Comparative Cost Analysis of Inpatients Admitted by Two Chest Disease Hospitals of Turkey Between 2006 and 2008

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ABSTRACT

***Aim**: This study aims at reviewing incomes obtained in return of health care provided in terms of cost per bed, cost per patient, cost per patient per day, and different type of diseases between 2006 and 2008 in two chest disease and thoracic surgery education and research hospitals in Turkey.*

***Method**: Chest disease hospitals face steadily increasing numbers of patients, most of them suffering from chronic diseases requiring long hospitals stays, but in terms of their incomes they are compelled to operate on smaller budgets. It was observed throughout the years of 2006, 2007 and 2008 that in the two chest disease hospitals, which are akin in terms of their numbers of beds, incomes per bed and per patient, as well as costs per patient decreased continually.*

***Result**: The rate of medications and hospital materials expenditures in total expenditures, as one of the factors affecting costs, on the other hand, was on the rise in both hospitals.*

***Conclusion**: Cost per patient per day was the highest in the case of lung cancer patients, followed by COPD patients.*

***Key words**: Chest disease, cost, expense parameters*

2006 2008 Yılları Arasında İki Göğüs Hastanesinde Yatan Hastaların Maliyet Analizinin Karşılaştırılması

Amaç: *Bu çalışma Türkiye' de iki Göğüs Hastalıkları ve Göğüs Cerrahisi Eğitim ve Araştırma Hastanesinde 2006-2008 yılları arasında yatak, hastabaşı, günlük hasta ve farklı hastalıklardaki maliyetlerini sağlık bakımından elde edilen gelirlere göre retrospektif olarak değerlendirmeyi amaçladık.*
Metod: *Göğüs hastalıkları hastaneleri gittikçe artan ve birçoğu uzun süreli hastane yatışını gerektiren ancak düşük maliyetler içinde kalınmasını gerektiren hastalarla karşılaşmaktadır. 2006, 2007 ve 2008 yılları arasında yatak sayıları, yatak gelirleri hasta başı gelirleri gittikçe azalan birbirine benzer iki göğüs hastalıkları hastanesi karşılaştırıldı.*
Bulgular:*Maliyetleri etkileyen faktörlerden biri olaran toplam tedavi maliyetleri ve hastane malzemeleri harcamaları hızı her iki hastanede artış göstermektedir.*
Sonuç: *Günlük hasta maliyetleri akciğer kanserlerinde en yüksek olup onu KOAH hastaları izlemektedir.*
Anahtar kelimeler: *Göğüs Hastalıkları, maliyet, harcama parametrleri*

INTRODUCTION

The cost of a product refers to the measurable value of various factors of production used by business enterprises in order to produce goods and services in their area of activity (1). In hospitals, "the cost of health care" is defined as "the measurable value of production factors used by each hospital in order to produce the health care pertaining to their specific areas of activity" (2).

Cost analysis is one of the most important financial management tools used by management accounting systems. Hospitals are obliged to use the resources they own at least in an efficient and productive manner, in order to survive and to produce the desired value added. Cost-performance analysis is a management tool that helps hospital administrators to plan how to offer maximum levels of qualitative and quantitative services to the public by employing their existing resources and to scrutinize service performance in practice (2).

Despite the obvious significance of cost and performance analyses, many hospitals in Turkey do not conduct them, and costs are not employed as an input in decision-making. Hence, this paper is written in view of alleviating this shortcoming and shedding light on the importance of strategic planning for hospital administrations.

MATERIALS AND METHODS

Data from two hospitals, Istanbul Yedikule and Izmir Dr. Suat Seren Chest Disease and Thoracic Surgery Training and Research Hospitals, were used in this study, as their indirect costs (such as number of beds, number of inpatients, and number of staff) were close to each other in 2006, 2007, and 2008, the years for which the researchers intended to conduct patient cost analysis. Hospital names were abbreviated as Hospitals A and B respectively. Research was based on numerical data collected for this purpose, and descriptive methods of analysis were used. Income per bed was calculated by dividing the income obtained from inpatients over a certain period of time to the number of serviceable beds. Income per patient, on the other hand, was calculated by dividing the income from inpatients to the total number of inpatients who were discharged or who died after having been hospitalized.

