



THE EVALUATION OF THE FINANCIAL EFFICIENCIES OF HOSPITALS THROUGH DATA ENVELOPMENT ANALYSIS METHOD IN TERMS OF THEIR TYPE AND GROUP

HASTANELERİN TÜRÜ VE GRUBU AÇISINDAN FİNANSAL ETKİNLİKLERİNİN VZA YÖNTEMİYLE DEĞERLENDİRİLMESİ

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Abstract

This study has been done with the aim of examining the financial operations of 825 hospitals affiliated to the Ministry of Health. For this purpose, the efficiencies of hospitals have been assessed based on their financial data according to their group and type. Selected 6 input and 3 output variables have been analysed through Charnes – Cooper – Rhodes (CCR) Input Oriented Primal Model, Banker – Charnes – Cooper (BCC) Input Oriented Primal Model and Super Efficiency Model. In the light of the results obtained, 73 hospitals in CCR Model and 143 hospitals in BCC Model have been determined financially efficient. The results of both CCR and BCC Model have been found to be the same according to hospital type and group; however, efficiency levels of hospitals according to their groups have shown differences. Furthermore, although it appears at the end of the study that all input should be reduced and output should be increased according to hospital group, it has been seen that the number of inputs and outputs to be reduced and increased are not the same in every hospital group. It is thought that the results obtained will be a guide to operate hospitals with more efficient financial policies throughout the country.

Keywords: Health Care, Hospital, Performance Evaluation, Financial Efficiency, Productivity, Data Envelopment Analysis,

Öz

Bu çalışma Türkiye’de bulunan Sağlık Bakanlığı’na bağlı 825 hastanenin mali etkinliklerini incelemek amacıyla yapıldı. Bu amaçla hastane grubu ve hastane türüne göre hastanelerin mali verilerinden hareketle etkinlikleri ölçüldü. Seçilen 6 girdi ve 3 çıktı değişkenleri Veri Zarflama Analizinde (VZA) kullanılan Charnes – Cooper – Rhodes (CCR) Girdi Yönlü Primal Modeli, Banker – Charnes – Cooper (BCC) Girdi Yönlü Primal Modeli ve Süper Etkinlik Modeli ile analiz edildi. Elde edilen sonuçlara göre CCR modelinde 73 hastane, BCC modelinde ise 143 hastane mali açıdan etkin olarak belirlendi. Bununla beraber hastanelerin türüne ve hastane grubuna göre hem CCR hem de BCC modeli sonuçları aynı bulundu, ancak hastane grubuna göre hastanelerin etkinlik düzeyleri farklılık gösterdi. Ayrıca çalışma sonucunda hastane grubuna göre bütün girdilerin azaltılması, çıktıların ise artırılması gerekliliği ortaya çıkmakla beraber her hastane grubunda artırılması ve azaltılması gereken çıktı ve girdilerin aynı oranda olmadığı görüldü. Dolayısıyla girdi minimizasyonu açısından yöneticilerin daha kolay kontrol edebilecekleri değişkenleri seçmekte serbest davranış gösterebilecekleri sonucunda varıldı. Elde edilen sonuçların ülke bazında hastanelerin daha etkili mali politikalar ile çalıştırılması için yol gösterici olacağı düşünülmektedir.

Anahtar Kelimeler: Sağlık, Hastane, Performans Değerlendirme, Finansal(Mali) Etkinlik, Verimlilik, Veri Zarflama Analizi,

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GENİŞLETİLMİŞ ÖZET

Çalışmanın Amacı

Bu çalışma Türkiye’de bulunan Sağlık Bakanlığına bağlı hastanelerinin türü ve grubu açısından finansal verilerine göre mali etkinliğinin değerlendirilmesi amacıyla yapıldı.

Araştırma Soruları

Çalışmada “Kıt kaynaklara sahip olan hastaneler mali etkinliğini artırmak isterken hastanenin sahip olduğu türü ve grubunu dikkate almalı mıdır?” temel sorusu üzerine odaklanıldı. Ayrıca çalışmada “Etkin olmayan hastaneler etkinliklerini artırmak için hangi girdi ve çıktı değişkenlerinde iyileştirmeler yapılmalıdır?”, “Hastanelerin karne başarı puanları ile mali etkinlikleri arasında bir ilişki var mıdır?” soruları üzerinde de duruldu.

Literatür Araştırması

Sağlık hizmetlerinin kaynaklarının kıt olması ve sağlık harcamalarının ise giderek artması göz önüne alındığında sağlık işletmelerinin finansal veriler açısından hangi kaynakların ne oranda kullanılacağı ve hangi çıktılarında iyileştirme yapması gerektiği önem taşımaktadır. Aynı zamanda kaynak kullanmaları ve iyileştirmelerin hastanelerin sunduğu hizmetlerin büyüklüğü ve çeşitliliği bakımından birlikte değerlendirilemediği için hastanelerin ait olduğu tür ve gruplara göre etkinliklerinin değerlendirilmesi daha faydalı bilgilerin elde edilmesini sağlayacaktır. Literatürde sadece hastanelerin mülkiyetine göre etkinliklerini inceleyen çalışmalar bulunmasına rağmen, hastanelerin vermiş olduğu hizmet grubu ve türüne göre etkinliklerini inceleyen çalışmaya rastlanılmamıştır. Bu yüzden bu çalışmanın yapılması bu açıdan önem arz etmektedir.

