

# Analysis of Cost Price and Net Profit of Laboratory: Case Study of Iran

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## Abstract

Diagnostic services are regarded as important hospital services, which are very costly due to the use of advanced technologies and facilities, and it seems so necessary to calculate and analyze the costs thereof. Understanding the profitability of lab services by traditional and ABC method that provided by military units is the purpose of the study. This study was an applied retrospective study that conducted in a lab of Iran in a hospital of military unit in 2015. After identifying the overhead and final centers, costs related topics were collected, and cost price of the final services was calculated using Activity-Based Costing method. Calculated cost of services had been consequently compared average tariff of common services using the principles of sharing. According to the results, there were deviations between average service tariff and per admission, and most services provided to armed forces were losing. The lab was no profitable in both methods but losses in ABC were more estimated. For Pathology, Blood Bank, Biochemistry, and Hematology tests, we were

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witnessing the greatest deviation from the tariff but Immunology, Serology and Microbiology tests were profitable.

**Keywords:** Activity-based costing, laboratory, costing, hospital.

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## Introduction

Hospital, as part of the health sector and for reasons such as scarcity, is forced to manage its resources. So hospitals need to control and calculate costs continuously for reasons such as changes in costs due to factors such as inflation (Ergun F et al., 2013). Accurate calculation of the cost of services in hospitals is difficult due to the following reasons.

- It is difficult to describe the consequences in hospitals because the treatment for each patient is different from one another
- We may see different daily expenses even in similar hospitals because of the extent of services in hospitals.
- The accounting system in hospitals does not support the accurate calculation of services.
- The most important differences between hospitals and other companies is the proportion of common costs, which is higher in hospitals.
- Hospital staff may have different roles. For example, they act as physicians and have executive responsibilities too. Therefore, the individual's wages should be calculated in light of his various roles (Yereli, 2009).

Due to inherent limitations, cost estimation through traditional accounting method does not enable the process of accurately measuring and calculating the costs (Akhavan et al., 2016). In traditional accounting system, costs are measured vertically (by identifying cost centers); however, sometimes costs are need to be calculated horizontally (i.e. calculation of the cost of care processes activities). Due to incorrect allocation of administrative costs, inability to control indirect costs, and lack of focus on the activities, it would be difficult to control costs through traditional methods (Ridderstolpe et al., 2002). Traditional costing system only uses one cost driver, resulting in overestimation or underestimation of each activity (Dwivedi & Chakraborty, 2015). To resolve these issues, the ABC method is recommended. ABC system is designed with the assumption that products consume activities, activities consume resources, and resources consume costs (Stefano & Casarotto, 2013). An advantage of ABC Method beside precise calculation of costs, especially in cases where we face a variety of products, is the identification of indirect costs accounting for a considerable share of total costs. In addition, this method allows sufficient deliberation in the relation between activities and

products (Lievens et al., 2003). The importance of implementing this method is evident from many studies in this regard. Popesko stated that accurate estimation of the cost of products is essential for effective management and Product costing is a useful tool for quantifying the cost of individual interventions carried out (Popesko, 2013).

Dwivedi et al. wrote that ABC is a new way that designed to overcome the limitations of the traditional one. This approach can be useful in managing decisions such as determining sales prices, determining the profitability of products, buying, eliminating inappropriate activities, and how employees are rewarded. They reviewed ABC method at a government hospital in India (Dwivedi et al., 2015). Ridderstrale pointed out, ABC is an advance method which identified activities, cost pools, and cost drivers. Thus indirect costs such as overhead, allocate to activities and accurate cost were estimated (Ridderstråle, 2017). Ben-Arieh et al, In addition to the objects mentioned, Saied that, ABC method can categorize value and non-value added activities too (Ben-Arieh et al., 2003).

Cost analysis is of great importance in hospital industry for provision of financial resources, sound financial planning in future periods, evaluation of projects within hospital industry, as well as determination of pricing strategies, and managers need to be accurately informed of costs carried out in hospitals, so that to be able to make efficient and effective decisions. This information is the output of accounting and hospital systems and is highly important in the calculation of the cost price of services provided. Due to the influence of diagnosis units on reducing the duration of hospitalization and increasing the quality of services as well as reducing the costs for patients and providers, and the significant share of these sectors in revenue generating, many managers have turned their attention to these units. Since laboratories are important Para-clinical units to which many refer and play an important role in increasing the income and paying off the hospital costs, this study is aimed at calculating the cost price of laboratory in a hospital Affiliated to the Armed Forces and examining the status of profitability or losses in one of the military hospitals in Tehran.