Cost per patient and per day may be defined as the daily medical cost occurring during the stay of one patient in the hospital because of his/her illness. It was calculated simply by dividing the amount of cost per patient admitted to hospital because of certain disease to the average time of hospital stay of inpatients with the same disease, and it is expressed in EUR. Univariate comparisons were conducted with x2 tests. $p<0.05$ was accepted as significant.

1 Euro = 2,10 was calculated as TL.

RESULTS

A Training and research hospital are establishments operating with revolving funds, and a great majority of revolving fund incomes (95% and above) of chest disease and thoracic surgery training and research hospitals are obtained from the Social Security Organization (SSO) and through green-card holding patients. The payments for green-card holding patients are made from the budget of the Ministry of Health, the payments of patients affiliated with the SSO are made from the budget of SSO, and the payments of patients employed at public organizations with auxiliary budgets are made from the budgets of these organizations. In 2006, the records

Table 1. *Comparison of Incomes of Hospitals A and B between 2006 and 2008*

Hospital/Years	Total Income (EUR)	Chest Disease Income (EUR)	Ratio %	p
Hospital A 2006	12,942,241.90	8,315,713.33	64.3	p<0.001
Hospital B 2006	20,458,012.38	10,310,440	50.4	
Hospital A 2007	13,340,621.42	7,518,231.91	56.4	p<0.001
Hospital B 2007	20,687,920.47	10,051,488.09	48.6	
Hospital A 2008	14,243,854.28	9,637,027.15	67.6	p<0.001
Hospital B 2008	26,815,858.66	11,202,805.71	41.8	

of Hospital A showed an accruement of income of EUR 12,942,241.90 and the records of Hospital B showed an accruement of income of EUR 20,458,012.38. In 2007, these figures rose up to EUR 13,340,621.42 and EUR 20,687,920.47, and in 2008, they again rose up to EUR 14,243,854.28 and EUR 26,815,858.66, respectively.

The sources of income of these hospitals consist of incomes derived from invoices issued for the examination and treatment of outpatients and inpatients. The outpatient and inpatient incomes of the chest disease clinics of these two hospitals for 2006, 2007 and 2008 were EUR 8,315,713.33, EUR 7,518,231.91 and EUR 9,637,027.14 for Hospital A, and EUR 10,310,440, EUR 10,051,488.10 and EUR 11,202,805.71 for Hospital B, respectively. While the total incomes of both hospitals increased in two years, by 10.1% in the case of Hospital A, and by 31.1% in the case of Hospital B, incomes from chest diseases decreased in both hospitals in the year 2007 (by 9.6% in Hospital A and by 2.5% by Hospital B), but these incomes increased once again in 2008 in comparison to 2007, by 28.3% in Hospital A and by 11.5% in Hospital B. Another significant difference between the two hospitals was evidenced in the fact that the share of incomes derived from sources than chest diseases was higher in Hospital B in comparison of Hospital A in 2006, 2007, as well as in 2008. The percentage of chest disease incomes in total incomes in Hospital B was 50.4 % in 2006, 48.6% in 2007 and 41.8% in 2008. These figures were recorded as 64.3%, 56.4%, and 67.6% in Hospital A respectively (Table 1). The difference between the two was found as significant (p<0.0001). It was also revealed that in Hospital B, which is a specialized branch hospital in the area of chest diseases, while incomes derived from chest diseases decreased (from 50% down to 41.8%), incomes derived from branches other than chest diseases were on a gradual increase (Table 1).

