

## Cost Analysis of a University Hospital's Adult Emergency Service

Bir Üniversite Hastanesi Erişkin Acil Servisinin Maliyet Analizi

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### Abstract

**Objective:** In this study we aimed to calculate the cost per patient in an emergency department by using the administrative, financial and medical data obtained from a university hospital in 2011.

**Material and Methods:** All services invoiced as well as all revenue and expenditure documented by an Adult Emergency Service between 1 January 2011 and 31 December 2011 were retrospectively examined by analysing the data obtained from the Hospital Information System and Revolving Fund Management. Cost per patient was calculated accordingly with a traditional cost analysis method.

**Results:** It was calculated that the total expenditure of the Adult Emergency Service, including personnel salaries, was \$2.236.909.28. Total revenue was \$2.045.861.78, meaning that there was a loss of \$191.047.49. Since the personnel salaries were paid from a central budget, a profit of \$224.252.84 was revealed in a cost analysis from which these salaries were excluded. Personnel salaries constituted 46.15% of the total costs, and it was calculated that the average cost per patient that the social security agency paid to the hospital was \$27.48. Cost per patient was \$30.05 if the salaries of emergency service personnel were included and \$24.47 if these salaries were excluded.

**Conclusion:** Public hospitals are non-profit healthcare organisations; however they are also enterprises and should be considered accordingly. To achieve high-quality, uninterrupted services, the revenue/expenditure balance should show a profit, and in order to make a profit hospitals, and departments within hospitals, should conduct regular cost analyses. (*JAEM 2013; 12: 71-5*)

**Key words:** Emergency department, cost, cost analysis

### Özet

**Amaç:** Bu çalışmada bir üniversite hastanesi erişkin acil servisinin 2011 yılı idari, mali ve tıbbi verileri kullanılarak, acil servis birim hasta maliyetinin hesaplanması amaçlandı.

**Gereç ve Yöntemler:** Hastane Bilgi Sistemi ve Döner Sermaye İşletme Müdürlüğü'nden temin edilen, erişkin acil serviste 1 Ocak 2011 ile 31 Aralık 2011 tarihleri arasında faturalandırılan tüm hizmetler ve bu süre içinde belgelenmiş olan tüm gelirler ve giderler retrospektif olarak incelendi. Geleneksel Maliyet Analizi yöntemi kullanılarak acil servis birim hasta maliyeti hesaplandı.

**Bulgular:** Erişkin Acil Servis'in 2011 yılı personel maaşı dâhil toplam gideri 2.236.909.28\$, toplam geliri 2.045.861.78\$ olarak hesaplandı. Yani 191.047.49\$ zarar tespit edildi. Personel maaşları merkezi bütçeden ödendiğinden maaşların dahil edilmediği maliyet hesaplamasında 224.252.84\$ kar elde edildiği görüldü. Toplam maliyetlerin %46,15'ini personel giderleriydi. Sosyal Güvenlik Kurumu tarafından hasta başına hastaneye ödenen ortalama birim gelir 27,48\$ olarak hesaplandı. Acil servis personel maaşı dahil birim hasta maliyeti 30,05\$ ve personel maaşı hariç birim hasta maliyeti 24,47\$ idi.

**Sonuç:** Kamu hastaneleri kar amacı gütmeyen sağlık kurumlarıdır. Ancak bu kurumların bir işletme olarak da dikkate alınması ve değerlendirilmesi gereklidir. Kaliteli ve sürekli hizmet için bu kurumlarda gelir-gider dengesinin kar lehine gözetilmesi gereklidir. Bunun için hastane ve bölüm yöneticilerinin düzenli olarak maliyet analizi yapmaları gereklidir. (*JAEM 2013; 12: 71-5*)

**Anahtar kelimeler:** Acil servis, maliyet, maliyet analizi

### Introduction

Hospitals are an important component of the healthcare system. They have changed rapidly, in parallel with improvements in the science and technology of medicine, and their importance has gradually increased as they have become socioeconomic organisations which consume a significant proportion of healthcare expenditure.