## **Methodology**

This study was an applied retrospective study conducted in a descriptive – analytical method. As previously mentioned, the aim of the study was calculating the Activity Based Costing of lab as a final unit and the bath of services of lab in a hospital Affiliated to the Armed Forces hospital in Iran in 2015. Unit level activities are which that performed on each unit of services but Batch level activities performed whenever a batch of the service is produced. This study focused on batch activities because the tests in laboratory are enormous. We compare ABC with traditional method too. ABC Method in this paper involves the following steps:

First of all, Identify and categorize the services and activities performed in the lab (table 1)

Table 1 Common tests examined in the lab

Classification	Common tests
Hematology	CBC, ESR, PBS, Retic count
Biochemistry	LDL,HDL,CHOL, TG,CR,SGOT,CA, FE, CR, BS
Microbiology	Anti-biogram ,SIC, UIC
Serology	CRP, RF, Wright, Coombswright, 2ME, VDRL,ASO, Widal, D-Dimer, Monotest
Immunology	C3,C4, ANA, ANCA, Anti DNA, Rubella IgG, Rubella IgM, CCP, CMV IgG, CMV IgM, HBC IgG, HBC IgM, Toxo IgG, TOXO IgM
Blood bank	BG, Cross match, Combs Direct
Hormonology	T3, T4, TSH, HBSAg, KIVAb, Hcv, FT4, FSH, LH, Prolactim
Pathology	Pop smear, different pathology specimens
Miscellaneous	URA, SLE, PT, PPT

In second step, Identification and accumulation of total costs of each batch of service (table 2) therefore, the direct cost of the laboratory as well as the batch of services was estimated.

Table 2 Cost heading of the lab

Direct cost	Payroll	Temporary doctors and other employees Special working hours Overtime
	Deterioration	For equipment
Maintenance	For equipment	
General consumables	Such as Eater, detergent, paper and ...	
Energy	water, electricity, gas, telephone	
Specific Consumables	Such as kits and etc	

Identification of centers and overhead costs in the third step was done. Overhead units are some which indirectly contributing to the production of services (table 3). In Step 4, we identified the appropriate cost driver because of allocating the overhead costs to final unit. Cost drivers were number of employee, Area of units and number of admission.

In step 5, the cost of each activity per unit of its relevant cost driver was estimated and indirect costs assigned to batch of services too. Finally, direct and indirect cost and ABC of lab and batch of services was estimated.

Table 3 overhead units in the case study

Support	Accounting and Insurance
Human resources	Reception
Feed	IT
Sentry	Quality Improvement
Housekeeping	Kindergarten
Medical Engineering	Nursing Office
Installations	Telecommunications
Prophylaxis	Transportation
Gardening	

## Findings

The present study examined the laboratory unit cost price in one of the hospitals of Iran in 2015. The cost of overhead and its allocation to final units is important factor in implementation of ABC method. In the study, we identified and measured overhead centers and their costs. The cost topics of the laboratory classification services and their average tariff were compared too.

The distribution of the cost inputs of the case study were payroll (24%), Specific Consumables (67%), Deterioration (3%), Maintenance (3%), General consumables (2%) and Energy (2%). The direct cost and the overhead cost of case study is shown in Table 3 and Table 4 respectively. Installations (28%), Housekeeping (16%), Feed (8%), Accounting and Insurance (7%) and Human resources (6.9%) Among the overhead centers, has the highest spending. All off activities for case study categorized into 9 type. Thus the batch of services identified and the average tariff of every group was estimated. Indirect costs was allocated. The cost of any categorise calculated based on the number of admissions and was compared average tariff (Table 5). 89 % and 11% of total costs in Lab unit of the hospital were direct and indirect costs respectively. On average, more than 70 percent of their costs for direct costs for all lab services type. Biochemistry (93%), Hormone (92%) and Microbiology (92%) had the highest direct cost. Immunology (25%), Serology (16%), and Emergency tests had the highest indirect cost.

Hormone (27%), Biochemistry (18%), Hematology (13%), and Pathology (10%) had the highest expense. Because of the low number of admissions, Pathology and Blood Bank had the hights cost per admissions. Pathology, Hormone and Immunology had the highest tariff between batch services respectively. For Pathology, Blood Bank, Biochemistry and Hematology tests, We were witnessing the greatest deviation from the tariff but Immunology, Serology and Microbiology tests were profitable. Totally the cost of lab tests with ABC method were grather than traditional one (Graph 1).