In 2006, 11,677 inpatients were admitted to Hospital A, which had 419 beds, and 15,436 inpatients were admitted to Hospital B, which had 469 beds. The bed turnover rate in Hospital A was calculated as 27.7, and in Hospital B as 33.0. In 2007, however, the number of beds of Hospital A rose to 427, and 13,779 inpatients were admitted, in comparison to Hospital B, whose number of beds rose to 474, and to which 15,099 inpatients were admitted for treatment. In 2008, 16,324 inpatients were admitted by Hospital A with 425 beds, and 15,173 patients were admitted to Hospital B whose number of beds rose to 500. The bed turnover rate in Hospital A was 38.4 and in Hospital B it was 30.3 in 2008. While the number of inpatients increased by 1.7% and the bed turnover rate increased by 8.1% in Hospital B, which increased its number of beds by 6.6% between 2006 and 2008, in Hospital A the number of beds increased by 1.4%, the number of inpatients increased by 40.5%, and

Table 2. *Bed Occupancy and Turnover in Hospitals A and B between 2006 and 2008*

Hospital year	Beds (n)	inpatients (n)	Bed occupancy rate, %	Avg. time of stay (days)	Bed turnover rate
A 2006	419	11,622	88.4	11.6	27.7
B 2006	469	15,436	73.8	8.2	33.0
A 2007	427	13,799	89.1	9.7	32.3
B 2007	474	15,099	78.4	9	31.9
A 2008	425	16,324	90.1	8.9	38.4
B 2008	500	15,173	76.3	9.2	30.3

Table 3. *Comparison of cost per inpatient in Hospitals A and B between 2006 and 2008.*

Hospital years	Inpatient incomes (EUR)	Income per patient (EUR)	Income per bed (EUR)	p value	Beds n	Income per bed (EUR)	p value
Hospital A 2006	5,571,450.5	4,339	611,4	p<0.05	348	16,009.9	p<0.001
Hospital B 2006	6,847,525.7	4,795.7	679,9		333	20,563.1	
Hospital A 2007	5,147,281.4	4,354.3	562,6	p>0.05	346	14,876.5	p>0.05
Hospital B 2007	5,570,249	4,274.3	620,5		356	15,646.8	
Hospital A 2008	5,693,347.1	4,790.5	566	p<0.001	346	16,454.8	p>0.05
Hospital B 2008	6,827,047.1	4,836.7	5,434		370	18,624.4	

the bed turnover rate increased by 38.6% over the same period of time (Table 2).

While Hospital A had significantly higher rates of bed occupancy in comparison to Hospital B in 2006, 2007 and 2008 (88.4%, 89.1%, and 90.1% versus 73.8% ,78.4% and 76.3%), the average duration of stay gradually increased in Hospital B (from 8.2 days up to 9.2 days) and it decreased gradually in Hospital A (from 11.6 days to 8.9 days). As such, one would expect that in Hospital A, given the increase in bed turnover rate, the decline in the average duration of stay, and the increase in the number of beds, the bed occupancy rate would increase and both the incomes per patient and per bed would be positively affected (Tables 2 and 3). However, even though there was a slight increase in incomes per bed, there was a slight decrease in incomes per patient.

In 2007, the bed turnover rate in Hospital A was calculated as 32.3 and in Hospital B as 31.9. While Hospital A had significantly higher bed occupancy rates in 2006 and 2007 compared to Hospital B (88.4% and 89.1% versus 73.8% and 78.4%), in terms of average times of stay, Hospital B had shorter average stays compared to Hospital A (8.2 and 9 days versus 11.6 and 9.7 days). As a result, one would expect that Hospital B had lower average cost per bed, considering that its bed turnover rate was higher and therefore its average time of stay was shorter (Tables 2 and 3).

The total number of chest disease beds in Hospital A fell down from 348 beds in 2006 to 346 in 2007 and 2008. In Hospital B, however, the total number of chest disease beds increased from 333 in 2006 to 356 in 2007 and to 370 in 2008 (a 10% increase in two years). Despite this, income per bed in both Hospitals A and B decreased significantly in 2007 compared to 2006 (7.1% decrease in Hospital A and 23.9% decrease in Hospital B), and they rose again in 2008 compared to 2007 (by 10.6% in Hospital A and by 19% in Hospital B). Hospital A obtained a lower incomes compared to Hospital B only in the year of 2006, the difference in 2007 and 2008 were not found as significant ($p<0.001$) (Table 3).