The inclusion of the private sector in healthcare service provision has created a competitive environment in which public hospitals are obliged to use their resources wisely to obtain maximum benefits. From the patients' perspective when they are choosing a hospital from

one of the many alternatives available, the quality of services offered is paramount. Hospital enterprises are struggling, however, to identify the ways in which they can offer higher-quality, less costly healthcare services than private hospitals to attract greater numbers of patients.

Managers of hospital enterprises are attempting to develop strategies that will enable the provision of high-quality services, while operating with increased costs and under pressure resulting from competition. In this regard, cost analyses are vitally important. In healthcare services, a cost analysis can be described as the value, measurable by money, of production factors spent in ensuring that hospitals can produce these services. Through such analyses it is pos-

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sible to draft plans and allocate resources in order to increase, and follow up, the efficiency of healthcare services (1, 2).

The identification of costs in healthcare services is complicated; the cost of treating a disease varies in each case, and the cost of the labour, tools and equipment, and services used to treat that disease must also be considered. The emergency service is an important element of healthcare services overall, but although healthcare organisations have put great effort into offering cost-effective emergency services, the results show that they have not been particularly successful in achieving the desired outcome (3-6).

An improvement of emergency services is an important stage in the development of the healthcare system. Population increases and longer average life expectancy mean that the requirement for emergency services is increasing every passing day. The need to renew and improve the operations of the emergency services has arisen in parallel with this increasing demand. Therefore, emergency services costs must be controlled, without a simultaneous decrease in service quality, so it is crucial to define appropriate criteria and indicators in order to evaluate the activity and quality of the services (5, 6).

In this study, we conducted a cost analysis of the Adult Emergency Service of a university hospital in Turkey. Through this analysis, we aimed to calculate the cost per patient.

## Material and Methods

This study was conducted at the emergency services department of the Şahinbey Research and Application Hospital, Gaziantep University, on receipt of approval by the Ethical Committee of Clinical Studies of Gaziantep University (17 January 2012, Resolution no: 17.01.2012/8). All services invoiced by the Adult Emergency Service, which operates under the Department of Emergency Medicine, between 1 January 2011 and 31 December 2011 and all revenues and expenditures documented during this period were analysed retrospectively from the hospital administrative, financial, and medical data. The data were obtained from the salary accrual service, revolving fund management, hospital automation system, hospital information centre, inventory accounting service, Social Security Agency, and the hospital's technical service, and were analysed via a traditional cost analysis method using the Microsoft Office Excel Program.

In the hospital, the Child and Adult Emergency Services are in the same unit. The children's emergency service operates under the Department of Children's Health and Diseases, however, so the data from this unit were excluded from the study.

The Adult Emergency Service consists of a triage room with: four stretchers; twelve outpatient booths; a surgical intervention room with two stretchers; a plaster room with two stretchers; two resuscitation rooms, one of which contains two stretchers, and the other has one stretcher; an ultrasound room with a single stretcher; an insulation room with a single bed; and an observation room with four beds for women and six beds for men, giving a total net area of 780 m<sup>2</sup>. There are three lecturers: one professor, one associate professor and one assistant professor, in addition to 16 research assistants, 20 assistant healthcare personnel, 10 medical secretaries, and 17 nurses' aides and cleaning staffs.

Emergency service revenue is primarily calculated under two separate headings; invoiced revenue and revenue derived from services offered to other departments. Invoiced revenue includes that obtained from clinical examinations, and invasive and non-invasive operations, as well as service revenue provided from other departments (such as radiology, emergency biochemistry laboratory, emergency microbiology laboratory, pharmacy, blood centre). The service revenues offered to other departments include revenues from the

port catheter placement, central venous catheter and dialysis catheter installed in emergency services.

Expenditures are calculated under four primary categories: service production expenditure, personnel expenditure, infrastructure expenditure, hospital management and food expenditure.

Service production expenditure is calculated separately to include materials and medications used, consumables (gloves, cotton, syringes, etc.), the service expenditure of other departments (radiology, emergency biochemistry laboratory, emergency microbiology laboratory, blood centre and consultation referrals from departments), invoice deductions or returns during that period, taxes on invoices, and research fund allowances.

