EFFECTS OF RECONSTRUCTION OF HEALTH CARE ON SERVICE DELIVERY PERFORMANCE IN TURKEY: THE PUBLIC HOSPITAL UNIONS

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Abstract

Objectives: In this study, the performance of 555 public hospitals was evaluated to research the impact of the Public Hospital Unions (PHU) practice applied in Turkey.

Materials and Methods: Performance has two dimensions: efficiency and effectiveness. The scores obtained as a result of Data Envelopment Analysis (DEA) and Malmquist Index (MI) methods were taken as efficiency indicators. The degree of achievement of the targets was taken as effectiveness indicators, and the evaluation of effectiveness was performed by examining to what extent it has gotten closer to the targeted values on the Strategic Plans prepared by Turkey Public Hospitals Authority (TPHA).

Results: According to the results of the DEA-VRS model, the percentage of efficient hospitals; was 69% in 2012, 74% in 2013, 70% in 2014, 70% in 2015, and 71% in 2016. According to the results of the DEA-CRS model, the percentage of efficient hospitals; was 55% in 2012, 60% in 2013, 56% in 2014, 55% in 2015, and 53% in 2016. The efficiency changes of all hospitals between the period of 2012-2016 were analyzed by the MI method, and the Technical Efficiency Change (TEC), Technological Change (TC), and Total Factor Productivity (TFP) values of the hospitals were found to decrease by 45%, 87%, and 72%, respectively.

Conclusion: The public hospital unions (PHU) model, which was created to use resources effectively and efficiently in the field of health, did not significantly enhance hospitals' performance.

Keywords: Public hospitals, performance, data envelopment analysis, Malmquist index.

Introduction

Turkey launched a program known as the "Health Transition Program" (HTP) in 2003. With this program, there have been important developments in hospital services and have made radical changes in the health care system in Turkey.[1] 663 numbered Decree-Law published on November 2, 2011, dated Official Gazette as by central and provincial organizations of Ministry of Health (MoH) restructured and Turkey Public Hospitals Authority (TPHA) were established.[2] Turkey Public Hospitals Authority, which is responsible for the service delivery of secondary and tertiary health care services, consists of central and provincial organizations. As the projection of this restructuring, an important step was reorganized in the MoH and rural hospital structure by uniting 843 MoH hospitals into 87 Public Hospital Unions (PHUs) and devolving important tasks to these PHUs in 2012.[3] The TPHA was delegated the authority of establishing financial and administrative regulations for public hospitals and carrying out annual monitoring and assessment of public hospitals and PHUs for improving effectiveness, quality, and efficiency.[2,3]

Public hospitals have an important role in the delivery of health services in the Turkish health system, as the number of these hospitals is more than the sum of private hospitals and university hospitals. There are three main types of providers of the hospital in Turkey, with public hospitals being the most common ones (62.5% of hospital beds), followed by private hospitals (20.8%) and university hospitals (16.7%). In addition, 63.2% of the health care professionals are employed in public hospitals.[4]

The distribution of budget differs for public hospitals, university hospitals, and private hospitals. Public hospitals are mainly financed from two sources. The general budget financial system is the part of the MoH and affiliated health institutions financed by the Ministry of Treasury and Finance.[5] Staff salaries, and investment expenditures are mostly covered by the appropriation item allocated from the general budget. Public hospitals also have an additional budget from their revolving funds from which they generate income from reimbursement agencies and households for services provided.

World Health Organization assessed comparative efficiency of national health systems;[6] Sahin et al. and Kacak et al. analyzed the technical efficiency of public hospitals under the health transformation project.[7,8] Besides, PHU technical efficiency was assessed with Constant Return to Scale (CRS) and Variable Return to Scale (VRS) model of Data Envelopment Analysis (DEA) by Yiğit.[9] Similarly, Yildirim et al. analyzed the efficiency of the pre and post PHU period with Malmquist Index (MI).[10] Kucuk et al. analyzed the efficiency of the public hospitals in Turkey and evaluated their efficiency at provincial and regional levels output-oriented model of VRS.[11]

According to Sherman and Zou, two key performance concepts are defined. Efficiency is the ability to reach outputs using the least amount of inputs; effectiveness is the ability of an enterprise to achieve its

predetermined goals and objectives.[12] In this study, the information had been obtained regarding the efficiencies of public hospitals through analyzing to what extent had the public hospitals actualized their objectives announced by the MoH. Thus, public hospitals have been evaluated in terms of efficiency and effectiveness. This feature makes up the unique aspect and the distinctive part of this study.

