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Applying ABC system for calculating cost price of hospital services case study: Beheshti hospital of Hamadan

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ABSTRACT

Introduction: activity based costing (ABC) is an accounting method that allows organizations such as hospitals to determine costs based on the resources they consume. This method is a new and more effective cost system. In this study, ABC method was used for calculating cost price of radiology services in Beheshti hospital of Hamadan.
Method: This cross-sectional study was performed in 2015. The statistical population was the diagnostic imaging department of Beheshti hospital in Hamadan University of medical sciences. The required data was collected through information forms, and the price was calculated by using Activity-Based Costing model. To apply ABC method, the hospital was divided into several cost centers and five cost categories were defined: wage, equipment, space, material, and overhead costs. Then activity centers were defined.
Results: the highest costs were for human resources (65.2%) and the lowest ones for energy conduits costs (0.4%). According to the obtained results the total cost of the support sector in Beheshti Hospital during the study period was 64,091,093,852 IRR.
Conclusion: By utilizing ABC, hospital managers have a valuable accounting system that provides a true insight into the organizational costs of their department. The results of this study indicated that there are differences between the real price of radiology services and approved tariffs. Suggest until tariff amending, hospital commence to modify financial and personnel structures and repair its costs.

1. Introduction

Over the recent decades, the increased healthcare costs resulting from technology development on the one hand and enhanced level of health awareness and expectations on the other hand have induced problems in financing healthcare services.[1] The health sector is facing severe resource constraints in many countries. In this regard, managers in healthcare sector shall consider achieving maximum efficiency as an integral part of the healthcare system management.[2] A major portion of the health sector resources is allocated to hospitals.[3] Thus, evaluating financial performance and calculating the total cost of services provided in this sector facilitate appropriate and favorable planning to increase efficiency and productivity. Diagnostic services provided by the hospital wards account for a major part of the costs.[4] Among the most important data and financial information required for a manager in diagnostic wards is the costs allocated to cost units and service unit costs.[5] Calculation of the total cost of services can improve managers' performance in terms of budgeting, strategic planning, outsourcing, transfers, and privatization as well as their overall organizational performance.[6] Using the activity-based costing method also will allow hospital managers to determine their pricing policies and to make more accurate decisions on budgeting and strategy planning.[2,7] Very few studies have been performed on the economics of hospitals in middle-income countries. Most of the studies have focused on individual units of hospital such as application of ABC in calculating cost price of surgery services.[8,9] Considering legal requirements and ultimate goals[10] of operational budgeting and final price calculations in adopting right decisions about the allocation of public resources based on measurable outcomes to create a rational process for decision-making, planning, evaluation and reporting performance relying on the activity-based costing technique, the total cost of all services provided by a relative value unit (called K) of Imaging Department of Beheshti Education and Treatment Center in Hamadan was calculated and compared with the approved tariffs in 2015.

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2. Method

2.1. Data collection

The present study was an applied descriptive study conducted in 2015. In order to estimate the radiology services costs in Beheshti Hospital, the ABC technique was used. Data was extracted using field studies through identifying cost centers and pre-specified tables. The study population and sample similarly consisted of the diagnostic imaging ward of Beheshti Hospital in Hamadan.

2.2. Data management and analysis

To run the ABC technique, the following steps were adopted[11]:

Step 1. The activity centers of the hospital were identified. They impose direct costs on the activity centers and attract indirect costs from other activity centers.[12]

Step 2. The identified activity centers were classified into three categories in terms of operations

i. Operational centers
ii. Diagnostic centers
iii. Public support activity centers such as accounting or logistic units, etc.[13]

Step 3. The output (activity) was determined for the imaging ward. A list of activities and the relative value of the relevant activity was determined using a book entitled 'relative values'. Then, the levels of activity in specific quarter periods were reported from the Hospital Information System (HIS).

Step 4. Examining the documents available in this step, the details of all expenditures were extracted based on personnel costs (salary, fee, clothes payments, management payments, etc), materials used for public consumption, specific materials and requirements, consumed drugs, energy costs, depreciation (building and equipment) and the like.