Personnel expenditure is calculated separately to include lecturers' salaries and benefits, research assistants' salaries and benefits, staff personnel salaries and benefits, and contracted personnel expenses.

Infrastructure expenditure is calculated separately to include inventory amortisation expenditure (buildings and equipment), costs of repair and maintenance of equipment, construction, and renovations to the service building, and utilities expenditure (power, telephone, water, internet gas fuel).

The 'm<sup>2</sup> cost of hospital construction' set by the Ministry of Public Works was taken as the basis for determining the cost of the hospital building. Set at \$686.11 per m<sup>2</sup> for 2011, this cost was multiplied by the total area of the emergency service to ascertain the building cost value of the emergency service department. In order to calculate total annual amortisation expenses, it was assumed that the average economic life of a building was 100 years, giving a building cost of 1%. Inventory amortisation expenditure was calculated as 20% of the amount of inventory purchases for the previous five years, on the basis of the values set by the Ministry of Finance.

Hospital management and food expenditure were calculated separately. Hospital management expenditure was calculated on the basis of the area covered by the Emergency Medicine Department at the hospital, and the ratio of services invoiced by the emergency service to all of the invoiced services in the entire hospital. Hospital management expenditure consisted of the expenditure of staff who did not belong to any department (information technology, invoicing service, register office, movables control service, etc.).

The main service cost was calculated by adding service production expenditure and personnel expenditure. The main operating profits were calculated by subtracting the main service cost from the total revenue. The other operating expenditure was calculated by adding infrastructure, hospital management and food expenditure. Total profit and loss were calculated by deducting other operating expenditures from the main operating profits.

The following formulas were used for calculation:

Revenue per emergency patient = total department revenue / total number of patients.

Cost per emergency patient = total department cost / total number of patients.

Finally, since personnel salaries are paid from the central budget, a new revenue and expenditure calculation, which excluded the salaries, was performed separately.

## Results

The Adult Emergency Service serves patients aged 16 and over. In 2011, a total of 74,433 patients were admitted, of whom 51.15% (n=38072) were female, and 48.85% (n=36361) were male. The average number of monthly clinical examinations was 6203. The lowest number of emergency clinical examinations occurred in February,

with the highest number being in January (Figure 1). The number of clinic examinations generally increased throughout the year (with the exception of January).

The total revenue of the Adult Emergency Service was \$2.045.861.78. Of this revenue, 98.16% (\$2.008.277.03) was invoiced, with the remaining 1.84% (\$37.584.76) being revenue from services offered to other departments (Table 1).

The total expenditure of the emergency service was calculated as being \$2.236.909.28 (Table 1, Figure 2). Of this, 41.18% (\$921.123.05) was service production expenditure, 46.15% (\$1.032.330.51) was personnel expenditure, 3.35% (\$75.001.23) was infrastructure expenditure, 7.69% (\$172.031.99) was hospital management expenditure, and 1.63% (\$36.422.49) was food expenditure (Table 1, Figure 3).

The main service cost for the year was \$1.953.453.56, with the other operating expenditure calculated as \$283.455.72. Subtraction of the main service cost from the total revenue gave a main operating profit of \$92.408.22 for the year. When the other operating expenditure was subtracted from the main operating profit, a total (including personnel salaries) loss of \$191.047.49 was observed (Table 1).

Personnel salaries were paid from the central budget, so when they were excluded from the revenue and expenditure account, total expenditure was calculated as \$1.821.608.94 (Figure 4). The total gross expenditure for personnel salaries paid from the central budget was \$415.300.33, and total profit was \$224.252.84 (Figure 4).