Yöntem

Yapılan çalışma retrospektif bir yatay kesit veri çalışmasıdır. Türkiye’de Sağlık Bakanlığına bağlı hastanelerin/ağız dış sağlığı hastanelerin/merkezlerin türü ve grubu açısından mali performanslarını belirlemek amacıyla 2016 yılı finansal tablolarında yer alan gider ve gelir verileri VZA yöntemi kullanılarak değerlendirildi. Çalışmada karar verme birimi (gözlemler) kümesi homojen bir küme olmalıdır. Bu nedenle karar verme birimlerinin kümesi belirlenirken hastane türleri ve hastane grubu faaliyet belirleyici ölçütü olarak alındı. Türkiye’deki Sağlık Bakanlığına bağlı hastanelerden finansal performansları üzerinde etkili olduğu düşünülen girdi ve çıktı kümeleri belirlendi. Bu çerçevede çalışmada 6 girdi değişkeni seçildi: ilk madde malzeme giderleri, personel ücret ve giderleri, dışarıdan sağlanan fayda ve hizmetler giderleri, diğer çeşitli giderler, kamu payları ile amortisman ve tükenme payları. Çıktı değişkenleri olarak ise ayaktan hasta gelirleri, yatan hasta gelirleri ve diğer gelirler alındı. Bu çalışmada CCR Girdi Yönlü Primal Modeli, BCC Girdi Yönlü Primal Modeli ve Süper Etkinlik Modeli kullanıldı.

Ayrıca etkin karar birimlerinin de karşılaştırılabilmesini sağlayabilmek için Süper Etkinlik Modeli ile çözümlene yapıldı.

Sonuç ve Değerlendirme

Çalışma sonucunda CCR modelinde 73 hastane, BCC modelinde ise 143 hastane mali etkin hastaneler olarak belirlendi. Ayrıca çalışma sonucunda tüm hastane gruplarında ve türlerinde aralarında farklılıklar olsa da kullanılan girdilerin çeşitli oranlarda azaltılması, tüm çıktılarının ise çeşitli oranlarda artırılması gerektiği sonucuna ulaşıldı. Bulunan sonuçlara göre yöneticiler daha kolay kontrol edebilecekleri değişkenleri seçmekte serbest davranış gösterebilirler. Sonuç olarak, sadece bir alana yönelik (çocuk, kadın doğum, göz, göğüs hastalıkları, ağız ve diş sağlığı vb.) hizmet veren bir dal hastanesi ile bütün branşları içinde bulunduran genel bir hastanelerin kendi içinde ayrı ayrı değerlendirilmesi ve iyileştirme önerilerinin buna göre yapılması girdi azaltmada veya çıktı arttırmada daha makul oranları ortaya koyacaktır. Diğer taraftan hem tüm hizmetlerin verildiği hem de eğitim verilen eğitim ve araştırma hastaneleri ile Afiliye hastanelerin aynı şekilde etkinliklerinin değerlendirilmemesi yöneticilere daha sağlıklı bilgiler sunabilecektir. Bunun için hastanelerin kendi grupları ve türleri içinde etkinlik düzeylerini ortaya konulup, etkin olmayan hastanelerin istenen etkinlik düzeyine ulaşmasını sağlayacak ve teşvik edecek bir ortamın yaratılması sağlanmalıdır. Birbirleriyle denk olanların kıyaslanmasından elde edilecek sonuçlara göre performans ölçümlerinin değerlendirilmesi ulaşılabilir hedeflerin konulması açısından daha faydalı olacağı düşünülmektedir..

1. INTRODUCTION

Hospital efficiency and productivity research are among the top priority areas for hospital management and health economics (Li & Dong, 2015). Also, inefficient use of healthcare service resources continues to be the main cause of increasing health service costs (Lee, Yang, & Choi, 2009). With regard to this, health reforms are implemented in order to eliminate inefficient use of already scarce health resources and to reduce the ever-increasing health costs. In Turkey, too, certain legislative regulations have been put in place within the framework of Transformation of Health Program with the aim of measuring the efficiency and productivity in service provision and resource use in hospitals. With such regulations, hospital managers and top executives are subject to performance evaluations for the years they serve in the hospital via the ‘productivity card’ program. One of the criteria in the productivity card is “Financial Services Management”. Based on the performance scores recorded on the productivity cards, performances of the managers have been evaluated, and they are either kept in or dismissed from their positions accordingly.

Furthermore, the implementation of “performance-based pay” system, which is also one of the reforms, has made it much more important for health service providers to ensure hospital productivity and allocate healthcare costs efficiently. Analyses of the correlations between hospital productivity and healthcare costs have provided basis for the importance of efficient allocation of healthcare expenses (Gok & Altindag, 2015).

Governmental bodies such as the Health-Care and Social Security Department agree that the current performance indicators shed relatively less light on the issue of productivity (Wagstaff, 1989). It has been suggested that it would be fair if productivity were also taken as a performance indicator in addition to comparing the performances of hospitals based on a single indicator such as profit margins or other financial indicators (Lee et al., 2009).