Materials and Methods

When the methods that can be used in health institutions for performance evaluation are examined, it is observed that these methods are divided into three main methods as ratio analyses, parametric methods, and non-parametric methods. Least squares regression and stochastic frontier analysis constitute the parametric methods, while DEA and MI are the non-parametric methods.[7-9] It is recommended to use DEA and MI when conducting performance evaluations for health institutions since they have complex inputs and outputs.[13-17]

Within the framework of the study, the relative efficiency scores of each hospital in the years 2012, 2013, 2014, 2015, and 2016 were measured via DEA.

Both the change in their efficiency score had been revealed year by year and their time-dependent change between 2012-2016 had been presented by using MI. Total Factor Productivity (TFP) scores had originated been determined by obtaining the scores for Technical Efficiency Change (TEC) and Technological Change (TC) constituting the TFP separately.[18]

As a result of DEA and MI analyses, recommendations have been proposed regarding optimal resource utilization and providing efficiency changes correspondingly.

In this study, firstly, efficiency scores and changes in efficiency scores were measured via DEA and MI. After that, the effectiveness of the study hospitals was examined. The realization degree of the objectives desired to be accomplished through the strategic plan TPHA's performance indicators has been used as the effectiveness degree. Thus, this study handled the performance holistically.

Research methods

DEA is a non-parametric analysis used to measure efficiency in decision-making units in various industries.[12,19-22] DEA can be benefited as input or output-oriented.[19-22] In this study, input-oriented DEA was selected because it was recommended to use input-oriented models in health care.[13-17] In addition, DEA can be benefited from the CRS or the VRS. In this study, both of them were used.

CRS model is presented below:[20]

$$E^k = max \sum_{r=1}^{s} u_r \, y_{rk}$$

$Constraints$;

$$\sum_{i=1}^{m} v_i x_{ik} = 1$$

$$\sum_{r=1}^{s} u_r y_{rj} \leq \sum_{i=1}^{m} v_i x_{ik} = 1$$

$$v_i, u_r \geq \varepsilon; \; r = 1,2, \ldots \ldots s; i = 1,2, \ldots \ldots m; j = 1,2, \ldots \ldots n$$

VRS model is presented below:[21]

$$E^k = max \sum_{r=1}^{s} u_r \, y_{rk} - U_0$$

$Constraints$;

$$\sum_{i=1}^{m} v_i x_{ik} = 1$$

$$\sum_{r=1}^{s} u_r y_{rj} - U_0 \leq \sum_{i=1}^{m} v_i x_{ij}$$

$$v_i, u_r \geq \varepsilon; \; r = 1,2, \ldots \ldots s; i = 1,2, \ldots \ldots m; j = 1,2, \ldots \ldots n$$

E^k: efficiency value of the decision-making unit k,
u_r: The weight given to the output of r by the decision-making unit k,
y_r: output of r produced by the decision-making unit k,
v_i: The weight given to the i input by the decision-making unit k,
x_{ik}: the input of i used by the decision-making unit k,
y_{rj}: the output of r produced by the decision-making unit j,
x_{ij}: the input of i used by the decision-making unit j,
ε: a sufficiently small positive number.

MI is a dynamic analysis based on DEA and shows the efficiency changes of decision-making units over time.[23,24] As in DEA, MI can also be benefited as input or output-oriented.[18] In this study, input-oriented MI benefited for the same reason as in the DEA.

The following formulas present TEC, TC, and MI:[23,24]

$$TEC = \left[\frac{d^{t+\iota}(y^{t+\iota}, x^{t+\iota})}{d^t(y^t, x^t)}\right]$$

$$TC = \left[\frac{d^t(y^{t+\iota}, x^{t+\iota})}{d^{t+\iota}(y^{t+\iota}, x^{t+\iota})} \times \frac{d^t(y^t, x^t)}{d^{t+\iota}(y^t, x^t)}\right]^{1/2}$$

$$MI = TEC \times TC = \left[\frac{d^{t+\iota}(y^{t+\iota}, x^{t+\iota})}{d^t(y^t, x^t)}\right] \times \left[\frac{d^t(y^{t+\iota}, x^{t+\iota})}{d^{t+\iota}(y^{t+\iota}, x^{t+\iota})} \times \frac{d^t(y^t, x^t)}{d^{t+\iota}(y^t, x^t)}\right]^{1/2}$$

D is the distant function. t and $t+\iota$ on x and y present the time period for the efficiency and represent the outputs and inputs. $D^t(x^t, y^t)$ and $D^{t+\iota}(x^{t+\iota}, y^{t+\iota})$ are within-period distance functions.

