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**Cost Analysis in Health Institutions:  
A Sample Application**

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Athens Institute for Education and Research

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### **Abstract**

The purpose of this study is to provide the executives with data they will use in making decisions in order to make the Dialysis Center render service more efficiently by performing a monthly cost analysis for the center. All financial data and medical statistics of the Dialysis Center belonging to March of 2010 constitute the basis of the research. Records of dialysis center, statistics of accounting and purchasing departments are made use of in order to determine the cost and expense flow in the study. Besides, stepdown distribution method is used in the study. According to the results obtained in the research, monthly break – even point of Dialysis Center is the implementation of 883,01 dialysis sessions. When the number of dialysis session of the center (1878) performed in March is taken into consideration, total cost of hemodialysis to the Dialysis Center is 185.486,34 TL. When the number of session is considered, total profit is 126.369,35 TL. The most important cost element of the Center is directly the labor cost. Monthly capacity of the center is 9360 hours, its capacity utilization is 7512 hours and its unutilized capacity is 1848 hours. Unit cost per patient is 1078.41 TL; unit sale is 1813,11 TL and unit profit is 734,71 TL.

**Key Words:** Cost Analysis, Stepdown Method, Accounting

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## Introduction

Costs of health services in most of the industrialized countries are increasing. On the contrary, debates that the cost of health services produced by the available scarce resources becomes more expensive in terms of health promotion of the crowd of people to whom the services are brought become continuous. At the present day, mistakes made in the activity and resource planning lie behind the problems resulting in the obstruction in the health sector (Durukan et al, 2007:20).

Due importance is not given about the calculation of the costs in health care facilities in Turkey. However, even the non-profit organizations have to have a strong financial structure in order to survive, to continue their activities and to follow the technology closely. In order for them to have a strong financial structure, they need to make sufficient profit and minimize their costs while they render services that they provide best without sacrificing quality. Since the resources are scarce also in the health sector, executives should aim at rendering health service in the quality and quantity required by using the resources at the optimum level (Yaman, 2009).

Health sector becomes one of the sector in which maximum resource is used due to the technological advancements and increase of demand continuing rapidly on the medical field. Expenditures made in the inpatient treatment establishments constitute the highest share in the resource utilization. A cost accounting system that is proper to the production processes and that could provide reliable information about the costs should also be established in the hospitals as in all establishments (Zehir, 2010).

Cost is the monetary amount of the assets that are waived in order to obtain other assets, or which are waived or will be waived for acquiring other assets (Ipçi, 1994). Cost accounting determines, defines, measures, reports and analyzes various elements of the direct and indirect costs related to the production of goods and services (Altınbaş, 2007). Cost accounting is an accounting type implemented to determine the costs appearing in an enterprise (Uslu, 1994). Cost analysis is one of the most important financial management tools that management accounting uses. Cost analyses consist of the analyses performed to provide assistance to the forward – looking financial planning by benefiting from the cost accounting data concerning the previous periods (Yiğit, 2003). Purposes of the cost accounting are to calculate the cost of goods and services produced, to help making future plans and help enterprises to make special decisions (Bursal, 1968).

Expense types are divided into 6 groups in the Cost Accounting. These are as follows; (Ipçi, 1994; Durukan, 2006)

- 1) Expenses according to their types: Costs of raw materials and supplies, workers' wages and expenses, civil servants' wages and expenses, outsourced benefits and services, miscellaneous expenses (Travelling allowances, insurance, research and development expenses etc.), taxes, duties and charges, depreciation and depletion expenses

- 2) Expenses according to their operating functions: Supply costs, production costs, research and development expenses, marketing expenses, management expenses, financial expenses
- 3) Expenses according to their cost impositions: Direct expenses, indirect expenses
- 4) Expenses according to their controllability: Controllable expenses, uncontrollable expenses
- 5) EXPENSES ACCORDING TO THE TYPE OF USE IN THE COST ACCOUNTING SYSTEM: ACTUAL EXPENSES, STANDARD EXPENSES
- 6) EXPENSES ACCORDING TO THE RELATIONS WITH OPERATING VOLUME: FIXED EXPENSES, UNIT FIXED EXPENSES, VARIABLE EXPENSES, UNIT VARIABLE EXPENSES, SEMI-VARIABLE EXPENSES, SEMI-FIXED EXPENSES.