As it can be followed from the above table, even though the incomes derived from patients admitted to the chest disease clinics of both hospitals did not decrease, their incomes per patient decreased gradually or they remained unchanged. Based on the comparison of costs of the two hospitals, it can be argued that Hospital B treated patients at lower costs than Hospital A, even though the difference was not found as significant.

Table 4. *Comparison of consumption of medications and materials in Hospitals A and B between 2006 and 2008.*

Hospital/Year	Chest Disease Incomes (EUR)	Consumption of medications and materials (EUR)	%	p
Hospital A 2006	5,571,450.5	1,519,364.3	27.3	<0.001
Hospital B 2006	5,457,406.2	1,924,158.1	35.3	
Hospital A 2007	5,147,281.4	2,073,464.3	40.3	<0.001
Hospital B 2007	4,327,929	1,752,168.6	40.5	
Hospital A 2008	5,693,347	2,142,731.4	37.6	<0.001
Hospital B 2008	5,616,841	2,601,473.3	46.3	

***Table 5**. Distribution of inpatients by four main disease groups in Hospitals A and B in years between 2006 and 2008, their ratios in total number of patients, and rates of increase/decrease*

	Hospital A			*Hospital B*		
	years			*years*		
Diseases	*2006*	*2007*	*2008*	*2006*	*2007*	*2008*
Lung Cancer	*2,685*	*3,361*	*3568*	*3,739*	*3,222*	*3,612*
	29,5%	*36.8%*	*35.5%*	*35.7%*	*33%*	*35,9%*
COPD	*1.718*	*2.875*	*3632*	*2.941*	*2.778*	*3,112*
	18,9%	*31.4%*	*36.1%*	*28%*	*28.4%*	*30,9%*
Pneumonia	*732*	*691*	*534*	*887*	*851*	*1,039*
	8%	*7.6%*	*5.3%*	*8.5%*	*8.7%*	*10,3%*
TB	*1.440*	*797*	*693*	*658*	*567*	*551*
	15.8%	*8.7%*	*6.9%*	*6.3%*	*5,8%*	*5,5%*
Total inpatients	*9,112*	*9,144*	*10,060*	*10,474*	*9,770*	*10,062*

An alarming situation arises if incomes per patient and bed decrease in spite of increasing numbers of patients, and particularly, increased use of medications and hospital materials. A reason for the decrease in the accruement of incomes was the fact that certain lines of income could not be invoiced as a result of inspections of the SSO in order to lower SSO contributions.

The difference in the costs of medications and hospital materials used for patients and the difference in the amounts of tests required may explain the difference in income per patient in the two hospitals. In Hospital A consumption of medications, in the amount of EUR 1,519,364, made up 27.5% of the invoices issued in 2006, however in Hospital B consumption of medications amounted to EUR 4,040,732 and made up 35.3% of invoices issued in the same year. However, whereas consumption of medications decreased in money terms in Hospital B in 2007, its percentage share in income increased significantly, from 27.3% to 40.3% in Hospital A, and from 35.3% to 40.5% in Hospital B. In 2008, on the other hand, in Hospital A, the consumption of medications and materials decreased down to 37.6%, but in Hospital B it increased by 14.3% and reached 46.3%. The differences between the years 2006, 2007 and 2008 were found as significant ($p<0.001$) (Table 4).

It was not possible to divide up for certain how much laboratory and radiological tests were conducted for the chest disease patients in both hospitals in 2006, 2007 and 2008, however, it was possible to arrive at an understanding on the subject by comparing the ratios of these income lines to total income on income tables. In Hospital A, the ratio of laboratory and radiological tests in total income was 25.5%, and in Hospital B it was 34.9% in 2006. In 2007, this ratio was calculated as 21.9% for Hospital A, and as 30% for Hospital B. In 2008, on the other hand, this ratio was calculated as 23.4% for Hospital A, and as 31.1% for Hospital B. As it can be seen from these percentages, Hospital B conducted significantly more tests in comparison to Hospital A ($p<0.001$).