Research variables

In the studies regarding the efficiency and effectiveness of the health care systems, there is a tendency to use activity-based measurements instead of health outcomes since the result indicators of health institutions such as health status cannot be measured directly.

While creating the model, the functional indicators and financial indicators of the public hospitals were used together as input and output variables (Table 1). In DEA and MI, as input variables; first material and material expense, staff fees and expenses, other service costs, general and administrative expenses, the total number of beds, number of specialist physicians, number of assistant physicians, number of general practitioners, number of nurses and midwives and number of other health personnel and as output variables; revolving fund sales, number of inpatients, number of outpatients, and number of A, B and C group surgeries were used. The variables used in this study are compatible with the relevant studies.[7-11]

Table 1. Input and output variables

	Variables	Definition
Input variables	The first material and material expense	First material and material
	Staff fees and expenses	Salaries of Civil Servants,
		Wage Expenses of Workers and Contracted Employees,
		Additional Payment
	Other service costs	Benefits and Services Provided From Outside,
		Other Miscellaneous Expenses, Taxes, Duties, and Fees
	General and administrative expenses	General Administrative Expenses Account
	Total number of beds	Intensive Care Beds Included
	Number of specialist physicians	
	Number of assistant physicians	Used only in A-I Group Hospitals
	Number of general practitioners	
	Number of nurses and midwives	
	Number of other health personnel	Including health officers
Output variables	Revolving fund sales,	Domestic Sales Account
		Overseas Sales Account
		Other Income Account
	Number of inpatients	Including Intensive Care
	Number of outpatients	Including the number of emergency department visits
	Number of A group surgeries	Excluded E group hospitals
	Number of B group surgeries	
	Number of C group surgeries	

Results

The aim of this study put forward to the performance of the public hospitals in Turkey between 2012-2016 period. Performance has two dimensions: effectiveness and efficiency. The purpose is to enhance the performance by achieving the desired scores both in terms of efficiency and effectiveness.[12] Therefore, scores obtained from DEA and MI have been regarded as an efficiency indicator; and the achievement level of the objectives is considered as an effectiveness indicator.

Evaluating efficiency

In this study, the efficiencies of public hospitals grouped as hospitals Group A-I, A-II, B, C, D, and E by the MoH have been evaluated. Within this context, each hospital's efficiency has been evaluated within its group, and a general result has been reached by combining the DEA and MI scores obtained afterward. Combined efficiency

scores of all the hospitals within the framework of this study are provided on the chart and the graphs below and a general evaluation of the efficiency of the public hospitals in Turkey have been performed.

Combined DEA scores of the public hospitals in Turkey between the years 2012-2013-2014-2015-2016 are shown in Table 2. Accordingly, the ratio of efficient hospitals among all hospitals on the CRS Model; is 55 % in 2012, 60 % in 2013, 56 % in 2014, 55 % in 2015, and 53 % in 2016. In the VRS Model, on the other hand, the ratio of efficient hospitals among all hospitals has been calculated as; 69 % in 2012, 74 % in 2013, 70 % in 2014, 70 % in 2015, and 71 % in 2016.

Table 2. DEA scores of all the hospitals

Total Hospital (n=555)	VRS					CRS				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
The number of efficienct hospital	384	413	390	387	393	308	331	309	306	292
The number of inefficienct hospital	171	142	165	168	162	247	224	246	249	263
Efficient hospital (%)	69	74	70	70	71	55	60	56	55	53
Inefficient Hospital (0,91-0,99)%	21	17	18	19	17	24	22	19	20	19
Inefficient Hospital (0,81-0,90)%	9	7	10	10	10	15	13	18	17	14
Average efficiency	0.98	0.98	0.98	0.98	0.98	0.96	0.97	0.96	0.96	0.94
Standard deviation	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.07

In the CRS Model, the ratio of inefficient public hospitals among all the hospitals was; 45 % in 2012, 40 % in 2013, 44 % in 2014, 45 % in 2015, and 47 % in 2016. In the VRS Model, on the other hand, the ratio of inefficient public hospitals among all the hospitals was; 31 % in 2012, 26 % in 2013, 30 % in 2014, 30 % in 2015, and 29 % in 2016 (Figure 1).