The most commonly used concept in performance evaluations is efficiency. Efficiency is obtaining maximum output through minimum effort or cost (Atmaca, Turan, Kartal, & Çiğdem, 2012). There are two main most commonly implemented methods in the world to measure efficiency of hospitals: parametric and non-parametric methods (Franco Miguel, Fullana Belda, & Rua Vieites, 2018) The parametric method, which is represented by Data Envelopment Analysis (DEA), is based on linear programming and is used to measure relative efficiency of hospitals with multiple inputs and multiple outputs (Daraio C & L., 2007).

The first study which researched the efficiency of health care enterprises through DEA method was conducted by Lavers and Whynes in 1978. In the study, the efficiency of 193

maternity clinics in England was measured by using 3 inputs (the number of doctors, the number of nurses, and pharmaceutical and medical supply costs) and 2 outputs (the number of patients and daily average hospital bed occupancy) as variables (Lavers & Whynes, 1978). Today, there are several studies that measure the efficiency of hospitals through DEA. However, those studies differ in terms of the input and output variables which are used to measure efficiency.

The review of literature has revealed that most of the DEA method-based relevant efficiency analyses on hospitals are based on non-financial input and output variables. While the number of health-care employees (such as doctors, assistants, nurses, auxiliary health-care workers) and the total number of beds are used as input variables, the number of outpatients, inpatients, and discharged patients, hospital bed occupancy rate, hospital bed turnover rate, the total number of hospitalization days, the total number of surgical operations, and hospital death rates are used as output variables (Atmaca et al., 2012; Bayraktutan & Pehlivanoglu, 2012; Franco Miguel et al., 2018; Gülsevin & Türkan, 2012; Kutlar & Salamov, 2016; Li & Dong, 2015; Yigit, 2016)

There are also studies in the literature, although not many, which defined inputs and outputs based on both financial and non-financial data or based only on financial data to measure performances of health care enterprises through DEA method. In such studies, total expenses variable is used as an input variable in addition to variables of specialist physicians, practitioners and the total number of hospital beds, whereas total income is used as an output variable in addition to the variables of outpatients, major surgeries, and the number of hospitalization days (Bal, 2013; Cypionka, Kraus, Mayer, & Rohrling, 2014; Temur, 2010; Temür & Bakırcı, 2008).

In efficiency analyses which are based only on financial data, costs of raw materials and supplies, salaries and fringe benefits, outsourced benefits and services, other miscellaneous expenses, and amortization and depletion allowance have been used as input variables, while revenue from services is used as an output variable (Ayanoğlu, Atan, & Bayram, 2008; Ayanoğlu, Atan, & Beylik, 2010).

Considering the scarce health care service resources and ever-increasing health care costs, it is important for health care enterprises, in terms of financial data, how much of each resource will be used and which outputs should be improved. Moreover, it will provide more useful insights when the efficiency of hospitals is evaluated according to the types and groups hospitals belong to so that the use of resources and improvements will not be evaluated together with the size and variety of the services hospitals provide. Although there are studies in the literature which focus on the efficiency of hospitals based only on the ownership of hospitals

(Czypionka et al., 2014; Gok & Altindag, 2015; Sibbel & Nagarajah, 2012), no studies have been found in the literature that analyze the efficiency of hospitals based on the groups and types of services that hospitals provide. Therefore, the present study has been conducted in order to evaluate the financial efficiency based on financial data regarding the type and group of hospitals affiliated to the Turkish Ministry of Health.

1.2. METHODOLOGY

The present study is a retrospective cross-sectional study. The income and expenditures data presented in 2016 financial statement have been analyzed through DEA method with the aim of determining financial performances of hospitals, oral and dental hospitals, and healthcare centers affiliated to the Ministry of Health in Turkey according to their types and groups. Private hospitals and university hospitals are not included in the study.

2.1. The Selection of Decision-Making Units

In the study, the set of decision-making units (observations) should be homogeneous .That is why, in the current study, hospital types and hospital groups have been taken as operation determinant criteria while determining the set of decision-making units.

The Ministry of Health adopted the understanding of Regional Health Planning to provide a balanced distribution of health resources such as health labor force ,institution, medical technology and finance and to use these healthcare resources efficiently and actively (Ministry of Health,2009) Within this scope, it has classified hospitals according to their service delivery capacity, institution, labor force, medical technology equipment, clinic and specialized medical unit .Hospitals are differentiated according to their groups that include Oral and Dental Health Hospital, Central Service of Oral-Dental Health, Affiliated Hospital, State Hospital, Training and Research Hospital. Hospitals are divided into two groups based on the type of service they offer in that General Services Hospitals and Hospitals Specialized in a Particular Area. While General Services Hospitals are hospitals where all medical branches exist, branch hospitals are Medical Specialties where just one branch such as Obstetrics and Gynecology, Pediatrics, Chest Diseases, Cardiology is offered.

The data according to hospital groups are; 17 Oral and Dental Hospitals (ODH), 128 Oral and Dental Clinics (ODC), 80 Affiliated Hospitals (AF), 590 State Hospitals (SH), and 10 Training and Research Hospitals (TRH). The data according to hospital types are 222 Specialty Hospitals and 603 General Hospitals.

2.2. Determination of Input and Output Variables to Present the Financial Performance of Hospitals

The input and output units that were thought to have impact on the financial performances of hospitals affiliated to the Ministry of Health in Turkey have been determined. Accordingly, 6 input variables have been selected in the present study: raw materials and supplies costs, personnel salaries and benefits, outsourced benefits and services costs, other miscellaneous costs, public shares, and amortization and depletion allowances. As for output variables, they have been determined as outpatient revenues, inpatient revenues, and other revenues.

