



## **Applying Activity Based Costing (ABC) Method to Calculate Cost Price in Hospital and Remedy Services**

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### **Abstract**

**Background:** Activity Based Costing (ABC) is one of the new methods began appearing as a costing methodology in the 1990's. It calculates cost price by determining the usage of resources. In this study, ABC method was used for calculating cost price of remedial services in hospitals.

**Methods:** To apply ABC method, Shahid Faghihi Hospital was selected. First, hospital units were divided into three main departments: administrative, diagnostic, and hospitalized. Second, activity centers were defined by the activity analysis method. Third, costs of administrative activity centers were allocated into diagnostic and operational departments based on the cost driver. Finally, with regard to the usage of cost objectives from services of activity centers, the cost price of medical services was calculated.

**Results:** The cost price from ABC method significantly differs from tariff method. In addition, high amount of indirect costs in the hospital indicates that capacities of resources are not used properly.

**Conclusion:** Cost price of remedial services with tariff method is not properly calculated when compared with ABC method. ABC calculates cost price by applying suitable mechanisms but tariff method is based on the fixed price. In addition, ABC represents useful information about the amount and combination of cost price services.

**Keywords:** Activity Based Costing, Remedial services, Cost price, Iran

### **Introduction**

From 1850s, medical tariff began in California by using coding method. First results of this information were published in 1956. In this method, a three- number code with a special listing was used for the classification of medical services (1, 2). Regarding weaknesses in tariff method in the late 1980s, most hospitals made their tariff's calculating method based on "Diagnosis Related Groups (DRG)". In this method, instead of fixed tariffs, cost price of hospital services was calculated based on the opinion of expert (3). In the recent decade, by increasing varieties of complex activities and the importance of cost

price in hospitals for managers and governments, understanding these changes and evaluating their effects on cost price is very important. Traditional costing methods, especially methods used in hospitals cannot practically meet these expectations. These methods determine cost price of offered services based on fixed price regardless of conditions in hospitals (1). Therefore, using proper and effective methods of costing is a fundamental necessity. For this purpose, "Activity Based Costing" (ABC) is introduced for calculation of cost price. ABC is one of the new costing methods with an increasing application throughout the world.

These methods, in calculating the cost price, apply complexity, variety, and specific features. A distinct feature of this method is the ability to diagnose exact costs and to present the non-financial information to improve the performance and efficiency of activities (4). In addition, by applying ABC method, organizational unused capacity resources can be diagnosed and decreased (5).

After the remarkable development and success of ABC method in industry, its application has been considered in other parts, especially in healthcare centers and hospitals since early 1990s. Kaplan had a key role in the development of this method (5). Meanwhile, by introducing ABC, the accuracy of calculated costs in health systems became so important for hospital managers, physicians, investors and governments, that over 20% hospitals in America and Canada used this method in 1990s (6).

In "General Zonal Hospital" in Argentina ABC method was used to determine costs of patient care in 1998. This hospital provides services to 190,000 patients in 26 treatment units. Finally, cost price of services was calculated based on the kind of disease, it was very different from the available methods at that time (7).

A study was performed by a group of quality guarantee in America as ordered by WHO for the possible applicability of ABC method in developing countries. To apply this method, the group chose a center of health service in Peru, called "Maxlud". Results revealed that ABC could be used as an efficient method in health centers in developing countries (8).

The applying of activity based costing in the recent decade has increased a lot in many countries to calculate cost price in medical services, for example, in Australia (9), Ireland (10), Canada (11, 12) and Island (13).

Therefore, main objectives of this research were:

- 1) Presenting a proper model to determine the cost price of offered services to patients.
- 2) Comparing enacted tariffs with ABC method for remedy services.
- 3) Presenting information to standardized activities and appraisal of performance (Benchmarking).

- 4) Providing necessary information for hospital budgeting, especially Activity Based Budgeting (ABB).