The efficiency scores of all the hospitals whose efficiency changes were evaluated in groups by the MI method, calculated by years between periods 2012-2013, 2013-2014, 2014-2015, and 2015-2016 have been compared with the previous year's scores and the scores that were obtained were combined and the ratio of hospitals which are progressing to TFP level, remaining stable and degrading has been presented in percentages (Figure 2). According to MI, the ratio of progressing hospitals between periods 2012=>2013 in terms of TFP among all the hospitals is 36 %, while this ratio was 39 % in the 2013=>2014 period, 32 % in 2014=>2015 period, and 42 % in 2015=>2016 period.
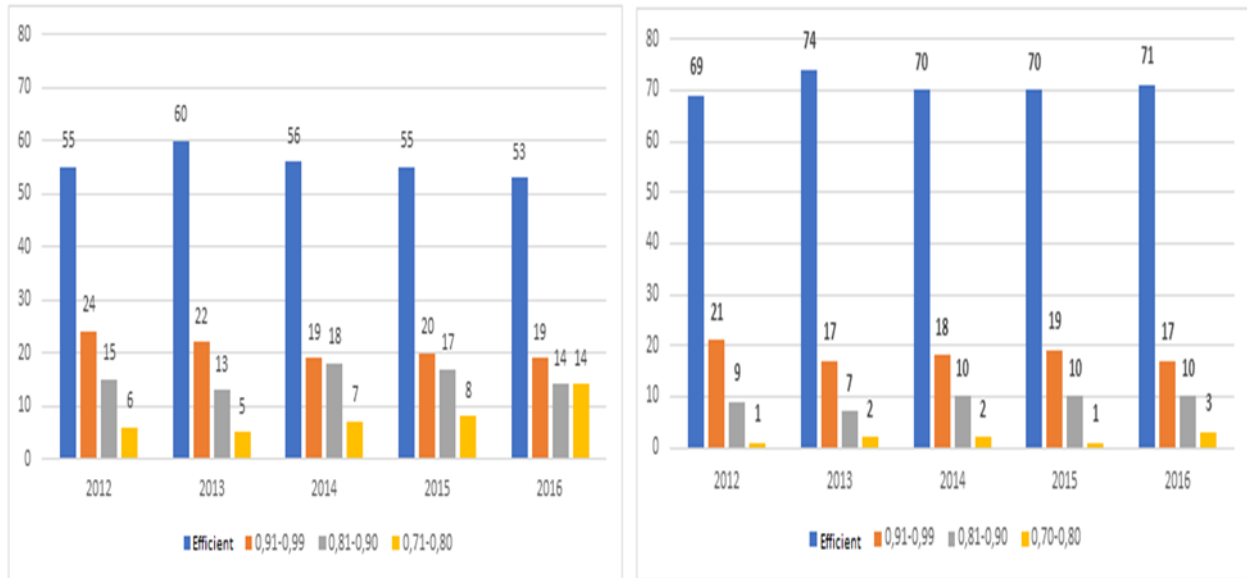
Figure 1. All the efficient-inefficient hospitals in DEA, (%) (All periods between 2012-2016)

All the hospital's efficiency changes have been evaluated by the MI method between the periods 2012=>2016, and the scores obtained were combined and their TEC, TF, and TFP values were presented in percentages. According to Graph 2, 49 % of all the hospitals examined within this study between periods 2012=>2016 have shown progress in TEC values, 11 % in TC values, and 24 % in TFP. While the hospitals showing the decrease in TEC values make up 45% of all the hospitals, hospitals showing the decrease in TC values make up 87%, and, showing the decrease in TFP values make up 72 %.
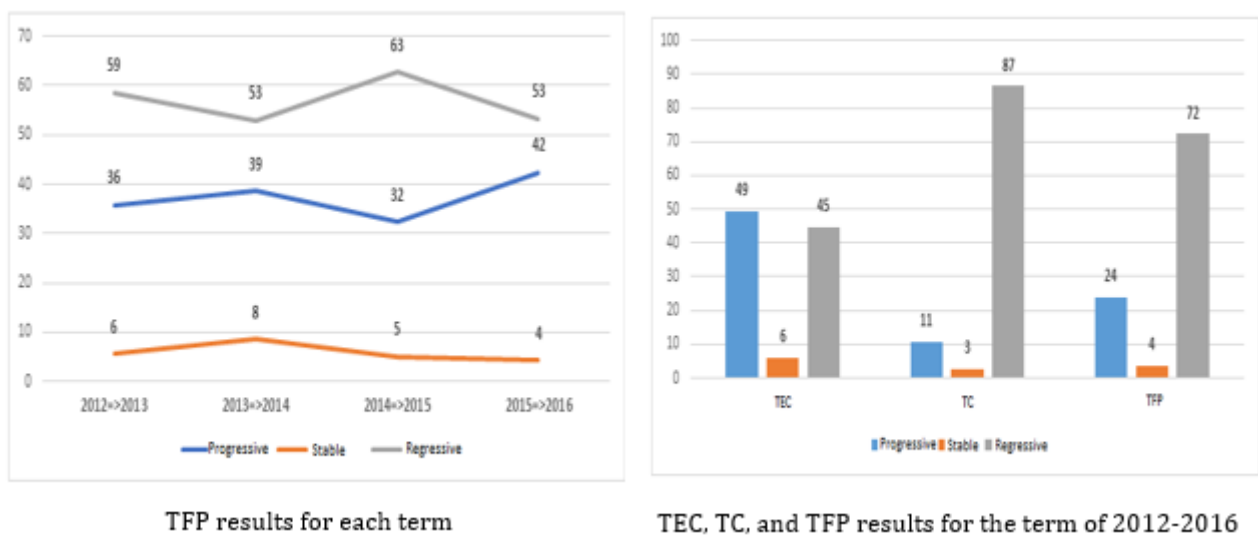

