli	69, 77
22	Edirne	20, 64, 76	**63**	Şanlıurfa	1, 64, 80

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23	Elazığ	20, 64	**64**	Uşak	
24	Erzincan	64, 77	**65**	Van	1, 47, 77, 80
25	Erzurum	20, 76	**66**	Yozgat	64, 74, 77
26	Eskişehir	20, 64	**67**	Zonguldak	20, 76, 77
27	Gaziantep	1, 64, 80	**68**	Aksaray	64, 74, 80
28	Giresun	20, 64	**69**	Bayburt	
29	Gümüşhane	69, 74, 77	**70**	Karaman	64, 74, 77
30	Hakkari	76, 77	**71**	Kırıkkale	64, 77
31	Hatay	20, 64, 80	**72**	Batman	
32	Isparta	20, 64	**73**	Şırnak	76, 77
33	Mersin	1, 80	**74**	Bartın	
34	İstanbul	1	**75**	Ardahan	76, 77, 80
35	İzmir	1	**76**	Iğdır	
36	Kars	20, 76	**77**	Yalova	
37	Kastamonu	20, 64	**78**	Karabük	69, 77
38	Kayseri	20, 64	**79**	Kilis	69, 77
39	Kırklareli	64, 77, 80	**80**	Osmaniye	
40	Kırşehir	64, 77, 80	**81**	Düzce	
41	Kocaeli	1, 20, 47	**82**	Türkiye	20

The DEA method assumes that inefficient provinces can achieve the same level of efficiency as the efficient ones by adopting the practices and input-output strategies used by the efficient provinces. The provinces listed in the table act as benchmarks for inefficient provinces to enhance their efficiency levels. In Table 5, the input and output resource amounts of the referenced provinces are presented. Inefficient provinces should follow and compare these amounts in their operations to improve their efficiency levels.

Table 6: Potential Improvement Rates for Provinces with Low-Efficiency Values

No.	Provinces	Efficient Input Suggestions	No.	Provinces	Efficient Input Suggestions
1	Adana		**42**	Konya	IN2 (%28), IN3 (%19), IN5 (%7)
2	Adıyaman	IN3 (%35), IN5 (%3)	**43**	Kütahya	IN2 (%55)
3	Afyonkarahisar	IN4 (%5), IN5 (%6)	**44**	Malatya	IN2 (%34), IN3 (%65), IN4 (%17), IN5 (%7)
4	Ağrı	IN1 (%27), IN3 (%58), IN4 (%2)	**45**	Manisa	IN5 (%2)
5	Amasya	IN2 (%26), IN4 (%8), IN5(%3)	**46**	Kahramanmaraş	IN1 (%17), IN2 (%69)
6	Ankara	IN1 (%18), IN2 (%3), IN3 (%51)	**47**	Mardin	
7	Antalya	IN2 (%25), IN3 (%25), IN5 (%12)	**48**	Muğla	IN3 (%32), IN4 (%22), IN5 (%18)
8	Artvin	IN3 (%19), IN4 (%22)	**49**	Muş	IN1 (%31), IN3 (%9)
9	Aydın	IN2 (%57), IN5 (%3)	**50**	Nevşehir	IN2 (%53), IN4 (%4)
10	Balıkesir	IN2 (%52), IN5 (%11)	**51**	Niğde	IN4 (%11), IN5 (%5)

11	Bilecik	IN2 (%11)	**52**	Ordu	IN2 (%13), IN5 (%8)
12	Bingöl	IN1 (%5), IN2 (%23)	**53**	Rize	IN2 (%51), IN3 (%86), IN4 (%13)
13	Bitlis	IN1 (%8), IN2 (%13)	**54**	Sakarya	IN2 (%33), IN3 (%38), IN5 (%5)
14	Bolu	IN2 (%24), IN3 (%31), IN5 (%7)	**55**	Samsun	IN2 (%97), IN3 (%46), IN4 (%4)
15	Burdur	IN2 (%17), IN4 (%11), IN5 (%7)	**56**	Siirt	IN1 (%4), IN2 (%76)
16	Bursa	IN1 (%20), IN2 (%33)	**57**	Sinop	IN2 (%10), IN3 (%13), IN4 (%21), IN5 (%11)
17	Çanakkale	IN2 (%70), IN3 (%21), IN5 (%4)	**58**	Sivas	IN2 (%64), IN3 (%82), IN4 (%22), IN5 (%10)
18	Çankırı	IN4 (%19), IN5 (%6)	**59**	Tekirdağ	IN2 (%60)
19	Çorum	IN2 (%9), IN4 (%6), IN5 (%8)	**60**	Tokat	IN2 (%69), IN5 (%2)
20	Denizli		**61**	Trabzon	IN2 (%41), IN3 (%73), IN4 (%15), IN5 (%10)
21	Diyarbakır	IN2 (%58)	**62**	Tunceli	IN2 (%11), IN3 (%22), IN4 (%13), IN5 (%5)
22	Edirne	IN2 (%53), IN3 (%45), IN4 (%7)	**63**	Şanlıurfa	IN1 (%43), IN2 (%85), IN4 (%10)
23	Elazığ	IN2 (%75), IN3 (%53), IN4 (%9), IN5 (%5)	**64**	Uşak	
24	Erzincan	IN2 (%25), IN3 (%34), IN4 (%24), IN5 (%7)	**65**	Van	IN2 (%74)
25	Erzurum	IN1 (%3), IN2 (%26), IN3(%5), IN4 (%9)	**66**	Yozgat	IN2 (%68), IN4 (%7), IN5 (%3)
26	Eskişehir	IN2 (%10), IN4 (%6), IN5 (%8)	**67**	Zonguldak	IN1 (%19), IN2 (%75), IN3 (%38)
27	Gaziantep	IN1 (%82), IN4 (%6)	**68**	Aksaray	IN2 (%5), IN5 (%3)
28	Giresun	IN2 (%51), IN4 (%15), IN5 (%8)	**69**	Bayburt	
29	Gümüşhane	IN2 (%59), IN4 (%11), IN5 (%5)	**70**	Karaman	IN2 (%13), IN4 (%5)
30	Hakkari	IN1 (%12), IN3 (%27), IN4 (%17), IN5 (%8)	**71**	Kırıkkale	IN2 (%60), IN3 (%85), IN4 (%7), IN5 (%3)
31	Hatay	IN4 (%16)	**72**	Batman	
32	Isparta	IN2 (%24), IN3 (%55), IN4 (%9), IN5 (%3)	**73**	Şırnak	IN1 (%53), IN2 (%36), IN5 (%3)
33	Mersin	IN1 (%3), IN2 (%40), IN4 (%4)	**74**	Bartın	
34	İstanbul	IN1 (%55), IN2 (%68), IN5 (%5)	**75**	Ardahan	IN3 (%10), IN4 (%22), IN5 (%6)
35	İzmir	IN1 (%81), IN2 (%59), IN3 (%27), IN4 (%8)	**76**	Iğdır	
36	Kars	IN1 (%3), IN2 (%48), IN3 (%43), IN4 (%6)	**77**	Yalova	
37	Kastamonu	IN2 (%35), IN4 (%26), IN5 (%16)	**78**	Karabük	IN2 (%81), IN3 (%51), IN4 (%6)