For this purpose, ABC method was applied in "Shahid Faghihi Hospital" to calculate cost price of hospital services

## Materials and Methods

To apply the proposed model, activities in Faghihi Hospital were observed by a team of system - designers during a 12 -month period and relevant data were collected in different parts of the hospital. Then, ABC system was designed based on the financial information of the hospital in 2009. Following steps were taken to design and to apply the proposed method:

### *Step 1: Separating the hospital based on services*

In this stage, the hospital was divided into three parts based on the offered services to patients as:

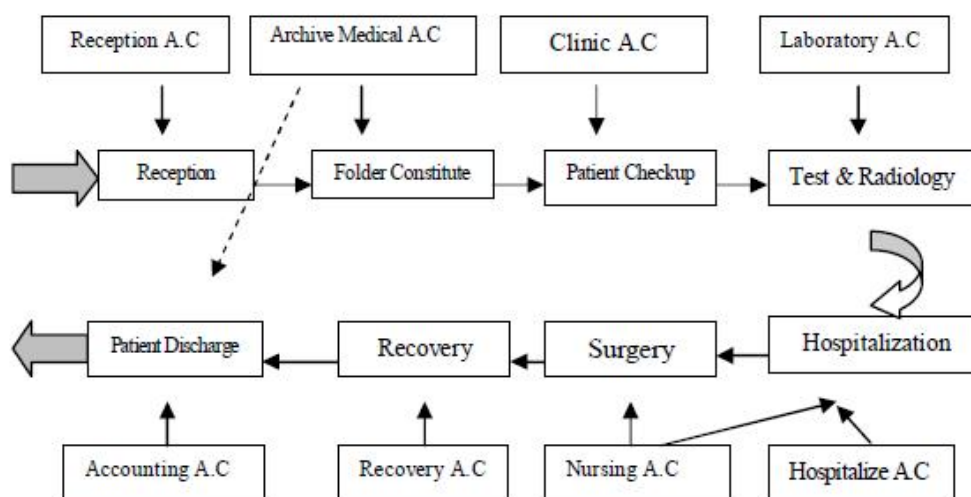
**Operational divisions:** These divisions offer services to hospitalized patients, such as recovery, operating room, heart surgery, and emergency units.

**Diagnostic divisions:** They offer diagnostic services to hospitalized patients as laboratory, radiology, etc.

**Administrative and Service divisions:** These units prepare facilities and offer services to all hospital units, such as accounting, management, and administrative units.

### *Step 2: Defining and analyzing activity centers*

In this stage, necessary activities in providing services to patients were identified. As an example, activities related to services in surgery department (unit level and batch level activities) are displayed in Fig. 1. A surgery operation consists of some activities requiring numerous sources involving some costs. Only the unit level and batch level have been indicated in the above figure and activities of sustaining level and hospital level are not included.



**Fig. 1:** Activity centers and the process of offering service to patients  
\*AC=activity center

### Step 3: Defining activity centers

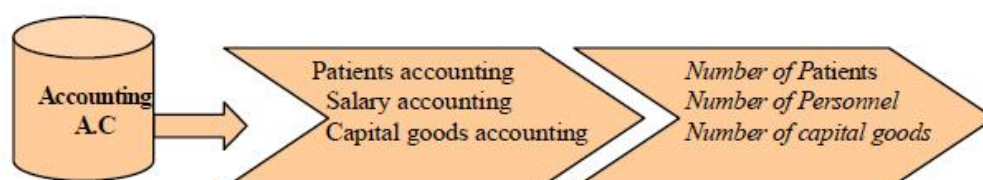
Definition of activity centers in hospital departments (administrative, diagnostic, and operational) is different.

In “administrative units”, services to patients are not offered directly. Then, based on its assigned duties in the hospital, each subdivision can be considered as an activity center. For example, “accounting department” is divided to three activity centers: 1-patients accounting, 2- salary accounting, 3-capital goods accounting (Fig. 2). Thus, its costs should not be allocated to these activity centers. Activity center of “patients accounting” only

provides services for released patients. It is obvious that all costs of these centers should be allocated only to discharge patients (cost object). However, “salary accounting” activity center accounts the personnel’s salary in the hospital. So, its costs should be allocated to the personnel of this division.