TFP results for each term

TEC, TC, and TFP results for the term of 2012-2016

Figure 2. All the progressing/stable/degrading hospitals according to Malmquist TFP Index and Sub-indexes (%) (All periods between 2012-2016)

To prevent this inefficiency arising from technological change, health care service delivery must be featured toward adopting new technologies through identifying the direction and the size of the change in treatment technologies and the expectations in demands for services. It does not seem possible to achieve this technological change with the hospital's facilities. MoH needs to make strategic decisions in resource allocation, and within this context, it is recommended that the technologically insufficient hospitals must apply prioritization in centralized resource allocation in such a way as to prevent these kinds of deficiencies.

Evaluation of effectiveness

Measuring the outcomes and quality is more problematic than efficiency measures.[22] Effectiveness is an indication as to what extent has the realized values come close to the pre-set objectives, in this section, the evaluation of effectiveness was performed by examining to what extent has it gotten closer to the targeted values on the Strategic Plans prepared by TPHA.[25]

According to the strategic plan prepared by TPHA, although the measurable performance indicators of the presented objectives are revealed, some performance indicators have not been assessed since the current situation analysis cannot be performed, or it is in the preparation phase.

Operating results regarding objectives and indicators of the public hospitals in Turkey are included in the Strategic Plan and Performance Program prepared by TPHA for the 2014-2018 period.[25] Performance indicators monitored within this period were evaluated by the accomplishment level in respect to the objectives, and the result has been provided below (Table 3).

In the strategic plan prepared by TPHA for the 2014-2018 period, 53 performance indicators were determined, 10 out of 49 singularly specified indicators were not included since the current state was not clarified, and 3 of them were not included because they were on the preparation phase while 19 indicators which are on the tables above were included in the evaluation.[25] Among these indicators included in the evaluation, 6 of them were deemed to be successful, and 13 of them were found unsuccessful; it is observed that the ratio of indicators that are found successful is 31.5 %.

Table 3. Effectiveness Evaluation based on the operating results of the Strategic Plan prepared by TPHA for the 2014-2018 period[25,26,30]

Performance Target	Performance Indicator	The situation in 2012-2013	Level of Realization 2016-2017	Targeted Indicator	Realization Status
Target 1.1. Target 2.2. Target 2.4.	Overall satisfaction with health care	75.7	71.7	85	Unsuccessful
Target 1.2.	Total number of physicians per 100,000 people in MoH hospitals	50	59	56	Successful
Target 1.2.	Number of dentists per 100,000 people in MoH hospitals	9	12	12	Successful
Target 1.2.	Number of nurses, midwives per 100,000 people in MoH hospitals	133	147	163	Unsuccessful
Target 1.3.	Number of medical specialty students per instructor in health facilities	3	3,1	20% increase	Unsuccessful
Target 2.1.	Number of intensive care beds in MoH hospitals	10,728	14,996	16,979	Unsuccessful
Target 2.1.	Rate of qualified beds in MoH hospitals (%)	36	60,3	92	Unsuccessful
Target 2.1.	Number of beds per 10,000 people (All Sectors)	26	27,9	30	Unsuccessful
Target 2.1.	Number of MRI devices per 1,000,000 people in MoH hospitals	4.1	3.9	5.45	Unsuccessful
Target 2.1.	Number of BT devices per 1,000,000 people in MoH hospitals	5.9	6.6	7.4	Unsuccessful
Target 2.2.	The bed occupancy rate in MoH hospitals	66.4	69	80	Unsuccessful
Target 2.2.	The average number of days of stay in MoH hospitals	4.3	4.5	3	Unsuccessful
Target 2.5.	Number of active patients receiving home health care	105,588	301,863	160,000	Successful
Target 2.7.	Number of patients in health tourism	14,000	153,063	100,000	Successful
Target 2.7.	Income from health tourism (TL)	6 million	48 million	300 million	Unsuccessful
Target 3.1.	Increase Rate of Revenues	10%	10%	10%	Successful
Target 3.1.	Revenue coverage ratio, %	102	87.3	100	Unsuccessful
Target 3.1.	Inventory turnover	5.2	28.5	5.8	Successful
Target 3.1.	Total debt to total assets ratio	0.84	2.5	0.5	Unsuccessful