Step 5. The cost of each activity center was assigned to the total cost centers. Regarding their origins, the costs were divided into 2 groups (i) Costs that are created in an activity center; (ii) Costs imposed by other activity centers to an activity center (overhead costs).[14] The total costs of administrative, support and radiology activity centers of Beheshti Hospital were separately calculated for 3-month intervals in 2015.

Step 6. The total cost per output unit was determined. After identifying the costs related to final pools of activity centers or centers possessing output to calculate the total cost of each output, the total costs allocated to each activity center was divided by the number of defined outputs for each activity center and the cost per output was obtained.To determine the exact cost of each service provided by the radiology activity center based on the portion of each service in total services offered in a 3-month interval, total relative value of the services (K) was estimated using 'relative value of a service' and divided by total value allocated to each activity center and the total price (K) was obtained. Total price was also achieved multiplying (K) by 'relative value for a service'.

Step 7. Services cost-benefit was estimated for the radiology ward of Beheshti Hospital during 3-month intervals in 2015 by comparing the total cost and the tariffs determined by the Ministry of Health, Treatment and Medical Education.

Step 8. The contribution of various costs (personnel, materials and consumed goods, medicines and equipment, etc.) was calculated for (K) to predict and estimate the financial impact of different policies on the total cost.[15]

To calculate the equipment depreciation costs, some information was obtained about medical equipment available in the hospital and then a list of available equipment and detailed information about the purchase date and price and its power consumption were extracted from activity centers by matching the list and the list available in each activity center.[16]

Since the hospital building does not belong to the university, the monthly rental fee and the cost of repairs carried out during this period were considered as depreciation cost of the hospital building. Then, the share of activity centers was calculated with regard to the hospital foundation area. The required statistical data related to radiology ward costs including salaries and job bonuses, available equipment in the radiology ward, consumed goods and supplies received from storeroom, consumed equipment and tools, the cost of water, electricity, gas, phone, fax, and internet subscription services were separately tabulated for activity centers. The required information was collected referring to the accounting unit, revenue and discharge accounting unit, medical records unit, storerooms, public and administrative affairs offices, medical equipment unit, information and technology unit, outpatient wards, human resources unit, and nursing office through reviewing available documents and receiving payroll system reports, energy consumption control and monitoring system, HIS system, Ghasedak system and new financial system.

3. Results

Hospital imaging department has 3.2% of the total number of the hospital expert, technical, and service human resources (N = 21) at its disposal and provides imaging services. According to Table 1 and with regard to the hospital physical resources, the costs for separate activity centers were determined. From 19000 square meters foundation area, 614 square meters (3.2%) is allocated to the imaging department.

The findings associated with the consumed energy conduits costs in hospitals show that, of the total costs of energy conduits consumptions and phone amounted to 2,584,812,535 IRR, 16.1% and 3.4% are allocated to support and imaging sectors, respectively; see Table (2).

As shown in Table 3, the frequency of services provided in the imaging sector was 41362. In this regard, the highest and the lowest

Table 1
Beheshti Hospital area specified for costs of activity centers.

department/unit	Wards		Foundation (m^2)	Foundation (%)
Imaging Department	CT scan, ultrasonography, bone densitometry and radiology		614	3.2
Support Units	Administrative and financial sectors		420	2.2
	Storeroom		136	0.7
	Service and Support Units	Installation	1618	12.3
		kitchen	358	
		Laundry	242	
		Waste elimination	99	
		Guarding	26	
		Transportation	9	
Hospital			19000	16.50

Table 2
Cost of the consumed energy conduits for support wards in Beheshti Hospital (IRR).

Unit	Water	Electricity	Gas	Gasoline	Phone	Total
Support	75802218	172391072	138667124	115014338	17564247	415938999
Imaging	15854059	36055649	29002274	2408227	3673568	86993778
Total	494960853	1125261590	774991092	74800000	114799000	2584812535
Share	19.2%	43.5%	30%	2.9%	4.4%	100%

Table 3
Frequency and total relative value of services provided in imaging sector of Beheshti Hospital in 2015.

Indices		First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Total
Number of Services Provided	Outpatients	5453	4380	4763	5008	20204
	inpatients	4979	5822	5210	5147	21158
	Sum	10434	10802	9973	10155	41362
Total relative value of services (K)	Outpatients	28350	26920	26603	27828	109701
	inpatients	18161	20895	19473	18543	77071
	Sum	46510	47815	46075	46371	186771

frequencies were related to the second (10802) and third (9973) quarters, respectively.