It is needed to associate the expenses with the costs of goods and services in order to calculate the costs of goods or services. All expenses to be imposed on the costs of goods or services should be gathered in the main production centers where these goods or services are produced, and expense distribution of the expenses to be transferred to the operating accounts as period costs should be carried out in order to gather them in the period cost items (Akdoğan, 2000).

Main production expense centers are the departments where the production of the goods constituting the main area of activity of the enterprise is performed. It is necessary to produce some collateral input for main production centers in the production establishment to carry on their activities. Those departments performing these types of productions are called supplementary production expense centers. Supplementary service expense centers cover the units such as maintenance and repair of machines, dining hall established to render service to other expense centers (Büyükmirza, 2003).

Expense Distribution Methods are divided into three in the Cost Accounting. These are as follows; (Sevim, 2004; Ozgülbaş, 2013)

1) Distribution of Expenses to the Expense Centers (First distribution): The process of determining to which expense centers should place the expenses when they appear and through which cost accounting they will be distributed is called the first distribution of the expenses. As a result of the first distribution, total direct expenses of each expense center will be calculated.

2) Distribution of Expenses of Supplementary Production and Supplementary Services Expense Centers to the Main Production Expense Centers (Second Distribution): After the total cost of the expense centers resulting from their own expenses in the first distribution or direct distribution is determined, the distribution of the expense centers other than the main expense centers is initiated. Distribution of expenses of supplementary production expense and service expense centers between the expense centers benefiting from the production and services of these expense centers is called second distribution. Allocation keys are used within the second distribution. Methods used in the second distribution are as follows;

- Simple Distribution Method: It is a method that divides the expenses accumulated in the expense centers subjected to the distribution only between the main production facilities.
- Hierarchical (stepdown) Distribution Method: It is a method that performs the distribution by putting the expense centers subjected to the distribution in order, and that performs this procedure within the framework of this order and in a way to give a share to the expense centers subjected to the distribution in the next orders.
- Ranging (Repeated) Distribution Method): It is a method that reaches to the total amount of expenses to be allocated on condition of giving an expense share in continuous co – tidal tours mutually with each other from the expense centers subjected to the distribution, and that distributes these sum to all expense centers where a benefit or service provided for once.
- Mathematical Distribution Method: It is same with the ranging method. The only difference is that total expenses to be allocated are calculated by mathematical equations not by ranging.
- Distribution over predetermined values: In this method, as in the ranging and mathematical distribution, distribution is made from expense centers subjected to the distribution in a way to give each other an expense share mutually. However, in the distribution, it is based on the expense amounts determined previously per key used (budgeted or planned) not the actual expenses. Distribution differences between the actual expenses and distributed expenses are reset by being distributed by means of a simple distribution method or at the rates determined previously.

3) Distribution of the expenses gathered in the main production expense centers to the products (Third Distribution): After the expenses of the period are gathered in the main production expense centers, the stage where the general production expenses per unit are distributed in order to make these expenses reflect onto the products is the third distribution stage. Distribution measures generally used in Turkey are measures directly such as labor hours, operating hours of machines, amount of production, direct labor costs, direct raw material costs, direct product costs, estimated imposition rates (Ghareeb, 2010).

## **Material and Method**

The purpose of this study is to provide executives with data they will use in decision making in order to make Dialysis Centers in İstanbul render service more efficiently by performing monthly analysis for the center. The importance of the research is to provide input to the pricing decision by determining the costs of Dialysis Center and by supporting the budget decisions to be made in the future.