2.3. Determination and Implementation of Returns to Scale in DEA Models

There are two basic models in DEA. Of these two models, CCR model is based on constant returns to scale assumption. BCC model, on the other hand, is based on variable return to scale assumption. Constant return to scale (CRS) means an increase in the input leads to the same rate of increase in the output. In variable return to scale (VRS), an increase in the input might lead to a disproportionate increase in the output (Özden, 2008). In CCR model, all the variables are constrained to be effective, whereas in BCC model it suffices that at least one of the variables is effective (Cooper, Seiford, & Zhu, 2011). In the present study, CCR Input-Oriented Primal Model, BCC Input-Oriented Primal Model, and Super-Efficiency Model have been used. Analyses have been conducted with the Super-Efficiency Model to ensure the comparability of efficient decision-making units.

The main reason why those models have been selected is that they make it possible for hospital managers to be able to control input so that they can develop and implement financial policies. Since the present study makes use of data obtained from state hospitals and since revenue items which have been taken as “output” in the analyses have been determined according to constant prices listed in Health Application Communiqué (HAC), and Budget Execution Communiqué (BEC), those revenue items have not been controllable by managers. Therefore, hospital managers have been in no position to actively control or intervene in those items. In this regard, cost items classified as “inputs” have been used in efficiency measurements.

In input-oriented analyses in data envelopment analysis, the rate of efficiency must be either equal to 1 (100%) or smaller than 1 (<100%). When the rate of efficiency is equal to 1 (100%), it suggests that the decision-making unit will work efficiently/productively; however, when it is <1 (<100%), it is assumed that the decision-making unit will not work efficiently/productively (Kocakoç Deveci, 2003).

2.4.Data Analysis

The spearman rank-order correlation analysis has been done for the correlations between the rankings of hospitals based on the scores on the cards, and rankings of CCR input-oriented super efficiency scores and BCC input-oriented super efficiency scores.

The application of the DEA model and the statistical analyses regarding the efficiency scores have been done through “Efficiency Measurement System (EMS) 1.3” package program based on CCR Input-Oriented Efficiency, CCR Input-Oriented Super Efficiency, BCC Input-Oriented Efficiency, and, BCC Input-Oriented Super Efficiency models.

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3. RESULTS

3.1. Descriptive Statistics

The selection of input and output variables in DEA is important regarding whether there is a correlation between these variables. A positive correlation between input and output variables is not necessary, but it is a positive factor contributing to the reliability of the analysis (Behdioğlu & Özcan, 2009). Therefore, the correlation between the input and output variables has been examined in order to determine the reliability of the analyses and a statistically significant and positive correlation at the level of 1% has been found between the variables (Table 1).

Table 2 presents the basic statistical values about the input and output variables used in DEA analysis. It is observed that among the input variables, the highest mean belongs to personnel salaries and benefits (14.766.261 TL), and the lowest mean belongs to amortization and depletion allowances (440.774 TL); as for the output variables, the highest mean belongs to outpatient revenues (14.747.521 TL), whereas the lowest mean to other revenues (5.423.784 TL).

3.2. Results On the Basis of Hospital Types and Groups

In the study, financial efficiency of hospitals has been measured using financial data based on hospital groups and types. For the findings to be better understood and interpreted, the hospitals were grouped as “Efficient Hospitals” and “Inefficient Hospitals” while using the efficiency values of hospitals. As a result of analyses, statistically significant correlations have been found ($P = 0,000 < \alpha = 0,05$) between hospital variables and efficiency group both for CCR and BCC models (Table 3, Table 4). Also, the same findings have been obtained for all variables in both models.

The most efficient hospitals according to hospital groups are 4 “Oral and Dental Hospitals” (23,5%) in CCR model and 37 “AF” hospitals (46,3%) in BCC model. The least efficient hospital group, on the other hand, are 7 “AF” hospitals (8,7%) in CCR model, and 62 “SH” hospitals (10,5%) in BCC model (Table 3).

The most efficient hospitals according to hospital types have been found to be “ODHs” in both CCR and BCC models; 44 hospitals (19,8%) in CCR model and 64 hospitals (28,8%) in BCC model. However, the least efficient hospital type has been diagnosed as “General” hospitals in both models; 29 “General” hospitals (4,8%) in CCR model, and 79 “General” hospitals (13,1%) in BCC model (Table 4).

3.3. Improvement Results of Input and Output units

Potential improvement results showing the kind of changes that should be made in the input and output variables for inefficient hospitals according to the results of BCC model have been given in Table 5, Table 6, and Table 7.

In the study, based on BCC Model results, how to improve input and output variables for inefficient hospitals have been given in Table 5, Table 6 and 7.

As a result of the analyses, it has been concluded that the inputs used in all hospital groups should be reduced at different rates, whereas all the outputs should be increased at different rates. As for inputs, it has been found that the highest decrease should be made in amortization and depletion allowances at a rate of 38,4%; the input requiring the least amount of improvement has been public share with a rate of 24,9%. As for financial outputs, the highest increase should be made in other revenues at a rate of 20,5%, whereas the output requiring the least amount of increase has been found outpatient revenues with a rate of 0,19% (Table 5).

