Doi: 10.5152/TJAR.2019.80445

Original Article

Intensive Care

Article in Press

Turkish Journal of Anaesthesiology & Reanimation

Cost Analysis on Intensive Care Unit Costs Based on the Length of Stay

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Cite this article as: Kılıç M, Yüzkat N, Soyalp C, Gülhaş N. Cost Analysis on Intensive Care Unit Costs Based on the Length of Stay. Turk J Anaesthesiol Reanim 2018.
DOI: 10.5152/TJAR.2019.80445

Abstract

Objective: The present study aimed to determine the profit/loss ratio and the service costs in intensive care unit (ICU) based on the length of ICU stay.

Methods: This retrospective study reviewed the medical records of 458 patients who were admitted to ICU between August 2016 and August 2017. Depending on the length of their ICU stay, the patients were divided into six groups: (I) 1 day, (II) 2 days, (III) 3 days, (IV) 4 days, (V) 5 days and (VI) more than 5 days. These charges were evaluated under six categories: surgery, laboratory tests, drugs, tools and equipment, radiographic workup and others.

Results: This study reviewed the medical records of patients including 273 (59.6%) men and 185 (40.4%) women. The mean age of the patients was 53.87±22.6 years. The profit/loss ratio was in favour of loss in group I (12,870.82 TL), group II (9,384.61 TL) and group III (371.18 TL). The ration was in favour of profit in group IV (16,505.4 TL). Total service costs comprised 38.51% drug costs, 24.45% tools/equipment, 13.14% laboratory tests, 10% other costs, 4.92% surgical costs and 3.1% radiographic tests.

Conclusion: The cost analysis based on the service costs in ICU with regards to the length of ICU stay revealed that due to the greater use of diagnostic, surgical and medical tools and equipment and laboratory and radiographic tests, the profit/loss ratio was in favour of loss within the first three days in ICU. This ratio turned to profit beginning from day 4 in ICU due to the decrease in the use of these equipment and tests. Moreover, total ICU costs comprised 38.51% drug costs and 24.45% medical tools and equipment.

Keywords: Cost analysis, healthcare expenditures, hospitalization, intensive care, length of stay

Introduction

Hospital administrators attempt to use financial resources economically due to increasing healthcare expenditures (1). In Turkey as well, healthcare expenditures increase every year (2).

Literature indicates that only 5% of the patients presenting to hospitals are admitted to intensive care unit (ICU). Although this rate may appear remarkably low, the ICU costs constitute a large portion of total hospital costs (1), accounting for 8%-30% of total hospital budget (3, 4). The high costs of ICU are associated with numerous factors including the admission of patients with complicated and serious diseases, the use of expensive tools and equipment and the higher number of ICU staff per patient (4, 5).

The need for higher number of ICU staff is the most significant contributor (58%-74%) to hospital overhead costs (3, 6, 7). Similarly, the use of expensive tools and equipment (3, 5) as well as the use of additional drugs and radiographic and laboratory tests (3, 5) in ICU are the other causes of high variable costs.

Intensive care units can be used more effectively and efficiently through cost analysis per patient (4, 6). Therefore, this study aims to determine the profit/loss ratio and the service costs in ICU based on the length of ICU stay.

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Received: 08.06.2018 Accepted: 26.07.2018
Available Online Date: 18.01.2019

Methods

This retrospective study reviewed the medical records of 458 patients who were admitted to ICU between August 2016 and August 2017. The study was approved Non-interventional Van Yuzuncu Yil University Clinical Ethics Committee (Approval date: 16 February 2018; No. 15).

For each patient, age, gender, length of ICU stay, duration of mechanical ventilation and surgeries and comorbidities during ICU stay were recorded. Depending on the length of ICU stay, the patients were divided into six groups: (I) 1 day, (II) 2 days, (III) 3 days, (IV) 4 days, (V) 5 days and (VI) more than 5 days.

For each patient, total service cost and the total charge billed by the hospital for total ICU stay were compared. The items included in total service costs were calculated based on the service and equipment charges defined in the Health Practices Communique published by the Turkish Social Security Institution. These charges were evaluated under six categories: surgery, laboratory tests, drugs, tools and equipment, radiographic workup and others (bed and nursing, consumables, oral care, postural drainage and insertion of urinary and nasogastric catheters).

Statistical analysis

Data were analysed using Statistical Package for the Social Sciences 20.0 for Windows (IBM SPSS Corp., Armonk, NY, USA). Continuous variables were expressed as mean, standard deviation (SD), minimum and maximum. Categorical variables were expressed as frequencies and percentages. The groups of continuous variables were compared using one-way ANOVA followed by Duncan's multiple range test for the determination of different groups. Relationships between the groups and the categorical variables were determined using the chi-square test. A p value of <0.05 was considered as statistically significant.