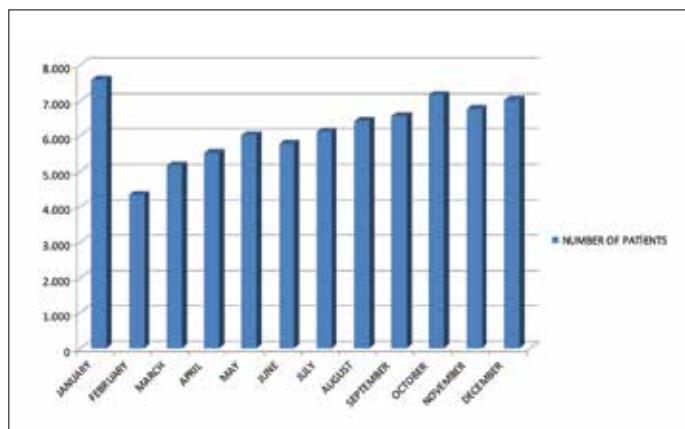
Adult Emergency Department revenue per patient (excluding personnel salaries) was \$27.48 (calculated as \$2.045.861.78/74433, i.e. total revenue of the Adult Emergency Department divided by the number of patients applying for emergency services), whereas

the unit cost of an emergency service patient (including personnel salaries) stood at \$30.05 (calculated as \$2.236.909.28/74433, i.e. total emergency services expenditure divided by the number of patients applying for emergency services). Average loss per patient (including personnel salaries) was calculated as \$2.57. The unit cost of an emergency service patient (excluding personnel salaries) was \$24.47 (calculated as \$1.821.608.94/74433, i.e. total expenditure divided by the number of patients applying for emergency services), and the average profit per patient (excluding personnel salaries) was calculated as \$3.01. The cost of personnel salaries per patient was calculated by subtracting the cost of each emergency patient, excluding personnel costs (\$24.47), from the cost of each emergency patient, including personnel costs (\$30.05), which gave a figure of \$5.58.

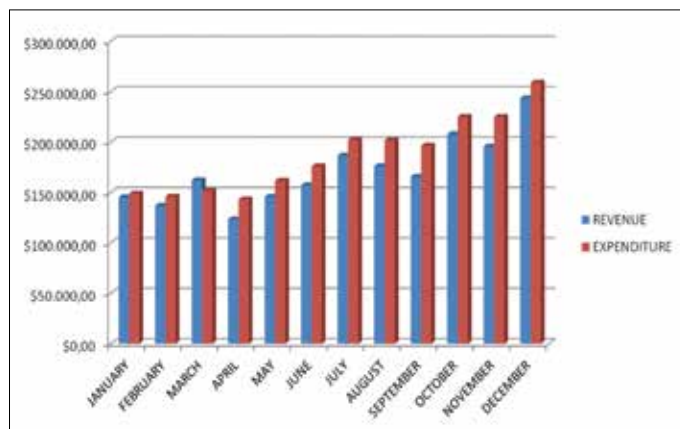
### Discussion

The increased need for healthcare services results in an increase in healthcare expenditure. This requires the efficient use and improvement of existing resources. Therefore, the costs generated for hospital services have become important indicators. Regardless of whether they are for profit, all items that result in costs for hospitals should be identified and service costs should be identified in a proper manner.

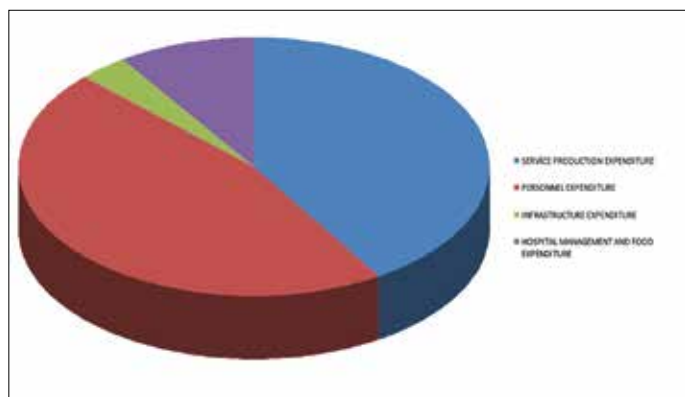
It is rather difficult to calculate service quality and cost precisely. With regard to management and programming of economic resources, an emergency service is one of the departments in which a great amount of effort is required (5-7). Emergency medical interventions for patients admitted to emergency services vary from one individual to another, as do the laboratory, tools and equipment, and services