In this example, if accounting department is not divided to activity centers, processes of cost allocation will not be performed correctly. As various activities are performed in the accounting unit, and some be not related to services of other activity centers.

Primary activity center   Subsidiary activity center   Driver and cost object



**Fig. 2:** Activity centers and cost assignment in accounting department

In “diagnostic divisions”, activity centers were defined based on the kind of the service. For example, the laboratory service is based on the number of “accomplished tests” or radiology division is the number of “accomplished radiography”. Therefore, the laboratory and radiology divisions are defined as two separate units. Of course, each activity center is divided into some sub centers with specific outputs. For example, the laboratory activity center is divided into hematology activity center, cytology activity center etc.

Activity centers in “operational divisions” were defined according to the kind of service it offered to patients. For example, the hospitalized departments offering services to patients’ pre and post surgery operation were considered as an activity center. Activity center output in such units was identified based on the “occupancy bed day”.

#### **Step 4: Activity analysis in activity centers**

The purpose of activity analysis is to acquire necessary information about the kind of activity, activity level, activity purpose, resources, and the time of activity accomplishment. Activity analysis is an important and fundamental stage in ABC method. In this stage, activities related to goals were identified. In addition, the amount of consumed materials and the equipment depreciation were calculated.

#### **Step 5: calculating activity center costs**

In this stage, by using the information of activity analysis and the accounting data, costs of each activity center consisting of material, manpower, equipment depreciation cost etc., were identified based on unit level, batch level, hospital level and sustaining level costs (Fig. 3).

#### **Step 6: Allocating costs of administrative activity centers**

In this stage, costs of administration center were allocated to other activity centers based on services. For example, the cost of drugstore activity center

was allocated according to the “number of prescriptions” or costs of technical services were allocated according to the “space” of each activity center.

Regarding the use of numerous bases to allocate costs in ABC method, in this research, “concurrent equations” was used to determine service loads in each activity center. Finally, allocated costs to other activity centers were identified regarding collected costs of each activity center.

#### **Step 7: Allocating resource costs to activities**

In this stage, the cost of consumed resources was allocated to activities. For example, activities in radiography include patient reception, radiography operations, and preparation of the final service (Fig. 3). In this stage, the cost of each activity was calculated separately. Then, according to total cost activities, cost price of services was calculated.

#### **Step 8: Calculating cost price of services.**

In this stage, cost price of remedial services (cost object) was calculated based on the usage of services in activity centers. Moreover, cost price was determined according to the hierarchical costs (Fig. 3).

## **Results**

With regard to the application of the above steps, the cost price was calculated in the hospital. For example, cost price in radiography department was based on “unit” and “batch” level costs (consumed material and the cost of manpower), “hospital” and “sustaining level costs” (equipments & building depreciation and allocated costs from other activity centers). In the last column of Table 1, cost price with ABC method is compared to tariff method and the deviation is presented. Cost price in sinuses radiology with ABC method was calculated as \$3.08 and based on tariff method was \$2.15. This difference showed cost price had \$.93 negative deviation.