Administrative activity reports explaining public hospitals' activities conducted according to their strategic plans and performance programs, determined performance indicators and causes of deviations associated with objectives and their accomplishment status, and containing general and financial information regarding the administration as well as TPHA financial performance indicators by their strategic plans are provided on Table 4.

Table 4. Public Hospitals Administration of Turkey financial performance indicators 2012-2016[25,26,30]

Million TL	Total Revenue	Total Expense	Revenue Growth Rate (%)	Income Coverage Rate	Inventory Turnover	Total of Foreign Resources / Total Assets
2012	18,079	17,907		100.96	11.85	0.84
2013	20,535	18,944	13.58	108.40	26.55	1.1
2014	22,524	21,752	9..69	103.55	32.60	1.25
2015	23,903	24,035	6.12	99.45	35.31	1.80
2016	27,192	31,164	13.76	87.25	28.25	2.50

According to the 2014-2018 TPHA strategic plan, among the performance indicators on Objective 3.1, an annual increase of 10 % has been projected for **the increase in income**. When we examine the realizations regarding these performance indicators, it is observed that the objectives have been achieved to a great extent. As follows, the increase in the income rate had become 10 % for the year 2014 and this increased rate decreased to 6 % in 2015. The negative realization difference in the rate of increase in the income for 2015 was recovered in 2016 with an increased rate of 14 %.

According to the 2014-2018 strategic plan of public hospitals, an objective of 100 % accomplishment rate has been set for the **expense coverage ratio of the incomes,** which were among the performance indicators on Objective 3.1. When we look at the realizations regarding the aforementioned performance indicators, it is observed that the objective was achieved in 2014 (103.5 %) but could not be accomplished in 2015 (99.5 %). Especially in 2016 (87.3 %), there has been a realization far below the aforementioned objective.

Under the 2014-2018 strategic plan of public hospitals, an objective of 5.8 % accomplishment rate has been set for the **inventory turnover,** which was among the performance indicators on Objective 3.1. When we look at the realizations regarding the aforementioned performance indicators, it is observed that while the inventory turnover was 26.55 in 2013, it had been 32.6 in 2014, 35.31 in 2015, and 28.25 in 2016.[26] There has been a realization far above the objective of 5.8 determined for the inventory turnover.

By the 2014-2018 strategic plan of public hospitals, an objective of 50 % accomplishment rate has been set for the ratio of the **total debt to total assets,** which were among the performance indicators on Objective 3.1.

When we look at the realizations regarding the performance indicators mentioned above, it is observed that the ratio of total debt to total assets increased 1.25 times in 2014, 1.8 times in 2015, and 2.5 times in 2016.[26]

While the **objective of the ratio of decrease in the expenses** as a performance indicator in providing efficient and effective usage of the resources in public hospitals had been determined as 7 % (growth and inflation-

adjusted expenses), the realization for the end of 2016 has been 0 %, the efficient and effective usage of the resources in health care service delivery has resulted in failure.[26]

When the Malmquist Index TFP scores for the 2012- 2016 period are taken into account, it is observed that the ratio of public hospitals making progress in this period in terms of TFP is 24 % (Graph 2). When it is considered that the two main determinants of performance are efficiency and effectiveness, it can be stated that the public hospitals in Turkey had not measured up to the desired level for the 2012=>2016 period both in terms of efficiency and effectiveness. Public hospitals in Turkey must make progress in efficiency and effectiveness to display high performance.