The analyses reveal that all the inputs should be reduced, and the outputs should be increased according to hospital groups; however, it has also been found out that rates of the outputs and inputs to be increased and reduced have not been the same for each hospital group. As for all the inputs, it has been found out that the hospital group which needs the highest rate

of reduction in its inputs was SHs, whereas the hospital group which needs the lowest rate of decrease in its inputs was ODHs. On the other hand, the hospital group which needs the highest rate of increase in outpatient revenues is AFs, and which needs the lowest rate of increase is SHs. The hospital group which needs the highest increase in inpatient revenues has been found to be ODHs, whereas AF hospitals have been the ones which need the lowest rate of increase in that regard. ODHs have been found to need the highest increase in other revenues, and the hospital group requiring the lowest rate of increase in that regard has been TRHs (Table 5).

Similar to the case of hospital groups, in the analyses based on hospital types it has been determined that the inputs should be reduced at different rates and outputs should be increased at different rates. It has been found out that general hospitals should reduce their inputs more and increase their outputs less compared to specialty hospitals. It has been observed that general hospitals requires the highest rate of decrease in amortization and depletion allowances with a rate of 41,1%, and the raw materials and supplies costs with a rate of 35%, while they require the lowest rate of decrease in public shares with a rate of 27,2%. Specialty hospitals, on the other hand, have been found to require the highest increase in other revenues, and the lowest increase in outpatient revenues (Table 6).

Hospitals groups have also been analyzed within each group according to hospital types in order to determine whether the improvements intended for their inputs and outputs have any impact. Among the hospital types, ODHs and ODCs provide services only as specialty hospitals and, therefore, the results of those analyses are not included in the table.

The results of the analyses show that the specialty hospitals among AFs and TRHs, compared to other hospital groups, should take actions to reduce their inputs the most compared to the general hospitals among them. According to hospital groups, the specialty hospitals among SHs have been the ones requiring the highest decrease in their costs, whereas it has been determined that they should decrease their outsourced benefits and services (32.4%) and other miscellaneous costs (35.9%) more compared to the general hospitals among them. The specialty hospitals among AFs and SHs should make more improvements on other revenues compared to the specialty hospitals among TRHs (Table 7).

3.4. Evaluation on the basis of Research Models

Spearman rank-order correlation coefficient (rs) is used to determine the nature of correlation between two variables which are ordinally scaled or ranked according to a certain criterion. In this regard, the Spearman rank-order correlations between the rankings of hospitals based on their scores on the cards and the rankings of CCR input-oriented super efficiency score and BCC input-oriented super efficiency score are given in Table 8. A statistically significant

correlation ($P < 0,01$) has been found between performance card score rankings of hospitals and both CCR and BCC Input-Oriented Super Efficiency Score rankings (Table 8). The correlation of CCR Input-Oriented Super Efficiency Score to the card scores has been found to be higher than that of BCC Input-Oriented Super Efficiency Score.

The same analysis has been conducted for hospital types and a statistically significant and positive correlation ($P < 0,01$) has been found between the rankings of CCR Input-Oriented Super Efficiency Score and BCC Input-Oriented Super Efficiency Score and the rankings of both specialty hospitals and general hospitals. In addition to the statistical significance of the correlation, the financial success rankings and card score rankings of specialty hospitals (CCR Rho:0,180 BCC Rho:0,125) have been found to be more significant compared to those of general hospitals (CCR Rho:0,168, BCC Rho:0,153).

4. DISCUSSION

As a result of the analyses, 73 hospitals in the CCR model and 143 hospitals in the BCC model have been determined to be financially efficient. In some studies measuring efficiency based on non-financial data, hospitals were found to be efficient 11, 24, but in some others hospitals were found to be considerably inefficient (Bayraktutan & Pehlivanoglu, 2012). However, there are also studies which conclude that the efficiency levels of hospitals are not low, but still the resources in those hospitals have not been used efficiently (Bal, 2013). In this regard, it has been emphasized by studying the reasons why health policy makers and hospital managers in the country do not use resources efficiently that the necessary measures should be taken to ensure a more rational allocation of resources (Bal, 2013).

In another study which measured the efficiency of hospitals based on financial data, it was determined that hospitals had a total of 13,43% idle expenditure and regarding the profitability/loss rates of hospitals, it was concluded that the hospitals should reduce their expenditures at a rate of 10,43% in order to reach a balance of income and expenditures (Ayanoglu et al., 2010). Kutlar and Salamov measured the efficiency of public hospitals in Azerbaijan, through DEA analysis using input-oriented CCR and BCC models. As a result of the study, of the hospitals in 36 provinces, 11 hospitals in the CCR model, and 19 hospitals in the BCC model were found to be fully efficient (Kutlar & Salamov, 2016).

Since hospitals operate in the service sector, it is not surprising that personnel salaries and benefits is the highest cost (14.766.261TL), but not raw materials and supplies cost as in the manufacturing sector. In a study which analyzed the differences between system-affiliated and independent hospitals in terms of financial performance, costs, and productivity, it was

observed that the only difference between the two groups of hospitals regarding their cost and productivity measurements was salary costs (Gary et al. 1985). Another significant cost item for hospitals is the outsourced benefits and services such as electricity, water, gas, telephone, sanitation, security, and surveillance. It was also supported in other studies that the outsourced benefits and services cost is the second highest cost among all inputs (Ayanoğlu et al., 2010).