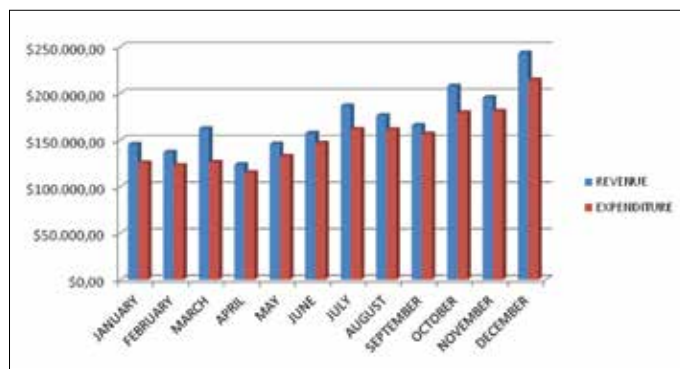
**Figure 1.** Distribution of the numbers of clinical examinations by month in 2011



**Figure 2.** Distribution of income and expenditure for each month in 2011, gross salaries included



**Figure 3.** Distribution of total expenditure in 2011



**Figure 4.** Distribution of income and expenditure for each month in 2011, gross salaries excluded

Table 1. Income and expenditure 2011 including gross salary

|                                | January    | February   | March      | April      | May        | June       | July       | August     | September  | October    | November   | December   | Total        |
|--------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|--------------|
| Revenue                        | 144,567.06 | 134,193.81 | 159,584.71 | 120,997.02 | 142,156.23 | 153,987.88 | 184,571.47 | 170,520.08 | 162,958.62 | 205,236.21 | 191,002.61 | 238,501.34 | 2,008,277.03 |
|                                | 694.06     | 2,646.70   | 2,502.92   | 2,446.66   | 3,445.84   | 3,430.87   | 2,052.94   | 5,616.83   | 2,710.52   | 2,569.34   | 4,553.77   | 4,914.31   | 37,584.76    |
|                                | 145,261.12 | 136,840.52 | 162,087.63 | 123,443.68 | 145,602.07 | 157,418.75 | 186,624.41 | 176,136.91 | 165,669.14 | 207,805.54 | 195,556.38 | 243,415.65 | 2,045,861.78 |
| Service Production Expenditure | 16,407.12  | 10,169.07  | 19,470.59  | 12,123.61  | 17,607.82  | 16,939.89  | 18,470.12  | 16,947.55  | 18,841.23  | 20,470.18  | 19,039.59  | 33,815.07  | 220,301.85   |
|                                | 4,273.36   | 8,010.81   | 6,175.64   | 3,670.48   | 2,220.74   | 5,594.50   | 3,274.02   | 3,537.13   | 5,006.19   | 2,888.57   | 6,176.56   | 5,774.38   | 56,602.40    |
|                                | 33,560.11  | 26,574.26  | 33,374.94  | 24,567.25  | 30,808.87  | 38,238.93  | 51,310.22  | 46,378.79  | 40,356.53  | 54,297.94  | 51,121.91  | 62,183.38  | 492,773.10   |
| Service Production Expenditure | 521.08     | 3,102.48   | 33.37      | 871.65     | 2,137.51   | 2,133.66   | 75.23      | 3,639.39   | 791.58     | 32.91      | 6,188.66   | 6,061.91   | 25,589.42    |
|                                | 3,860.43   | 1,342.21   | 1,610.80   | 1,216.50   | 1,424.90   | 1,560.80   | 1,850.37   | 4,597.46   | 1,630.06   | 2,052.79   | 1,910.40   | 2,385.71   | 25,442.42    |
|                                | 7,228.36   | 6,709.69   | 7,979.23   | 6,049.85   | 7,107.81   | 7,699.39   | 9,228.57   | 8,526.01   | 8,147.93   | 10,261.81  | 9,550.13   | 11,925.07  | 100,413.85   |
| Service Production Expenditure | 14,697.12  | 15,046.18  | 12,128.74  | 15,393.94  | 15,393.94  | 15,393.94  | 15,560.08  | 16,031.16  | 16,394.29  | 21,634.15  | 24,459.13  | 24,458.55  | 206,591.22   |
|                                | 22,176.62  | 19,041.77  | 15,459.66  | 24,278.19  | 29,012.75  | 29,169.36  | 29,977.91  | 27,820.43  | 30,163.87  | 35,429.28  | 37,255.99  | 37,308.74  | 337,094.58   |