Discussion

The HTP aimed to improve the overall performance of the hospital system by providing efficient, quality healthcare due to more horizontally organized hospitals with administrative and financial autonomy. However, structural and functional problems arising after the implementation of the union model could not be solved.[27] In this period, four ministers in MoH and seven Chairperson in TPHA have been replaced. Nearly all of the senior management positions have been reassigned in the headquarters based on these replacements in the institution and the province; both the secretary-general position in PHU have encountered reassignments, and significant rotations in the hospitals affiliated to TPHA have taken place in the management systems and managers.[28]

Turkey requires a certain change of approach to enable the realization of the TPHA organization and PHU, which are among the reconstruction practices for the health care services in Turkey. However, this change could not be adequately managed since the legislative changes were not supported by mental change. In this period, the demands on changing the organizational structure aimed at decree-law no. 663 have outweighed without actually being realized, and TPHA had been shut down upon the decree-law no. 694 introduced on August 25, 2017, TPHA has been transferred to MoH and some of the changes made had been withdrawn.[2,29]

In the TPHA Reports of the Court of Accounts, it is recommended to define the activities related to the performance targets of the hospitals at regular intervals with scientific evaluations and to reach the performance targets completely and accurately by establishing a relationship between the resources allocated from the budget and the performance target.[30] More objective performance criteria and evaluation could not be created, and accountability along with administrative effectiveness could not also be provided since holistic analysis had not been performed to the scores obtained from the Efficiency Scorecard Evaluation.

The reorganization in the health care system must be designated to produce high-quality health outputs, and health managers should focus on ways to find practices that will improve quality and use the current resources efficiently. One of these policies is putting the Turkish health care system into service in other countries; neighboring countries are first. Thus, both the capacity usage problem of large-scaled hospitals can be solved, and contributions can be made to the financial sustainability of the hospitals. Practices and applications to be made both by the public and the private sector would feature Turkey in the health care field.

As a limitation of this study, general budget subsidies, which have an important place in the budget of hospitals, were not included in the financial data.

The results of the PHU Productivity Scorecard Evaluation application were used to evaluate the associations and hospitals affiliated to the TPHA in terms of the determined criteria and quality objectives. It is known that effectiveness also naturally includes quality objectives.[12,22] Since the results of the Productivity Scorecard Evaluation could not be accessed; the inability to assess in terms of quality objectives constitutes the limitation of this study.

Ethical Considerations: The data used in this study were obtained with the permission of the TR Ministry of Health, Department of Strategy Development, dated 17.11.2017 and numbered 15722817/841.99.

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

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References

1. Akdağ R. Türkiye Sağlıkta Dönüşüm Programı Değerlendirme Raporu (2003-2011). [Internet]. 2012; https://sbu.saglik.gov.tr/Ekutuphane/kitaplar/SDPturk.pdf. (Accessed: 28.02.2022).

2. 663 Sayılı Sağlık Bakanlığı ve Bağlı Kuruluşlarınınn Teşkilat ve Görevleri Hakkında Kanun Hükmünde Kararname. [Internet]. 2011; https://www.resmigazete.gov.tr/eskiler/2011/11/20111102M1-3.htm. (Accessed: 28.02.2022).

3. Yildiz MS, Heboyan V, Khan MM. Estimating technical efficiency of Turkish hospitals: implications for hospital reform initiatives. *BMC health services research.* 2018;18(1):1-16.

4. Sağlık İstatistikleri Yıllığı 2020 Haber Bülteni. [Internet]. 2021; https://sbsgm.saglik.gov.tr/Eklenti/41611/0/haber-bulteni-2020pdf.pdf. (Accessed: 28.02.2022).

5. Bağcı H, Atasever M. *Türkiye Sağlik Sistemi.* Ankara: Akademisyen Kitabevi AŞ; 2020.

6. Evans DB, Tandon A, Murray CJ, Lauer JA. The comparative efficiency of national health systems in producing health: an analysis of 191 countries. *World Health Organization.* 2000;29(29):1-36.

7. Sahin I, Ozcan YA, Ozgen H. Assessment of hospital efficiency under health transformation program in Turkey. *Central European Journal of Operations Research.* 2011;19(1):19-37.

8. Kacak H, Ozcan YA, Kavuncubasi S. A new examination of hospital performance after healthcare reform in Turkey: sensitivity and quality comparisons. *International Journal of Public Policy.* 2014;10(4-5):178-94.