All financial data and medical statistics of the Dialysis Center belonging to March 2010 constitute the basis of the research. Records of dialysis center, statistics of accounting and purchasing departments are made use of in order to determine the cost and expense flow in the study. Besides, a cost analysis method called stepdown distribution method is used in the study. Data obtained are analyzed by M.S. Office Excel Program.

## Findings

Number of hemodialysis device in the Dialysis center is 40, number of bed in the center is 40, number of patient receiving service in March 2010 is 172 and number of dialysis session is 1878. Daily working hours of the center is between 7:30 – 16:30 (9 hours); it is holiday on Sundays. Sessions are held for 3 times on Monday, Wednesday and Friday; for 2 times on Tuesday, Thursday and Saturday.

**Table 1.** *Distribution of Patients According to Their Health Coverage*

Health Coverage	Number of Patient	Number of Session
Social Security Institution	162	1764
Green Card	5	61
Private Insurance	5	53
<b>Total</b>	<b>172</b>	<b>1878</b>

Monthly capacity; 9 hours \* 26 days=234 hours

234 hours \* 40 (number of device) = 9360 hours.

One dialysis session lasts for 4 hours. Accordingly, the utilization of capacity is; 4 hours\* 1878 sessions= 7512 hours.

Unutilized capacity is; 9360 hours – 7512 hours = 1848 hours.

Table 2 indicates the income of Dialysis Center in March. When incomes in March is considered for the Dialysis Center, while polyclinic income is placed on the top with a 94,03 % share, bed income is ranked at the second place with a 3,3 % share.

**Table 2.** *Income of Dialysis Center in March*

Income	Amount	Percent
Medicine Income	10.476,08	3,3
Medical Consumables Income	817,02	0,26
Income from Polyclinics	293.251,79	94,03
Bed - Income	7.310,80	2,34
<b>Total</b>	<b>311.855,69</b>	<b>100</b>

Total cost of Dialysis Center in March is 185.486,34 TL. In this amount, direct labor costs has the highest share by 39,9 %, then general production costs are seen by 38,6 %, and then direct raw material and supply expense is seen by 21,5 % share.

**Table 3.** *Functional Expense Distribution of Dialysis Center*

<b>Functional Expense Distribution</b>	<b>Amount</b>	<b>Percent</b>
General Production Expenses	39.938,50	21,5
Direct Raw Material and Supply Expense	71.519,50	38,6
Direct Labor Cost	74.028,34	39,9
<b>Total</b>	<b>185.486,34</b>	<b>100,0</b>

Table 4 indicates the raw material and supply expenses of the Dialysis Center. At first, 8% VAT is imposed on the unit price by considering the amount of utilization as a piece, and then cost amount of the direct raw material and supply is calculated as 38,083 TL by multiplying each cost with the number of utilization. Since the Dialysis Center is a commercial enterprise affiliated with the foundation, it is exempt from the corporate tax. Direct labor cost of the Dialysis Center is 74.028,34 TL.

**Table 4.** *Direct Raw Material and Supply Expense*

<b>Direct Raw Material and Supply</b>	<b>Number of utilization</b>	<b>Piece</b>	<b>Unit Price</b>	<b>8% VAT</b>	<b>VAT included Cost of utilization</b>
Dialyzer	1 Piece	1	16,65	0,08	17,982
D.A/V Set (Arterial and Venous Set)	1 Piece	1	3,78	0,08	4,082
D. Fistule Needle	2 Pieces	2	0,5	0,08	1,080
Serum	1000 cc	1	2,08	0,08	2,246
Serum	250 cc	1	1,24	0,08	1,339
Bicarbonate solution	8 Lt	1	3,52	0,08	3,802
Acidic Solution	5 Lt	1	2,6	0,08	2,808
Heparin 2500IU Flk	2,5cc	1	1,5	0,08	1,620
Injector	5 cc	1	0,08	0,08	0,086
Cotton	10 gr	1	0,03	0,08	0,032
Plaster	25*10	1	0,74	0,08	0,799
Gauze Bandage	20 cm	1	0,03	0,08	0,032
Injector	20 cc	1	0,16	0,08	0,173
Fruit Juice	1	1	1,5		1,500
Food	1	1	0,5		0,500
<b>Total</b>			<b>34,91</b>		<b>38,083</b>