The income of lab unit was 11,782,000,000 Rials in 2015. The costs, taking into account method ABC and traditional one, were 15925455754 and 14201346210 Rials respectively. As can be seen, overall, costs in ABC method have increased due to the

sharing of indirect costs. The lab was no profitable in both methods in 2015 But losses in ABC method were more estimated (Graph 2).

Table 4 direct cost of case study

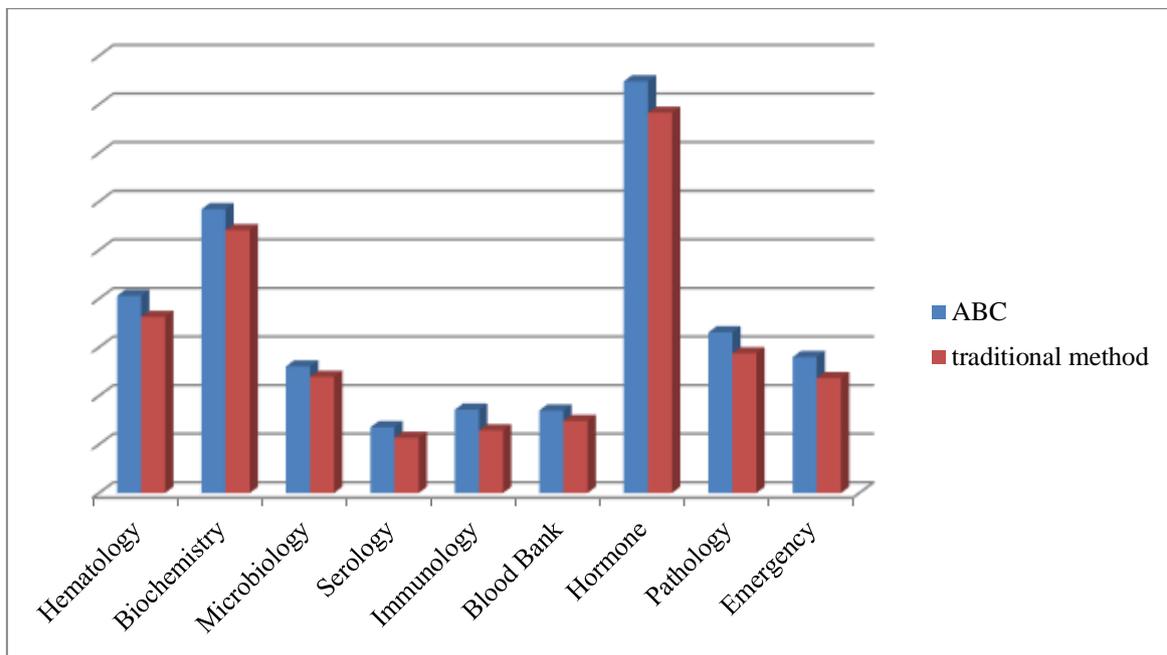
Cost topic	Cost (Rial)
Payroll	3,423,225,450
Deterioration	440,186,852
Maintenance	382,714,236
General consumables	268,159,154
Energy	232,960,624
Specific Consumables	9,454,099,894
Total	14,201,346,210

Table 5 overhead centers and costs (Rial)