38	Kayseri	IN2 (%39), IN5 (%3)	**79**	Kilis	IN1 (%44), IN2 (%41), IN3 (%9), IN5 (%4)
39	Kırklareli	IN3 (%63), IN4 (%12), IN5 (%5)	**80**	Osmaniye	
40	Kırşehir	IN3 (%23), IN4 (%13), IN5 (%5)	**81**	Düzce	
41	Kocaeli	IN1 (%80), IN2 (%53)	**82**	Türkiye	IN2 (%45), 3 (%82), IN4 (%76), IN5 (%47)

Table 6 shows the potential improvement rates of the provinces. Upon examining Table 6, it was observed that the provinces identified as the least efficient based on the scores from the DEA application, such as Van, Hakkari, İstanbul, Adıyaman, Erzurum, and Yozgat, had high improvement percentages. For example, in the case of İstanbul, the potential improvement percentages are 55% for IN1 (Number of Family Medicine Units), 68% for IN2 (Number of Doctors), and 5% for IN5 (Number of Emergency Stations). By reducing these input levels by the specified percentages, Istanbul would be considered efficient. Other inefficient provinces should also apply this framework to improve their efficiency.

CONCLUSION

The objectives of healthcare institutions are to improve health outcomes, increase accessibility, enhance efficiency, elevate service quality, meet patients' needs, and ensure the continuity of healthcare services. An analysis of healthcare providers reveals substantial investments and considerable operational costs. In Türkiye, the majority of healthcare institutions are affiliated with the Ministry of Health. Formulating and implementing health policies is a key responsibility of the Ministry of Health. It is particularly crucial for healthcare institutions affiliated with the Ministry to deliver services efficiently and effectively, given that they rely on public resources (Doğan, 2024).

In this study, the efficiency of provinces in Türkiye regarding primary healthcare services in 2022 was assessed, and the necessary improvements in underutilized resources were identified. The findings reveal variations in healthcare service efficiency across provinces. While 11 provinces were classified as efficient, 70 were not, resulting in an efficiency rate of 13.58%, which falls below the average. In 2022, the provinces identified as efficient included Adana, Denizli, Mardin, Uşak, Bayburt, Batman, Bartın, Iğdır, Yalova, Osmaniye, and Düzce.

Provinces with efficient healthcare services are known to utilize their resources more effectively. In contrast, provinces with lower efficiency can enhance their performance by implementing targeted improvements. These findings offer valuable insights for healthcare policymakers and underscore the importance of taking concrete actions to enhance healthcare services. Specifically, strategies such as reducing input quantities and optimizing the use of existing resources present significant opportunities to improve the performance of provinces with lower efficiency. Additionally, by learning from the practices of efficient provinces, similar strategies can be adopted by inefficient provinces. Analyzing the successes of these efficient provinces can provide valuable models that contribute to improving the overall quality of healthcare services. Addressing the identified areas for improvement in inefficient provinces is essential to enhancing the efficiency and effectiveness of primary healthcare services. The primary limitation of this study is the restricted scope of the dataset used as the study is based on data collected within a specific time frame, and it is important to acknowledge that these data may evolve over time. Moreover, given the sensitivity of the DEA methodology to the selection of inputs and outputs, the results may vary when different input-

output variables are used. Future research could build on this study by applying DEA with different time periods and input-output combinations. Additionally, long-term monitoring studies evaluating the effectiveness of strategies implemented to improve healthcare services in inefficient provinces would also be valuable.

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