Given the fact that both hospitals are specialized branch hospitals, more than 2/3 of their inpatients were patients with lung cancer, chronic obstructive pulmonary disease (COPD), pneumonia, and tuberculosis (TB) (Table 5). Percentages differed in the two hospitals, but lung cancer took the number one position, followed by COPD in the second position and on the rise. As it can

***Table 6**. Costs per inpatient by four main diseases in Hospitals A and B between 2006 and 2008.*

	Hospital A			*Hospital B*		
	2006	*2007*	*2008*	*2006*	*2007*	*2008*
Lung Cancer	*784,5*	*680,3*	*765,8*	*629,4*	*692,7*	*826,4*
COPD	*830,4*	*497*	*609,3*	*900,5*	*765,7*	*831,7*
Pneumonia	*620,9*	*509,2*	*532,7*	*794,9*	*649,9*	*687*
Tuberculosis	*421,1*	*367,9*	*436,6*	*695,9*	*665*	*694,4*

Table 7. *Cost per patient/day of four main diseases between 2006 and 2008 (EUR/days)*

	Hospital A 2006	Hospital B 2006	Hospital A 2007	Hospital B 2007	Hospital A 2008	Hospital B 2008
Lung Cancer	74,79	76,81	70,27	76,76	89,10	91,81
COPD	74,83	90,05	57,59	83,10	59,46	83,19
Pneumonia	54,41	81,38	47,67	68,67	50,84	68,86
Tuberculosis	26,27	28	22,85	24	24,38	23,14

be observed from the table below, while the number of patients hospitalized for tuberculosis decreased considerably in both hospitals, the number of pneumonia cases showed an upward trend.

Cost per patient in chest disease clinics decreased significantly in 2007 compared to 2006 (in Hospital A by 7.9% and in Hospital B by 8.7%). In 2008, costs increased slightly in comparison to 2007, but remained much lower than the costs of 2006 (in Hospital A by 7.4% and in Hospital B by 6.2%). In order to understand which diseases contributed to this decrease, hospitalization costs associated with the four diseases, for which admissions were highest, were compared (Tables 3 and 6). In Hospital A, patients with lung cancer were identified as having the highest cost per person, and patients with tuberculosis had the lowest cost per person. In Hospital B costs were similar, but patients with COPD had the highest cost per person.

In all the four disease groups, costs per inpatient decreased in 2007 compared to 2006, and they increased partially in 2008. Costs of Hospital A were significantly lower ($p<0.0001$) than the costs of Hospital B in 2007 (Table 6).

Costs per patient per day of patients admitted to Hospitals A and B during 2006 and 2007 because of the four disease groups are presented in Table 7. As it can be observed from the table, the costs per patient per day for all four disease groups decreased in Hospitals A and B except in the case of lung cancer. According to the cost per patient per day calculation, Hospital A operated with significantly lower costs ($p<0.0001$) in 2006 and 2007 in comparison to Hospital B. In 2008, however, the gap was closed, with the exception of patients with COPD and pneumonia.

Average time of hospital stay, which is one of the main factors affecting the cost per patient per day, was about 9-10 days for lung disease, COPD, and pneumonia in both Hospitals. The only difference was with tuberculosis. In Hospital A, patients with tuberculosis stayed for an average of 16-18 days, and in Hospital B, this duration was approximately twice as much (Table 8). The table shows that the difference in costs per tuberculosis patients between the two hospitals was due to the duration of stay. The differences in other patients were independent of the duration of stay as durations of stay did not vary between the two hospitals.

DISCUSSION

The two main groups of public hospitals in Turkey are State hospitals offering secondary health care and training and research hospitals offering tertiary health care. There are also specialized branch hospitals established solely for the treatment of certain diseases (such as

Table 8. *Average time of stay by four main diseases in 2006 and 2007 (days)*

	Hospital A 2006	Hospital B 2006	Hospital A 2007	Hospital B 2007	Hospital A 2008	Hospital B 2008
Lung cancer	10,5	8	9,0	9	8,9	9
COPD	11,1	10	8,6	9	10,2	10
Pneumonia	11,4	10	10,7	9	10,4	10
TB	16	25	16,1	28	18,1	30

chest diseases, cardiovascular surgery, physical therapy, and mental and nervous disorders). In addition, there are those hospitals which are geared toward the training of interns, and are also considered as specialized branch hospitals. Under the Transformation Program in Health implemented since 2003, just like in the case of general hospitals, the service load of chest disease hospitals has increased by 2.5 folds. Consequently, hospitals have started to obtain higher incomes, and since 2004, have redistributed a certain portion of this income (on an average, 28%) to their staff (3,4).