Table 5 indicates the general production costs of the Dialysis Center. General production expenses of the Dialysis Center consist of general management expenses, machine maintenance – repair expenses, other maintenance – repair expenses, heating expenses, electricity expense, water expenses, communication expenses, fixture depreciation expense, building depreciation expenses. The highest amount within these expenses belongs to fixture depreciation expense with 16.495,88 TL.

**Table 5. General Production Expenses**

<b>General Production Expenses</b>	<b>Amount</b>
General Management Expenses	6.390,13
Machine Maintenance – Repair Expenses	1.820,34
Other Maintenance- Repair Expenses	760,91
Heating Expenses	5.478,00
Electricity Expenses	3.618,00
Water Expenses	748,00
Communication Expenses	619,25
Fixture Depreciation expense	16.495,88
Building Depreciation expense	2.655,46
<b>Total</b>	<b>38.585,97</b>

Table 6 indicates the lists and costs of the fixtures depreciation in the Dialysis Center. 20% depreciation is imposed on the result obtained by the multiplication and accumulation of number of fixtures with unit costs; the amount of monthly fixture depreciation is calculated as 16.495,88. In the calculation of the building depreciation amount, area of Dialysis Center (3501,7 m<sup>2</sup>) and unit cost of Dialysis Center is considered as 455,00 TL/ M<sup>2</sup>, and 2% depreciation is imposed. In order to find the monthly building depreciation expenses; 31.865,47 TL/m<sup>2</sup> is divided to 12 months and monthly expense of the building depreciation is found as 2.665 TL/m<sup>2</sup>.

**Table 6. Fixture Depreciation Expenses**

<b>List Of Fixture</b>	<b>Piece</b>	<b>Costs</b>	<b>Amount</b>
Dialyzer	40	21.054	842.160
EKG Device	1	4.800	4.800
Dialysis Bed	40	1.500	60.000
Weighing Scale	4	1.054	4.216
Screen	3	70	210
Set of shelves	40	442	17.680
Desk	3	500	1.500
Aspirator	3	432	1.296
Satellite Receiver	7	100	700
Television	7	3.276	22.932
Negatoscope	3	230	690
Oxygen Tube	1	130	130
Wheel Chair	6	110	660
Defibrillator	3	8.500	25.500
Crash Trolley	1	3.076	3.076
Stool	10	70	700
Wall mounted <a href="#">sphygmomanometer</a>	7	119	833
<a href="#">Sphygmomanometer</a>	15	130	1.950
Stethoscope	15	20	300
Wireless Telephone	3	120	360
Telephone	4	15	60
<b>Total</b>			<b>989.753</b>

Direct and indirect expenses of the Dialysis Center are indicated in the Table 7. Direct expenses met by the Dialysis Center are direct raw material and supply expenses, direct labor expenses, electricity, water expenses, building depreciation expenses, fixtures depreciation expenses, maintenance – repair expenses. Accordingly, total direct expense that it needs to meet is 170.885,52 TL. Direct labor cost has the highest share with 43,3% within this total. Direct raw material and supply expense follow the direct labor expense with 41,8%. Indirect expenses met by the Dialysis Center are indirect labor expenses, general management expenses, heating expenses, communication expenses, and other maintenance- repair expenses. Total amount of the indirect expenses that needs to be met is 14.600,82 TL. Expense item that has the highest share within this total amount is the general management expense by 43,7%. Heating expense is ranked at second place by 37,5%.