The amortization rates of estates and intangible assets are determined by the Ministry of Finance based on their economic life. A lot of intangible assets which have reached the end of their economic life continue to be used in hospitals. Since the amortization for those intangible assets is not recorded as a cost item, amortization costs were found to be the lowest cost among the inputs (Rates, 2018).

The basic income sources of the hospitals, as imposed by the nature of their operational field, are outpatients and inpatients. In this regard, it is expected that the rates of outpatient and inpatient revenues, which are among the output variables, are close to each other, and that the average of revenues other than those two are low. The fact that in almost all efficiency studies which are based on non-financial data, the number of personnel is taken as the input and the number of outpatients and inpatients as the output, and that in the present study the financial values for those variables have been found to be high are proof that those variables are significant in terms of determining the efficiency of hospitals.

Since in CCR model all inputs should be efficient, and since ODHs are smaller and more manageable compared to other groups of hospitals, of the hospitals in this group, 23,5% have been determined to be efficient. The results of the BCC model reveal that larger hospitals cannot utilize all their resources efficiently and that each hospital utilizes at least one of the resources efficiently. To illustrate, while 8,7% of AFs have been found to have the second least efficiency rate in the CCR model, in the BCC model they have been determined to be the second most efficient hospitals with a rate of 53,8%, which suggests that the hospitals manage some of their inputs efficiently. In a study, fixed and variable returns to scale efficiency and super efficiency of 5 countries (Turkey, Azerbaijan, Kazakhstan, Kyrgyzstan, Uzbekistan) were aimed to be determined by using CCR and BCC models. In all the analyses, all the countries, except for two, were found to have full efficiency. As a result of the analysis done through BCC method, as far as the recommended potential improvement rates are concerned, there has been a decrease in the improvement rates of input variables compared to the CCR model, but it is considered necessary that improvements should be made by increasing the output variables (Yeşilyurt & Salamov, 2017). It has also been seen that the costs of hospitals which do not operate on an optimal scale increase at a lower rate (Ferrier & Valdmanis, 1996).

According to the CCR model, 20% of specialty hospitals, but 5% of general hospitals have been found to be efficient. The reason for that might be that specialty hospitals have a more specific scope of service and are smaller compared to general hospitals, and therefore, financially more manageable.

It has been determined that general hospitals should especially reduce their raw materials and supplies costs more compared to specialty hospitals, whereas specialty hospitals should increase their outputs, especially other revenues, more than general hospitals. As for the results obtained from the BCC model, it has been observed that the efficiency percentage of general hospitals increases by a rate of 2,6. Similar to the case of “Hospital group” criterion, in “hospital type” criterion it has been detected that larger hospitals which provide a wider range of health care services utilize at least one of their input variables efficiently.

It has been concluded in the present study that hospitals should generally reduce their amortization and depletion allowance costs the most in order to improve their financial performances. As has been mentioned in the previous sections, enterprises in Turkey cannot freely determine an economic life for their intangible assets and therefore, they cannot amortize their assets freely and all those procedures are implemented according to the legal list of amortization criteria. However, the case is that a lot of intangible assets continue to be used although their amortization periods are over. As a result of that, such assets create an output with 0 (zero) input. On the other hand, hospitals which provide services by newly-bought assets or assets the amortization periods of which continue calculate high prices of amortization. Thus, such hospitals do not seem to be efficient since they obtain the same output with high inputs, and they can only ensure improvement by decreasing the rates of high costs.

Since contribution rates are determined by fixed percentages and therefore there has not been found a considerable difference between efficient and non-efficient hospitals, and since improvements can be provided by less amounts of decrease, it has been concluded in the present study that public share costs should be the least to be reduced to ensure improvement.

In order to make improvements in terms of financial outputs, it has been determined that other revenues should be increased the most, whereas outpatient revenues are the least to be increased. However, in a study conducted in a private hospital, it was concluded, contrary to the conclusions of the present study, that the efficiency of the hospitals might be increased by reducing the total number of examinations and practicing physicians (Atmaca et al., 2012).

The reason why SHs have been found to be the hospital group which require the highest decrease in the inputs for improvement might be that the outsourced benefits and services costs and other costs of specialty hospitals of SHs have been high. As for TRHs, the outsourced

benefits and services costs and other miscellaneous costs should be reduced the most in order to make improvements.

The hospital group which has been determined to require the least amount of decrease in their inputs have been ODCs and ODHs because they do not have high costs of supplies due to the fact that they are smaller, and they offer a single form of health care service compared to other hospital groups. In a study conducted in dental hospitals, it was concluded that the units of the hospitals would be more productive when the number of auxiliary health care workers and academic staff was decreased (Gülcü, Coşkun, Yeşilyurt, Coşkun, & Esener, 2004). Since ODHs provide more outpatient services rather than inpatient services compared to other hospital groups, their inpatient revenues are not high. ODHs have been found to be the hospital group which require the highest amount of increase in their inpatient revenues and other revenues in order to improve their revenues, which has already been an expected result. In a study, it was concluded that optimizing the number of beds would increase hospital productivity (Pirani, Zahiri, Engali, & Torabipour, 2018). As for AFs, since they earn more from inpatients, they should increase their outpatient revenues the most.