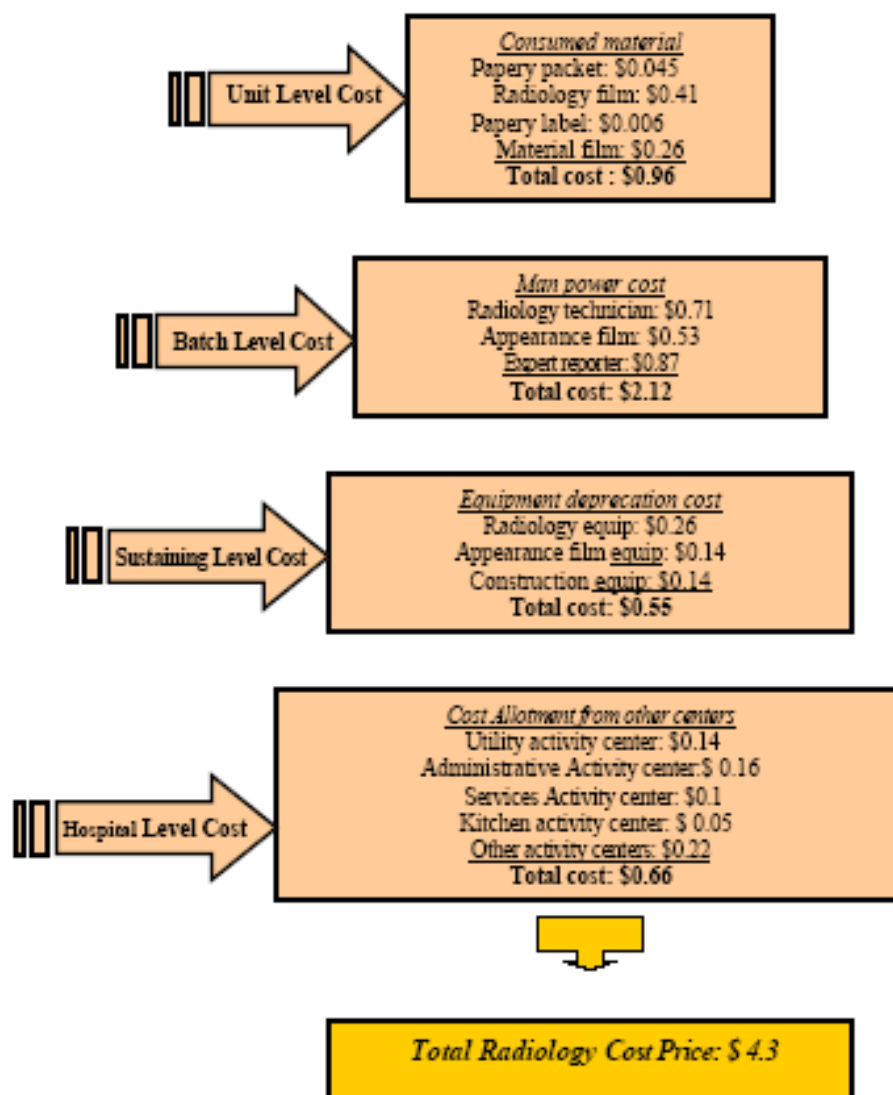


Fig. 3: Hierarchical costs in radiology activity center

Table1: Cost price of radiology services with ABC and tariff method

Radiology Services	Cost price with ABC Method(\$)					Cost of service with tariff method(\$)	Deviation of calculated cost price ABC with tariff method(\$)
	Cost of material for each unit	Cost of manpower for each unit	Unit & batch level cost	sustaining & hospital level cost	Cost price for each unit		
Thorax radiology	0.82	2.28	3.1	1.19	4.29	2.39	-1.9
Urinary radiology	0.69	2.14	2.83	1.22	4.05	2.41	-1.64
Sinuses radiology	0.29	1.93	2.21	0.87	3.08	2.15	-0.93
Pelvis radiology	0.74	2.3	3.05	1.09	4.14	2.41	-1.73



Cost price in remedial services in hospitalized centers are calculated based on unit level, batch level, hospital and sustaining level costs for “occupancy bed day” (Table 2). In the last column of the table, the cost price of these two methods has been compared and the deviation of cost price has been determined.

As showed in Table 2, calculated cost price in the hospital has significant difference from tariff because tariff determines cost price without the actual price information. This leads to loss for the hospital in long time.