**Table 7. Direct and Indirect Expenses**

<b>Direct Expenses</b>	<b>Monthly</b>	<b>Percent</b>
Direct Raw Material and Supply Expense	71.519,50	41,8
Direct Labor Expense	74.028,34	43,3
Electricity Expense	3.618,00	2,11
Water Expense	748,00	0,43
Building Depreciation	2.655,46	1,55
Fixtures Depreciation	16.495,88	9,65
Machine Maintenance – Repair Expenses	1.820,34	1,06
<b>Total</b>	<b>170.885,52</b>	<b>100</b>
<b>Indirect Expenses</b>		
Indirect Labor Expenses	1.352,53	9,26
General Management Expenses	6.390,13	43,7
Heating Expenses	5.478,00	37,5
Communication Expenses	619,25	4,2
Other Maintenance- Repair Expenses	760,91	5,2
<b>Total</b>	<b>14.600,82</b>	<b>100</b>

Fixed expenses needed to be met by the Dialysis Center are direct labor expenses, indirect labor expenses, general management expenses, other maintenance- repair expenses, heating expenses, electricity expenses, water expenses, communication expenses, fixtures depreciation expenses and building depreciation expenses. According to this, the highest fixed expense needed to be met by the Dialysis Center is the direct labor expenses by 66%. While the second one is the fixtures depreciation expense by 14,70 %, the third one is general management expense by 5,70 %. Variable expenses needed to be met by the Dialysis Center are direct raw material and supply expenses and machine maintenance – repair expenses. According to this, total amount of variable expenses of the Dialysis Center is 73.339,84 TL. The expense that has the highest share within this total amount is the direct raw material and supply expense.

**Table 8. Fixed and Variable Expenses**

<b>Fixed Expenses</b>	<b>Monthly</b>	<b>Percent</b>
Direct Labor Expenses	74.028,34	66
Indirect Labor Expenses	1.352,53	1,20
General Management Expenses	6.390,13	5,70
Other Maintenance- Repair Expenses	760,91	0,68
Heating Expenses	5.478,00	4,88
Electricity Expenses	3.618,00	3,22
Water Expenses	748,00	0,66
Communication Expenses	619,25	0,55
Fixtures Depreciation Expenses	16.495,88	14,70
Building Depreciation Expenses	2.655,46	2,37
<b>Total</b>	<b>112.146,50</b>	<b>100</b>
<b>Variable Expenses</b>		
Direct Raw Material and Supply Expenses	71.519,50	97,5
Machine Maintenance- Repair Expenses	1.820,34	2,5
<b>Total</b>	<b>73.339,84</b>	<b>100</b>

Total cost of Dialysis Center is 185.486,34 TL.

**Table 9. Total Cost**

<b>Expenses</b>	<b>Total</b>	<b>Cost Allocation</b>	<b>Percentage Distribution of Costs</b>
Direct Raw Material and Supply Expense	71.519,50	38,08	38,6
Direct Labor Expenses	74.028,34	39,42	39,9
Indirect Labor Expenses	1.352,53	0,72	0,7
General Management Expenses	6.390,13	3,40	3,4
Machine Maintenance- Repair Expenses	1.820,34	0,97	1,0
Other Maintenance- Repair Expenses	760,91	0,41	0,4
Heating Expenses	5.478,00	2,92	3,0
Electricity Expenses	3.618,00	1,93	2,0
Water Expenses	748,00	0,40	0,4
Communication Expenses	619,25	0,33	0,3
Fixtures Depreciation Expenses	16.495,88	8,78	8,9
Building Depreciation Expenses	2.655,46	1,41	1,4
<b>Total</b>	<b>185.486,34</b>	<b>98,77</b>	<b>100,0</b>

**Table 10. Unit Cost**

	<b>Per Patient</b>	<b>Per Session</b>	<b>Percent</b>
<b>Unit Cost</b>	1078,41	98,77	59,5
<b>Unit Sale</b>	1813,11	166,06	
<b>Unit Profit</b>	734,71	67,29	40,5

After meeting the variable expense belonging to that unit for each unit dialysis session performed, the contribution that it leaves to meet the fixed expense and gain profit is 127,01 TL according to the formula as “Unit Contribution Share = Unit Sales Amount – Unit Variable Cost”.