Results

The present study reviewed the medical records of 458 patients including 273 (59.6%) men and 185 (40.4%) women. The mean age of the patients was 53.87±22.6 years. Mean ICU stay was 10.99±12.6 days, and mean duration of mechanical ventilation was 8.78±12.8 days. Table 1 presents the demographic characteristics of the patients, length of ICU stay and duration of mechanical ventilation. Table 2 presents a group-based analysis on the total service cost, total charge billed by the hospital, profit/loss ratio (difference) and differ-

Table 1. Demographic characteristics, length of ICU stay, duration of mechanical ventilation

	n	Min.	Max.	Mean±SD
Gender (M/F) (%)	273/185 (59.6/40.4)			
Age (years)	458	5	96	53.87±22.6
Length of ICU stay	458	1	67	10.99±12.6
Duration of MV	458	0	67	8.78±12.8

ICU: intensive care unit, MV: mechanical ventilation; SD: standard deviation

Table 2. Cost analysis based on the length of ICU stay (TL)

Group	n	Total service cost	Charge billed by the hospital	Difference	Difference per patient
I	80	141,413	128,542	−12,870	−160
II	74	169,525	160,140	−9384	−126
III	41	164,938	164,567	−371	−9
IV	29	115,021	131,527	16,505	569
V	24	88,013	104,250	16,236	676
VI	210	2,454,863	4,635,636	2,180,772	10,384

Table 3. Cost analysis in groups (TL)

	Group I	Group II	Group III	Group IV	Group V	Group VI
n	80	74	41	29	24	210
Total service cost	141,413	169,525	164,938	115,021	88,013	2,454,863
Charge billed by the hospital	128,542	160,140	164,567	131,527	104,250	4,635,636
Difference	−12,870	−9384	−371	16,505	16,236	2,180,772
Difference per patient	−160	−126	−9	569	676	10,384

Table 4. Parameters used in cost analysis (TL)

	Group I	Group II	Group III	Group IV	Group V	Group VI
n	80	74	41	29	24	210
1. Surgery	19,607	21,569	15,710	9950	8228	79,270
2. Radiographic tests	4437	5711	6438	3487	3408	73,855
3. Laboratory tests	14,345	18,123	24,610	14,472	12,063	328,109
4. Drugs	18,064	26,400	31,548	38,752	21,327	1,070,790
5.Medical tools/equipment	44,681	50,694	46,016	26,673	25,271	574,391
6. Others*	29,441	26,861	22,482	16,615	12,312	207,407

*Bed and nursing, consumables, oral care, postural drainage and insertion of urinary and nasogastric catheters

ence per patient. Table 3 presents cost analysis in groups in Turkish lira (TL). Table 4 presents the parameters used in the calculation of ICU cost in TL.

Discussion

The costs of ICU comprise a significant portion of hospital overhead costs (3). In Turkey as well as the world, the numbers of inpatient health centres and hospital beds are growing on a daily basis (2). In particular, the number of ICU beds in Turkey has increased 15-fold to 32,155 over the last 15 years, with 60.84% of them comprising adult ICU beds (8). Moreover, this number is gradually increasing. These adult ICU beds comprise 35% tertiary-level and 39% secondary-level ICU beds (8, 9). According to the 2015 statistics, there were 1.6 beds per 10,000 population in Turkey (9), as compared to 2.8 beds in USA and 1.15 beds in Europe (2.8 beds in Germany and 0.4 beds in Portugal) (10). Additionally, the ratio of the ICU beds to hospital beds in Turkey was 11.2% (11). On the other hand, it is a fact that almost one-third of the patients admitted to ICUs, which are characterized by high cost-per-bed with an increasing number of beds, are inappropriate for being admitted to ICU.

Performing an exact analysis on the direct or indirect costs of hospital services and equipment is a time-consuming and challenging task (1). Literature reviews indicate that there have been numerous studies investigating hospital cost analyses (1, 6, 7, 12, 13). In these studies, various aspects of cost analysis, including inpatient unit cost, examination cost per unit, clinical service costs, hospital capacity utilization and cost analysis per disease, have been evaluated (1, 13).