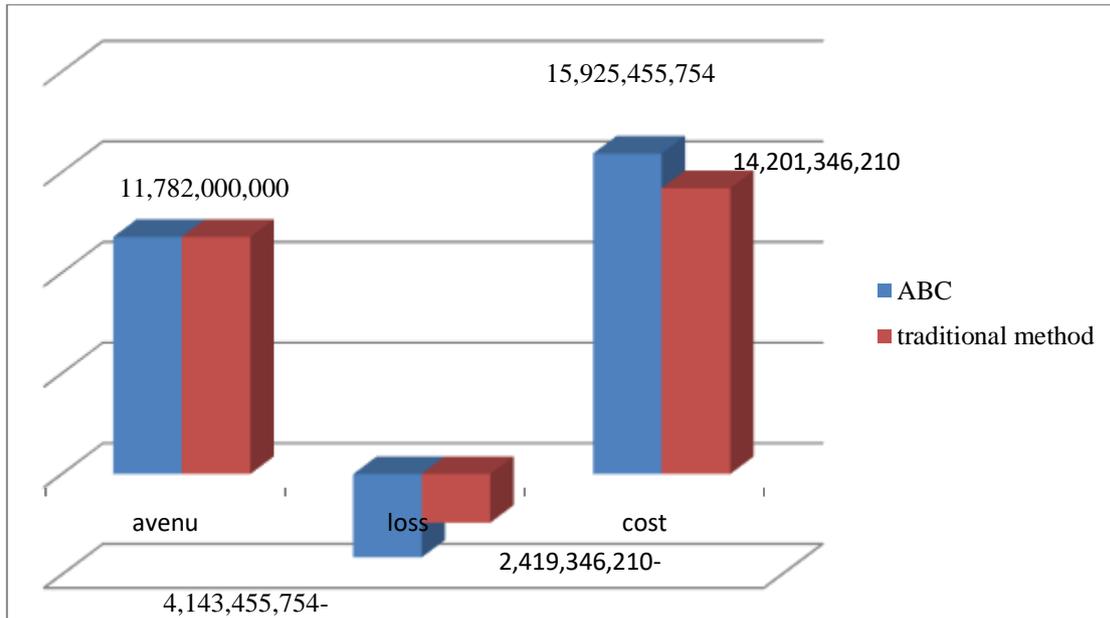
Support	48,704,124	Accounting and Insurance	120,367,858
Human resources	119,291,492	Reception	84,164,850
Feed	138,955,894	IT	17,767,252
Sentry	83,956,730	Quality Improvement	27,552,626
Housekeeping	284,317,818	Kindergarten	46,255,168
Medical Engineering	5,263,226	Nursing Office	111,226,862
Installations	488,053,878	Telecommunications	341,800
Prophylaxis	15,022,790	Transportation	4,172,320
Gardening	128,694,858		
Total			1,724,109,546

Table 6: comparing ABC and average tariff (Rial)

	Direct costs	Indirect costs	ABC	Per admission	Average tariff	Deviation from tariff
Hematology	1,812,562,832	215,513,693	2,028,076,526	96,576	39,270	-57,306
Biochemistry	2,705,741,116	215,513,693	2,921,254,808	143,198	63,358	-79,840
Microbiology	1,195,255,704	107,756,847	1,303,012,550	98,714	106,568	7,854
Serology	568,642,950	107,756,847	676,399,796	75,156	94,454	19,298
Immunology	643,267,771	215,513,693	858,781,464	26,024	264,000	237,976
Blood Bank	741,671,074	107,756,847	849,427,920	943,808	68,376	-875,432
Hormone	3,913,576,717	323,270,540	4,236,847,256	235,380	216,720	-18,660
Pathology	1,437,465,327	215,513,693	1,652,979,020	2,754,966	1,354,954	-1,400,012
Emergency	1,183,162,720	215,513,693	1,398,676,414	72,848	52,668	-20,180
Total	14,201,346,210	1,724,109,544	15,925,455,754	4,446,668	1,901,914	-2,544,754



Graph 1 Comparing ABC and traditional method for case study



Graph 2: Comparing the losses of the laboratory by use of ABC and traditional methods

## Discussion

First, let's point out the strengths and weaknesses of the present study. The main weaknesses of this study was that the cost price of each service was not taken into account because of diversity and enormous test of lab services. Thus the cost of lab services and its main categorise was studied instead. The comparison of the cost for each admission with the average tariff was the other weaknesse. As noted, due to the volume of services, There may not be a proper comparison.

However, one of the strengths of this study is it can direct hospital managers to decide insourcing or outsourcing of the unit, reasonable budgeting, omiting or adding some tests. So they can turn the lab into a unit of profit.

Lab in the paper, occupied 4 percent of the land of the hospital. At the time of the study, the lab had 135,300 admissions. Based on the calculations and studies done, direct costs and indirect costs accounted for 89 and 11 percent of costs, respectively. The highest indirect costs related to facilities, housekeeping, and feeding, respectively. Consumables and personnel cost accounted for the largest share of the direct costs with 67% and 24%, respectively. The lowest cost was related to energy and general consumables, each with 2 percent of total direct costs. Tests related to the classification of hormones, biochemistry and hematology had the highest, and tests related to classification of serology and immunology had the lowest costs. The highest and lowest costs per capita were related to the pathologic and immunologic tests, respectively. Based on the classification performed, serology, immunology and microbiology categories were benefiting and the remaining were losing. At the time of the study, more than 80 percent of hospital admissions evaluated were the patients insured by the armed forces, but given the remarkable size of admissions, about 50 percent of the revenue of this section came from