9. Yiğit V. Hastanelerde teknik verimlilik analizi: Kamu hastane birliklerinde bir uygulama. *Süleyman Demirel Üniversitesi Sağlık Bilimleri Dergisi.* 2016;7(2):9-16.

10. Yildirim S, Kacak H, Yildirim C. Reorganization Health Care Delivery and Productivity Change: An Assessment of Turkish Public Hospital Performance with Malmquist Index. *Journal of Applied Business & Economics.* 2018;20(3).

11. Küçük A, Özsoy VS, Balkan D. Assessment of technical efficiency of public hospitals in Turkey. *European Journal of Public Health.* 2020;30(2):230-5.

12. Sherman HD, Zhu J. *Service productivity management: Improving service performance using data envelopment analysis (DEA).* Springer science & business media; 2006.

13. Gok MS, Sezen B. Analyzing the efficiencies of hospitals: An application of Data Envelopment Analysis. *Journal of Global Strategic Management.* 2011;10(1):137-46.

14. Teleş M, Çakmak C, Konca M. Avrupa Birliği döngüsündeki ülkelerin sağlık sistemleri performanslarının karşılaştırılması. *Yönetim ve Ekonomi: Celal Bayar Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi.* 2018;25(3):811-35.

15. İlgün G, Konca M. Assessment of efficiency levels of training and research hospitals in Turkey and the factors affecting their efficiencies. *Health Policy and Technology.* 2019;8(4):343-8.

16. KESKİN Hİ. Türkiye'de sağlıkta dönüşüm programı ve kamu hastanelerinin etkinliği. *Akdeniz İİBF Dergisi.* 2018;18(38):124-50.

17. Bağci H, Konca M. Evaluating the Technical Efficiency of Hospitals Providing Tertiary Health Care in Turkey: An Application Based on Data Envelopment Analysis. *Hospital Topics.* 2021;99(2):49-63.

18. Chowdhury H WW, Laporte A. A. Efficiency and technological change in health care services in Ontario: An application of Malmquist productivity index with bootstrapping. *International Journal of Productivity and Performance Management.* 2011;60(7):721-745.

19. LaPlante AE, Paradi J. Evaluation of bank branch growth potential using data envelopment analysis. *Omega.* 2015;52:33-41.

20. Charnes A CW, Rhodes E. . Measuring the efficiency of decision making. *European Journal of Operational Research.* 1978;2(6):429–44.

21. Banker RD, Charnes A, Cooper WW. Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management science.* 1984;30(9):1078-92.

22. Ozcan YA. *Health care benchmarking and performance evaluation. An Assessment using Data Envelopment Analysis (DEA).* Springer; 2014.

23. Caves DW, Christensen LR, Diewert WE. The economic theory of index numbers and the measurement of input, output, and productivity. *Econometrica: Journal of the Econometric Society.* 1982:1393-414.

24. Färe R, Grosskopf S. Malmquist productivity indexes and Fisher ideal indexes. *The Economic Journal.* 1992;102(410):158-60.

25. Sağlık Bakanlığı Kamu Hastaneleri Kurumu 2014-2018 Dönemi Stratejik Planı. [Internet]. 2014; http://www.sp.gov.tr/upload/xSPStratejikPlan/files/1zPvc+TKHK.pdf. (Accessed: 28.02.2022).

26. Sağlık Bakanlığı Türkiye Kamu Hastaneleri Kurumu İdare Faaliyet Raporu. [Internet]. 2016; http://www.sp.gov.tr/upload/xSPRapor/files/j14JE+2015.pdf. (Accessed: 28.02.2022).

27. Küçük A. Public hospital reform in T urkey: The "public hospital union" case (2012-2017). *The International Journal of Health Planning and Management.* 2018;33(4):e971-e84.

28. Aydın S. Reisü'l-Etibba'dan Başkanlık Hükümeti Sağlık Bakanlığı'na. *SD Sağlık Düşüncesi ve Tıp Kültürü Dergisi.* 2018;47:6-9.

29. 694 Sayılı Olağanüstü Hal Kapsamında Bazı Düzenlemeler Yapılması Hakkında Kanun Hükmünde Kararname. [Internet]. 2017; https://www.resmigazete.gov.tr/eskiler/2017/08/20170825-13.pdf. (Accessed: 28.02.2022).

30. Türkiye Kamu Hastaneleri Kurumu 2017 Yılı Sayıştay Denetim Raporu [Internet]. 2017; https://sayistay.gov.tr/reports/download/356-turkiye-kamu-hastaneleri-kurumu (Accessed: 28.02.2022).