Hospital administrators can use the financial resources more effectively and efficiently through a meticulous itemisation of incomes and expenses for each unit (1, 13, 14). The high costs of ICUs are associated with numerous factors including the follow-up of patients with complicated and serious diseases and the use of expensive tools and equipment (13). Additionally, staff expenses comprise the largest portion of the ICU overhead costs, as in other units (1, 15). On the other hand, the ICU overhead costs are invariable and thus difficult to alter. In contrast, variable charges can be altered, some of which include factors that are directly associated with patient costs (15). In our study, the ICU overhead costs were evaluated under six categories: surgery, laboratory workup, drugs, tools and equipment, radiographic workup and others. The results indicated that the total service costs were higher than the total charges billed by the hospital in patients with ICU stay of 1, 2 and 3 days. This implicates that among these patients, the ICU costs per patient was higher than the charges billed by the hospital. Moreover, the profit/loss ratio per patient was mostly in favour of loss in the patients with ICU stay of 1 day compared to the ration in the patients with ICU stay of 2 and 3 days. However, no loss was detected in patients with an ICU stay of 4 or more days. In these patients, the total charge billed by the hospital was higher than the total service cost per patient. Thus, the profit/loss ratio was in favour of profit.

Herritt et al. (15) evaluated the effect of ICU and hospital costs on early versus late tracheostomy in intensive care settings to estimate daily hospital and ICU costs per patient. The authors estimated the daily direct variable costs for ICU stay as follows: day 1, $3678; day 2, $1057; day 3, $839; day 4, $834; day 5, $690. Moreover, the daily cost for hospital stay was estimated as $249 (15). In our study, the cost analysis indicated that the profit/loss ratio was in favour of profit in the total hospital costs of the patients in groups IV, V and VI with the rates of 12.55%, 15.57% and 47.04%, respectively.

Esatoglu et al. (12) evaluated the cost analyses for three hospitals at Ankara University in 2010. The study reported that the total hospital costs comprised 70% direct staff costs and 7%-25% tools and equipment. However, no evaluation was performed for the variable costs other than tools/equipment and drugs (7). In our study, the costs of surgery, tools/equipment, radiographic workup and laboratory tests were higher in groups I, II and III and decreased in groups IV, V and VI. These findings indicate that the service costs of surgery, tools/equipment, radiographic workup and laboratory tests for patients staying in ICU are relatively higher on the first three days, which can be attributed to the fact that the diagnostic

tests and surgical procedures are often performed within the first three days in ICU.

In our study, the 'others' category (i.e. bed and nursing, consumables, oral care, postural drainage and insertion of urinary and nasogastric catheters) was the only category among overhead costs that gradually decreased beginning from day 1 in ICU (group I). In contrast, the drug costs increased gradually beginning from day 1 in all six groups except group IV. Moreover, the drug costs comprised 5.53% of total costs in group I and gradually increased as the days in ICU increased. It ultimately reached 43.62% in group VI. On the other hand, infections are common in hospitals, particularly in ICU. These infections lead to long-term use of expensive and combined drugs, which significantly increases the drug costs in ICUs (16).

Kisakurek et al. (1) conducted a cost analysis in 2010. They reported that the variable costs comprised 41% of total costs, consisting of 22% variable staff costs, 35% drug costs and 28% consumable costs. In our study, independent of groups, total service costs comprised 38.51% drug costs, 24.45% tools/equipment, 13.14% laboratory tests, 10% other costs, 4.92% surgical costs and 3.1% radiographic tests.

Conclusion

The cost analysis based on the service costs in ICU with regards to the length of ICU stay revealed that the profit/loss ratio was in favour of loss within the first three days in ICU due to the greater use of diagnostic, surgical and medical tools and equipment and laboratory and radiographic tests. The profit/loss ratio turned to profit beginning from day 4 in ICU due to the decrease in the use of these equipment and tests. In contrast, the drug costs increased gradually beginning from day 1. Moreover, total ICU costs comprised 38.51% drug costs and 24.45% medical tools and equipment.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Van Yüzüncü Yıl University School of Medicine (Approval date: 16 February 2018; No. 15).

Informed Consent: Written informed consent was obtained from patients and the parents of the patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – M.K., N.Y.; Design – M.K., N.Y., N.G.; Supervision – M.K., N.Y., N.G.; Resources – M.K., C.S., N.G.; Materials – M.K.; Data Collection and/or Processing – M.K., N.Y., C.S.; Analysis and/or Interpretation – M.K., N.Y., C.S., N.G.; Literature Search – M.K., N.Y., C.S., N.G.; Writing Manuscript – M.K., N.Y., N.G.; Critical Review – C.S., N.G.; Other – M.K., N.Y., C.S., N.G.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

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