**Table 2:** Cost price of occupancy bed day with ABC and tariff method

Hospital Parts	Cost of activity center(\$)		Occupancy bed day	Cost Price of occupancy bed day With ABC Method(\$)			Costs of occupancy bed day based on tariff(\$)	Cost price Deviation of occupancy bed day ABC method with tariff(\$)
	unit and batch level cost	hospital and sustaining level cost		cost price based on unit and batch level costs	cost price based on hospital and sustaining level cost	Cost price based on total cost		
Emergency	50376.3	88207.1	0.71	8.93	15.63	24.56	10.06	-14.61
Surgical unit	33835.7	45620.8	0.57	7.46	10.06	17.53	9.94	-7.59
Heart ICU	49597.4	32829	0.11	85.83	38.94	97.8	49.18	-48.21
Heart CCU	30572.6	41584	0.24	15.82	21.52	37.34	23.65	-13.19
Internal ICU	43669.3	30169.1	0.16	33	22.78	55.76	48.18	-7.45

## Discussion

Calculation of the cost price based on unit level, batch level, hospital level and sustaining level costs are one of the important conclusions of this research. For example, the cost price of the occupancy bed day in the emergency department equals to \$24.56 of which 63% (\$15.63) has been allocated from activity centers services. Cost price in “sinuses photography” is \$2.21 of which 39% (\$.87) has been allocated from them too. The high amount of indirect costs(hospital and sustaining level costs ) indicates that the capacity of activity centers are not used properly because indirect costs are related to preparing facilities and have a fixed character. If the volume of services is high, it ultimately decreases the cost price in each unit of services.

Duffy (2008) suggested that ABC method data compared to traffic method is very suitable and applicable for decision-making (10). His study in

Ireland hospitals in 2006 showed the maximum 50% of cost price was related to indirect cost. In Canadian hospitals showed that the portion of indirect costs in cost price of services is near to 45% (11). Meanwhile, the study performed in one of the Indian laboratory, showed Cost price per test decreases as total number of samples increases. Cost price per test is higher for specialized tests, which are interpreted and done by a pathologist (14). These findings show in the situation in which this study was conducted the hospital did not use resources properly.

The difference of cost price in ABC method and tariff method is another result of this research. For example, the cost of the occupancy bed day in the surgical unit is calculated about \$17.53, but the enacted tariff for this bed is \$9.94 with an unfavorable price deviation equal to \$7.6 It is considered that all deviations are negative. A study in

Australian governmental hospitals in 2010 showed applying tariff method does not provide useful information and leads to mislead decisions for managers (9).

One of the other important results of this research is the identification of the cost price difference in occupancy bed day in intensive care units (ICU) than in other departments. The main reason for high costs in occupancy bed day is due to costs of equipments depreciation, facilities, manpower costs and low number of occupied bed day. For example, the cost of each occupied bed day in the "Heart ICU" is about \$97.8, which has the negative deviation of \$48.2 in comparison to the enacted tariff (\$49.18). One of the reasons for the negative deviation of costs in occupancy bed day especially in intensive care units (ICU) is the low number of occupied beds. For example, occupancy bed day in the heart surgery ICU was 38.6% during the observed period. Regarding the high amount of costs, their full capacity has not been used and the total fixed cost of these activity centers is only allocated to occupancy bed day. Therefore, the cost of every occupied bed day has increased significantly.

In a study performed in some American hospitals, cost price in ICU department had tangible difference to other parts of the hospitals especially in specialized hospitals compared with general hospitals. This difference is meaningful (15). However, another study performed in one of the Canadian hospitals showed the occupancy bed day was very high. This lead to low cost price services in the hospital (16).

Determining the unused capacity of resources in various departments of the hospital is another result of this research. For example, in "sinuses photography", the standard time for presenting the output should be equal to 432 hours but it was 2211 hours. So, the available resources are not used completely. In other words, about 1779 hours of resources (Manpower, facilities and other equipments) are not utilized. A Study in hospitals Health Care in Australia showed that as suitable mechanisms for costing were not applied, they were not able to detect unused capacities and it lead to organizational cost to be increased (17).

## Ethical Considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

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