| Service Production Expenditure | 4,636.63   | 4,636.63   | 4,636.63   | 5,512.18   | 5,331.65   | 5,331.65   | 5,331.65   | 5,331.65   | 10,421.40  | 10,421.40  | 10,421.40  | 10,421.40  | 82,434.27    |
|                                | 25,712.26  | 25,668.41  | 26,695.88  | 30,834.88  | 30,619.20  | 30,585.10  | 41,454.60  | 41,528.77  | 37,960.49  | 38,594.77  | 38,293.77  | 38,262.32  | 406,210.45   |
| Service Production Expenditure | 2,855.51   | 2,855.51   | 2,855.51   | 2,855.51   | 2,855.51   | 2,855.51   | 2,855.51   | 2,855.51   | 2,855.51   | 2,855.51   | 2,855.51   | 2,855.51   | 34,266.13    |
| Infrastructure Expenditure     | 0.00       | 0.00       | 2,261.67   | 0.00       | 0.00       | 0.00       | 0.00       | 997.22     | 0.00       | 0.00       | 0.00       | 0.00       | 3,258.89     |
|                                | 155.56     | 276.67     | 0.00       | 11.50      | 16.67      | 5.56       | 0.00       | 1,557.22   | 0.00       | 0.00       | 27.78      | 0.00       | 2,050.94     |
| Infrastructure Expenditure     | 665.54     | 3,014.90   | 2,467.05   | 2,314.53   | 2,904.26   | 3,218.63   | 1,640.46   | 4,468.66   | 4,612.64   | 4,749.50   | 2,684.56   | 2,684.56   | 35,425.27    |
| Infrastructure Expenditure     | 9,779.19   | 17,426.49  | 13,216.01  | 10,954.81  | 11,851.80  | 15,078.37  | 13,862.68  | 14,933.78  | 16,323.20  | 18,376.88  | 12,295.93  | 17,932.84  | 172,031.99   |
| Infrastructure Expenditure     | 2,233.48   | 2,151.24   | 3,337.70   | 2,311.21   | 2,399.66   | 2,235.32   | 7,464.76   | 2,656.07   | 2,874.17   | 3,043.29   | 2,822.44   | 2,893.13   | 36,422.49    |
| Infrastructure Expenditure     | 148,762.35 | 146,026.32 | 151,703.42 | 142,966.11 | 161,693.09 | 176,040.60 | 202,356.19 | 201,806.80 | 196,379.09 | 225,108.99 | 225,103.75 | 258,962.57 | 2,236,909.28 |
| Infrastructure Expenditure     | -3,501.23  | -9,185.80  | 10,384.21  | -19,522.42 | -16,091.03 | -18,621.85 | -15,731.78 | -25,669.89 | -30,709.95 | -17,303.45 | -29,547.38 | -15,546.92 | -191,047.49  |

used in their treatment. Therefore, effective cost analysis follow-up is very difficult for emergency services to conduct. It is believed that the findings of the present study will contribute positively to this process.

Only a limited number of studies have been conducted with regard to cost analyses of emergency services. Furthermore, although costs per patient were calculated, these studies made no mention of profit and loss (5-8). The earliest comprehensive study addressing this subject was carried out by Williams et al. (6). In that study, unit revenues per patient were \$124 for non-emergency patient admissions, at a cost per patient of \$62; unit revenues per patient were \$321 for semi-emergency patient admissions, at a cost per patient of \$159; and unit revenues per patient were \$621 for emergency patient admissions, at a cost per patient of \$351. In the same study conducted by Williams et al. (6), unit revenues per patient were \$383, and cost per patient was \$209. This study showed that the profit per patient was greater for those admitted as a genuine emergency.