Lastly, the present study has also identified that there is a significant correlation between the ranking of the hospitals based on their financial success scores in the present study and the rankings of the Ministry of Health based on performance card success scores. Especially, the correlation between the financial success ranking of specialty hospitals and their performance card success ranking has been found to be more significant than that of general hospitals. The reason for that, as has been mentioned in the previous sections, is that specialty hospitals are smaller and therefore easier to be managed. Another reason is that they have less amount of costs which are more easily controlled since they provide a single form of health care service.

5. CONCLUSION

Although hospitals are nonprofit businesses, this research offers a highly important contribution as it provides improvement suggestions for sustainability of finances doing profitability analysis and efficiency analysis.

Furthermore, this study is one of the most comprehensive studies that has evaluated the efficiencies of all hospitals affiliated to the Ministry of Health in terms of their types and groups through financial data. The current study concludes that in all hospital groups and types the input should be reduced at different rates and all output should be increased at various rates. It has been diagnosed that hospitals use other miscellaneous costs inefficiently in terms of their

types and groups. The reason of this is both as it is impossible to control greater amount of insurance expenses than other expenses such as marketing, advertising, hiring, training, culture, court and notary and public hospitals lack marketing and advertising activities. Therefore, managers can increase the efficiency of hospitals preferring more easily controllable variables.

When specialty hospitals which provide a single form of health care service (pediatrics, gynecology, ophthalmology, pulmonology, oral and dental health, etc.) and general hospitals which embody all branches of medicine are separately evaluated and improvement recommendations are made accordingly, more reasonable results will be achieved in terms of input decreases and output increases.

Moreover, if the efficiency of the training and research hospitals, which provide all kinds of health care services, and affiliated hospitals are evaluated on different measures, more reliable insights will be provided for the managers. In this regard, it should be ensured that the efficiency levels of hospitals are evaluated within the hospital groups and types they belong to, and that a conducive environment is created in order to ensure and encourage that non-efficient hospitals reach the desired level of efficiency. It is suggested that it will be more beneficial in terms of setting achievable goals if equivalent hospitals are compared and the performance evaluations are conducted according to the results of such comparisons.

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TABLES

Table 1. Correlation Between The Input and Output Variables Used In Analysis

	Raw Materials and Supplies Costs	Personnel Salaries and Benefits	Outsourced Benefits and Services Costs	Other Miscellaneous Costs	Public Shares	Amortization and Depletion Allowances	Outpatient Revenues	Inpatient Revenues	Other Revenues
Raw Materials and Supplies Costs	1	0,944**	0,931**	0,565**	0,956**	0,702**	0,894**	0,912**	0,952**
Personnel Salaries and Benefits	0,944**	1	0,979**	0,529**	0,989**	0,705**	0,953**	0,954**	0,907**
Outsourced Benefits and Services Costs	0,931**	0,979**	1	0,559**	0,980**	0,696**	0,950**	0,949**	0,895**
Other Miscellaneous Costs	0,565**	0,529**	0,559**	1	0,520**	0,342**	0,557**	0,464**	0,579**
Public Shares	0,956**	0,989**	0,980**	0,520**	1	0,721**	0,962**	0,962**	0,913**
Amortization and Depletion Allowances	0,702**	0,705**	0,696**	0,342**	0,721**	1	0,676**	0,737**	0,636**
Outpatient Revenues	0,894**	0,953**	0,950**	0,557**	0,962**	0,676**	1	0,878**	0,842**
Inpatient Revenues	0,912**	0,954**	0,949**	0,464**	0,962**	0,737**	0,878**	1	0,859**
Other Revenues	0,952**	0,907**	0,895**	0,579**	0,913**	0,636**	0,842**	0,859**	1

** The correlation coefficient is statistically significant at 1% level. (P < 0,01)

Table 2. Basic Istatistical Values About The Input And Output Variables Used in Analysis

	Raw Materials and Supplies Costs	Personnel Salaries and Benefits	Outsource d Benefits and Services Costs	Other Miscellaneous Costs	Public Shares	Amortization and Depletion Allowances	Outpatient Revenues	İnpatient Revenues	Other Revenues
N	825	825	825	825	825	825	825	825	825
Mean	₺7.171.501	₺14.766.261	₺9.806.780	₺881.218	₺2.088.296	₺440.774	₺14.747.521	₺10.455.803	₺5.423.784
Std. Error	491377,66	751715,05	500509,07	57272,05	112502,59	35183,94	664153,87	634511,93	412601,92
Minimum	₺10.607	₺0	₺78.530	₺0	₺3.789	₺0	₺7.644	₺0	₺0
Maximum	₺111.065.005	₺146.143.449	₺85.954.049	₺27.364.824	₺19.634.298	₺19.409.204	₺113.716.828	₺143.170.480	₺99.026.081