Total Cost = Total Income at break – even point. Profit = Loss = 0.

**Table 11. Break – Even Point**

Fixed Expenses	112.146,50
Unit Variable Expenses	39,05
Break- even Point (Amount)	883,01
Break- even Point (Sum)	146.629,77

Total amount of fixed expenses met by the Dialysis Center is 112.146,50 TL. Variable expenses needed to be met by the Dialysis Center are direct raw material and supply expenses and machine maintenance- repair expenses. When the allocation of costs is considered accordingly, total amount of unit variable expense is 39,05.

According to the following formula;

BEP (amount) = Total Fixed Expenses / Unit Contribution Share (Unit Sales Price- Unit Variable Expenses)

BEP (amount)= 112.146,50/166,06-(38,08+0,97) = 883,01 Sessions

According to the following formula;

BEP(Sum)= Total Fixed Expenses / Contribution Rate (Unit Sales Price- Unit Variable Expenses)/ Unit Sales Price

it is;

BEP (Sum) = 112.146,50/ 166,06 - (38,08+0,97) / 166,06 = 146.629,77 TL.

Break- even point indicating the production volume necessary for the Dialysis Center to move into profit is 883,01 for the Dialysis Center. Center makes loss until that point. After this point, total cost and total income of the Dialysis Center become equal, and profit – loss statement reaches zero point. As long as the center continues production after that point, it will be able to move into profit. Income of Dialysis Center is 311.955,69 TL, its expenses are 185.486,34 TL, and its profit is 126.369,35 TL.

## Conclusion

It is attempted to define the cost structure of a Dialysis Center by data of Dialysis Center belonging to March 2010 and implement a cost accounting in this study. According to the results obtained as a result of the research carried out according to the data of March 2010, monthly break- even point of the Dialysis Center is the practice of 883,01 dialysis sessions. In order to move into profit, the center has to perform at least 883,01 sessions in a month. As the number of sessions increases, the profitability of the centers will also increase at that rate. When the number of dialysis sessions (1878) performed by the Center in March is taken into consideration, total cost of hemodialysis to the Dialysis Center is 185.486,34 TL. Total income of the Dialysis Center in March is 311.855,09 TL. When the number of sessions is considered, total profit of the Dialysis Center is 126.369,35 TL. The most important cost element of the Dialysis Center is the direct labor expenses. This situation increases the fixed costs of the Dialysis Center a lot. Even if the production is not made, dialysis has to meet this high cost. Monthly capacity of the center is 9360 hours; its capacity utilization is 7512 hours, and its unutilized capacity is 1848 hours. Unit cost per patient is 1078.41 TL; unit sale per patient is 1813.11 TL; unit profit per patient is 734.71 TL. Unit cost per session is 98.77 TL; unit sale per session is 166,06 TL; unit profit per session is 67,29 TL.

Since direct labor expenses constitute the most important cost items in the Dialysis centers, they are stated among the labor intensive enterprises. It is needed to audit the expenses and minimize the costs of the Dialysis Center. In this respect, useful results could be obtained by using work analysis and work valuation method with the Standard variable cost methods. Another item leading to an increase on the cost of the Dialysis Center is the raw material and supply expense. The following items could be found; material price and standards for each session or process, time and wage standards for the personnel and capacity and spending standards for the general production. Results obtained may be compared with the standards of other centers. Dialysis Center has many competitors due to its location. It is needed to look for a way to increase the number of patients and develop various push and pull strategies. Therefore, the rate of personnel cost which is a fixed expense may be decreased; besides, the center may use its resources more efficiently by increasing the capacity utilization rate. Dialysis centers use many different fixtures with the advancing technology and they renew them over time. Depreciation rates of the fixtures must be reflected on the costs.

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