Cremonesi et al. (5) calculated a patient cost of €126.69 in their study, in which green-coded patients cost 50% more than white-coded patients, yellow-coded patients cost twice as much as white-coded patients, and red-coded patients cost 2.5 times more than white-coded patients. The study found that the cost of genuine emergency patients was higher, but the unit revenue and profit gained from these patients were not calculated.

In a cost analysis of emergency services, Bamezai et al. (8) found that the unit cost of trauma patients was \$412. The unit cost of non-trauma patients was \$295, but unit revenue and profit per patient were not calculated.

In their emergency service cost analysis study, Cremonesi et al. (5) found that personnel costs constituted 70% of total costs. In our study, the highest cost was personnel expenditure, at 46.15% (Figure 3). In Turkey, the patient examination fee for 2011, as set by the Social Security Agency, stood at \$8.61. In our study, cost per patient was \$30.05, and patient unit revenue was calculated as \$27.48 when personnel salaries were included. This shows a loss of \$2.57 per patient. When personnel salaries were excluded, the cost per patient was \$24.47. The cost per patient and patient unit revenue were lower in our study than in others.

Our study revealed that the revenue obtained in January (when the greatest number of patients was admitted) and February (when the fewest patients were admitted) was very similar. The lowest revenue was obtained in April, although the number of examinations was close to the annual average during this month (Figure 2). In general, there was no correlation between monthly revenue and expenditure and the number of clinical examinations (Figures 1, 2). There may be several reasons for this. First, revenue may be low in a certain month, despite a high number of patients, because the number of non-emergency patients is high; second, the rapid turnover of patients in emergency services may result in omissions in the registration process, which in turn may reduce revenue; and third, invoice deduction by the Social Security Agency may also reduce income. In our opinion, the most important factors affecting revenue were the omissions in the registration process and the training of secretaries and all other staff members. Highlighting the issue could reduce such omissions.

It is now mandatory that hospital departments conduct cost analyses. The dynamic structure of emergency services makes this extremely difficult, however. In cost analysis calculations, an approach which considers only the medical supplies used in the treatment of the patient as expenditure is insufficient. Personnel salaries, hospital construction works, and equipment purchases are all paid from the central budget, which means that this expenditure is not included in the cost analysis. Yet these are also items of expenditure for the organisation, and they affect cost per patient. Therefore, to

reveal a true picture of profit and loss, all expenditure (including infrastructure, personnel, management and food expenditure) must be determined. In our study, we calculated all these types of expenditure separately and presented a sample cost analysis.

Social Security Agencies, hospitals and professional bodies, such as the Turkish Medical Association, create pricing policies without conducting any cost analysis studies. Lack of such studies results in service fees being assessed as higher or lower than the actual fees, leading to losses for hospitals or repayment agencies. Hospitals claim that the fees determined unilaterally by repayment agencies are very low and that they are suffering losses. There is a lack of documentary evidence to prove these claims, however, because cost analysis studies are not regularly conducted. Therefore, such claims are ignored by repayment agencies when making decisions, meaning that both hospitals and their departments should conduct their own cost analyses and set costs per patient.

## Conclusion

Public hospitals are non-profit healthcare organisations; however these organisations are also enterprises and should be considered accordingly. To achieve high-quality and uninterrupted services, the revenue and expenditure balance should show a profit. Therefore, all expenditure (including infrastructure, personnel, management, and food expenditure) must be determined to reveal true profit and loss. Regular cost analyses by hospitals and their departments would be beneficial in evaluating their existing situation.

### Conflict of Interest / Çıkar Çatışması

No conflict of interest was declared by the authors.

*Yazarlar herhangi bir çıkar çatışması bildirmemişlerdir.*

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### Author Contributions / Yazar Katkıları

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