Table 3. Efficiency Values By Hospital Group

DEA Model	CCR Input-Oriented Primal Model		BCC Input-Oriented Primal Model	
	Non-Efficient Hospitals n (%)	Efficient Hospitals n (%)	Non-Efficient Hospitals n (%)	Efficient Hospitals n (%)
ODH	13(76,5)	4(23,5)	10(58,8)	7(41,2)
ODC	108(84,4)	20(15,6)	97(75,8)	31(24,2)
AF	73(91,3)	7(8,7)	43(53,8)	37(46,3)
SH	550(93,2)	40(6,8)	528(89,5)	62(10,5)
TRH	8(80,0)	2(20,0)	4(40,0)	6(60,0)
Total	752(91,2)	73(8,8)	682(82,7)	143(17,3)
Chi-Square (χ^2)	16,504 ve P = 0,002		89,548 ve P = 0,000	

Table 4. Efficiency Values By Hospital Types

DEA Model	CCR Input-Oriented Primal Model		BCC Input-Oriented Primal Model	
	Non-Efficient Hospitals n (%)	Efficient Hospitals n (%)	Non-Efficient Hospitals n (%)	Efficient Hospitals n (%)
Specialty	178 (80,2)	44 (19,8)	158 (71,2)	64 (28,8)
General	574 (95,2)	29 (4,8)	524 (86,9)	79 (13,1)
Total	752 (91,2)	73 (8,8)	682 (82,7)	143 (17,3)
Chi-Square (χ^2)	45,329 ve P = 0,000		28,011 ve P = 0,000	

Table 5. Potential Improvement Results According to Hospital Group for Non-efficient Hospitals

Hospital Group	Input						Output		
	Raw Materials and Supplies Costs %	Personnel Salaries and Benefits %	Outsourced Benefits and Services Cost %	Other Miscellaneous Costs %	Public Shares %	Amortization and Depletion Allowances %	Outpatient Revenues %	Inpatient Revenues %	Other Revenues %
ODH	-22.9	-14.1	-19.6	-30.5	-17.2	-28.1	0.35	150.3	103.5
ODC	-13.9	-12.8	-14.1	-27.1	-14.6	-22.9	0.13	33.3	74.5
AF	-25.4	-21.1	-21.0	-26.0	-16.3	-34.3	2.10	0.2	21.9
SH	-35.3	-32.7	-30.1	-33.9	-27.7	-41.9	0.05	1.0	8.8
TRH	-31.5	-30.9	-30.6	-31.8	-20.6	-44.9	0.45	0.7	3.5
Total	-31.4	-28.8	-27.1	-32.3	-24.9	-38.4	0.19	7.8	20.5

Table 6. Potential Improvement Results According to Hospital Types for Non-efficient Hospitals

Hospital Types	Input						Output		
	Raw Materials and Supplies Costs %	Personnel Salaries and Benefits %	Outsourced Benefits and Services Cost %	Other Miscellaneous Costs %	Public Shares %	Amortization and Depletion Allowances %	Outpatient Revenues %	Inpatient Revenues %	Other Revenues %
Specialty	-19.6	-17.8	-19.5	-29.6	-17.3	-29.6	1.4	30.0	69.9
General	-35.0	-32.2	-29.4	-33.1	-27.2	-41.1	-0.2	1.0	5.4
Total	-31.4	-28.8	-27.1	-32.3	-24.9	-38.4	0.2	7.8	20.5

Table 7. Potential Improvement Results According to Hospital Group and Hospital Types for Non-efficient Hospitals

Hospital Group	Hospital Types	Input						Output		
		Raw Materials and Supplies Costs %	Personnel Salaries and Benefits %	Outsourced Benefits and Services Cost %	Other Miscellaneous Costs %	Public Shares %	Amortization and Depletion Allowances %	Outpatient Revenues %	Inpatient Revenues %	Other Revenues %
AF	Specialty	-26.4	-23.0	-24.8	-31.6	-18.8	-40.0	4.82	0.1	49.8
	General	-24.7	-19.6	-18.0	-21.6	-14.2	-29.7	-0.05	0.3	-0.2
	Total	-25.4	-21.1	-21.0	-26.0	-16.3	-34.3	2.10	0.2	21.9
SH	Specialty	-31.9	-30.7	-32.4	-35.9	-24.7	-44.0	3.85	0.1	60.7
	General	-35.5	-32.9	-30.0	-33.7	-27.9	-41.7	-0.18	1.1	5.7
	Total	-35.3	-32.7	-30.1	-33.9	-27.7	-41.9	0.05	1.0	8.8

TRH	Specialty	-38.8	-37.8	-40.5	-38.7	-25.6	-56.3	0.25	0.8	5.8
	General	-24.2	-24.0	-20.8	-24.9	-15.6	-33.5	0.65	0.6	1.1
	Total	-31.5	-30.9	-30.6	-31.8	-20.6	-44.9	0.45	0.7	3.5

Table 8. Correlation between performance card score rankings of hospitals and both CCR and BCC Input-Oriented Super Efficiency Score rankings

			CCR Input-Oriented Super Efficiency Score	BCC Input-Oriented Super Efficiency Score	Performance Card Score
Spearman's rho	CCR Input-Oriented Super Efficiency Score	Correlation Coefficient	1.000	0,825**	0,343**
		P		0.000	0.000
		N	825	825	798
	BCC Input-Oriented Super Efficiency Score	Correlation Coefficient	0,825**	1.000	0,277**
		P	0.000		0.000
		N	825	825	798
	Performance Card Score	Correlation Coefficient	0,343**	0,277**	1.000
		P	0.000	0.000	
		N	798	798	798

** Correlation Coefficient is statistically significant at 1% level.