providing services to them. Because of the self-relying nature of the hospital and the importance of generating income to the outpatient sections including laboratories, it is necessary to pay attention to the expenses and income of this section. The cost price of all the case study laboratory in the second half of 2005 was 7,066 million Rials, about 80 percent of which (5,653 million Rial) was associated with the armed forces. Total revenue during the study period was 15,029 million Rials, of which 5891 million Rials was yielded through admitting patients covered by armed forces insurance. So it can be said that by only admitting patients covered by the armed forces, the laboratory unit is placed in break-even point and may even become unprofitable.

Many factors affect the comparison of studies, including the examination as a unit or as a service package, time of the study, data accuracy, etc. Therefore, periodic comparisons and calculation of deviations contribute to accurate evaluation of performance. A study done in 2011 by Mehr Al-Hasani et al on calculation of cost price of clinical laboratory in Shafa Shahr Krman Hospital based on activity-based costing method indicated that personnel and consumables had the highest shares, respectively. About 94% of the costs were related to direct costs and the remaining were placed in indirect category. According to this study, due to the difference between the tariff and the cost price, the section was realized as unprofitable, and the solution suggested was reduction of the expenses of human resources as well as standardization. In the present study, consumables and work force costs with 67% and 24% accounted for the highest share of costs, respectively. There was a deviation between the tariff and the service cost, leading to the laboratory's unprofitability in serving the clients covered by armed force insurance. Management of costs and admission of non-covered clients are regarded as solutions for bringing this section into profitability (Mehrolihasani MH et al, 2011). according to a study done by Sirizi et al, "Analysis of Cost Price and Net Profit of Para-clinic Services in Private and Public Sectors", in Kermanshah in 2014, there was a deviation between cost price of Para-clinic services including laboratory tests as well as radiology services and the specified tariffs. The results of this study indicate that radiology services in public sector have been unprofitable, and MRI service has had the highest deviation with the tariff (Sirizi MJ et al, 2014). In a study, Calculation of the Cost Price of Clinic Laboratory in Vali Asr Hospital in Tehran in 2008 Using Activity-based Costing Method (MyABCM), Nasiri Poor et al found that topics related to human resources costs and energy accounted for 44% and 5% of cost share, respectively. Urine analysis accounted for the highest and sediment test the lowest share of costs. Given the budget deficit of the case study, paying attention to human resources and standardization can be effective (Tabibi Jet al, 2010). In the present study, consumables and human resources accounted for the highest share of costs. Certainly, high cost of consumables, as the work appliances for this unit, is justifiable. Besides, many of the work appliances and consumables are produced abroad and are affected by political factors such as sanctions. Care in the use of consumables and preventing their wastage are measures to decrease the cost of this cost topic.

## Conclusion

Deviation of costs against tariff in the lab studied indicated that the services provided to patients covered by the Armed Forces do not cover their costs. Low tariffs for services

of the armed forces in the studied hospital led to a fall in the efficiency of the laboratory. Implementation of health development plan in the country and increased service tariffs were the key factors in the increase in profit margin of the mentioned unit. But this was because of admission of patients covered by other insurance companies, non-covered clients as well as non-coverage of some services by insurance companies. Thus, if the studied hospital did not use the above strategies to generate income, and only admitted the clients covered by the armed forces, it would become unprofitable. Given the deviation of cost price of services from the tariff, some strategies to reduce costs and consequently increase profit margins for the studied hospital include tariff increase, proper management of resources especially consumables, increase of admissions, admission of non-covered clients, informing patients having conditions for testing, and also enhancement of the care of personnel in tests in order to avoid duplication, avoid unnecessary services, and reduce overhead costs (Hospital management has more flexibility in managing the cost of these units).

### **Recommendations**

Closer inspection of processes, prevention of downtimes, the correct management of costs and resources, studies, work and time measurement will be useful in increasing the profit margins of these units. In order for proper management and optimum allocation of resources, as well as enhancement of the efficiency and effectiveness of departments and affiliated units, a strong management tool in the hands of managers and decision-makers will be putting together the results of costing studies and identification of potential earnings as well as analyzing them. Using new methods in costing, particularly TDABC Method is recommended to accurately calculate costs and to take into account the time.

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