Health economics strives to find ways for a rational utilization of limited resources. In this line of thought, our hospitals also need to be operated in a cost-effective manner. Thus, expenditures must be lowered as much as possible and incomes must be used efficiently. Even though the incomes of both hospitals increased in 2006-2008, the incomes they obtained from patients with chest diseases did not increase at the same rate over the same period of time. Consequently, incomes per bed and per patient of both hospitals declined or remained unchanged (Table 3). A promising finding in terms of health economics was the fact that the expenditures for medical tests made by both hospitals were either partially reduced or they remained unchanged.

Income per patient, which is typically much higher in branches of surgery, is below the general average in hospitals and clinics for mental and nervous disorders, chest diseases, and physical therapy and rehabilitation, which require longer hospital stays. In tuberculosis wards in particular, given the fact that some TB patients do not have social security coverage and patients are required to stay on an average more than 20 days, income per patient is negligibly small. Taking into account that about 10-15% of the bed capacity of chest diseases hospitals are used by tuberculosis patients, income per bed of these hospitals is bound to come out as low. The loss incurred due to this needs to be balanced, bearing in mind that these hospitals operate as revolving fund establishments.

As the number of cases increased, total incomes, and more importantly net incomes, decreased significantly, on account of a steady rise in the use of medications and hospital materials. Another factor causing incomes to decline was the fact that hospitals were not able to invoice certain expenditures to the SSO, albeit the share of these uncovered expenditures were diminishing. About 40% of incomes of the two hospitals was derived from the consumption of medications and hospital materials. The same overall percentage for Turkey is about 15% (4). The comparison of the figures over two years shows that the consumption of medications and hospital materials was on a steady rise. Hospital administrations need to research the reasons behind this and take necessary measures.

The fact that in both hospitals the numbers and the ratios of patients admitted for being diagnosed with the four diseases were similar to each other shows that the indications for hospitalization for both hospitals were also similar. For all of the four main disease groups, costs per inpatient diminished in 2007 compared to 2006. In 2008, these costs increased slightly but remained below the figures of 2006 (Table 7). The reasons for this should be assessed by reviewing the lines of expenditure.

The cost per patient per day may be defined as the daily medical cost of a patient during his/her stay at the hospital due to a disease. This parameter is used when insurance companies make economic assessments of hospitals, and it is also utilized when calculating the total burden caused by a certain disease from the point of view of health economics (5). The importance of cost per patient per day lies in the fact that it does not only indicate inpatient productivity by diseases when compared to the daily cost per bed, it also enables organizations making the payments to assess disease costs and to make their budgets accordingly. On an average, in 2007 the cost per patient per day was realized as EUR 47.95 in Hospital A and as EUR 44.43 in Hospital B. For secondary health care hospitals, this cost was reported as EUR 17.67 for chest diseases and as EUR 28.10 for thoracic surgery for the year 2002 (6). It was not possible to obtain a figure for the cost per patient per day in tertiary health care hospitals, as this had not been researched earlier. Nevertheless, it can be argued that the values of the two training hospitals represent more accurate figures, considering that they are very close to each other.

In both hospitals, patients with lung cancer and COPD were found to have the highest values for cost per patient/day. Given the direct relationship of both diseases with tobacco use and thus their significance as public health problems, this figure alone shows the immensity of their economic burden.

In conclusion, it was found that in both hospitals expenditures were carried out in a rational and efficient

manner, and costs were reduced. Nevertheless, in view of the increasing number of patients with chronic diseases and the need to monitor and treat patients with tuberculosis for longer hospital stays, it can be argued that specialized branch hospitals can offer better, more modern, and efficient services, if their expenses are covered more effectively.

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