Total costs of imaging sector in 2015 amounted to 22,736,215,369 IRR, with 94.9% of direct costs and 5.1% of indirect costs. Of the total costs of the imaging sector, there were 65.2% personnel, 8.3% consumed materials and supplies, 5.1% support units (public services, cleaning, etc.), 5.4% depreciation of office, medical equipment and building repair, 15.5% contracts, and 0.4% energy conduits costs. The highest percentage of direct radiology services costs was related to human resources. The total cost of the support sector in Beheshti Hospital during the study period was 64,091,093,852 IRR. Regarding the imaging sector contribution, overhead costs were identified and added to the sector direct costs. Furthermore, depreciation and energy conduits costs formed a substantial portion of the direct radiology services costs.

In Table 4, the total cost of a relative value unit was estimated to be 128,518 IRR and the largest portion was associated with personnel costs amounted to 83836 IRR (65.2%; see Table (4).

According to the approved tariff (K = 88000 IRR) issued in 2015, the losses imposed on the hospital per k was equal to 40581 IRR. This represents the income deficit amounted to 7568 million IRR in the radiology department, compared to costs. The maximum financial loss resulting from the provision of imaging services amounted to 1937 million IRR for the second quarter and the minimum financial loss was equal to 1867 million IRR for the third quarter; see Table (5).

4. Discussion

A total of 41362 services were provided by imaging department of Beheshti Hospital within one year. There were 21158 and 20204 services provided for inpatients and outpatients, respectively. The highest frequency of service delivery (n = 10802) was observed in the second quarter and the lowest frequency (n = 9973) was related to the third quarter.

Total relative value of imaging services provided in Beheshti Hospital for 4 quarters in 2015 shows that, of relative value of the services (K) equal to 186,771, there were 109701 (K) and 77,071 relative value of the services (K) provided for outpatients (58.7%) and inpatients (41.3%), respectively. The maximum (n = 47815, 25.6%) and minimum (n = 46075, 24.7%) numbers of services were provided in the second and third quarters, respectively. Of 152 types of services, 28 services formed 90% of total services provided.

The results of this study determined the amount of costs in administrative and support activity centers and its impact on total cost of services in imaging sector. Total cost calculated per K was equal to 128815 IRR, which was divided into direct and indirect costs. The direct costs were highly associated with the volume of performed activity and work. Costs in support centers (equal to 18% of the hospital total costs) had less effect on total cost of imaging services (1.5%). The major cost component for the hospital were human resources and capital cost, it is supported by another studies.[17] Costs were associated with personnel (65.2%), consumed materials and supplies (8.3%), support units including public services and cleaning (5.1%), and depreciation of office and medical equipment and building repairs (5.4%), contracts (15.5%) and energy carriers (0.4%). The findings are consistent with the results of a study conducted by Mahani et al., in 2011.[18] Of the total costs of this sector, 7.57%, 1.32%, 0.32%, and 14.96% of costs were reported for consumables and nutrition as well as water, electricity, phone and fuel and depreciation, respectively. The information provided by each center could greatly assist the hospital management to control and track expenses. Using the information provided by this system, activity-based budgeting can be performed for various sections of the hospital.[19]

5. Conclusion

The results of this study indicated that there are differences between the real price of radiology services and approved tariffs. The difference between a calculated relative value unit in imaging sector and tariffs approved in 2015 was significant. It is recommended that hospitals until the issuance of new tariffs to balance cost-income ratio have cost structure and financial reforms. Suggest until tariff amending, hospital commence to modify financial and personnel structures and repair its costs.

Table 4
Separated costs (IRR) for imaging department of Shagid Beheshti Hospital in 2015.

Costs	Annual sum	frequency of the relative value of services provided	Costing (%)	Cost per K
Personnel costs	14831574178	186.771	65.2%	83836
Consumed materials and supplies	1890280920	186.771	8.3%	10685
Support (Public service and cleaning)	1167024899	186.771	5.1%	6597
Depreciation of office and medical equipment and building repair	1231585256	186.771	5.4%	6962
Other costs	3516529253	186.771	15.5%	19877
Energy conduits	99220863	186.771	0.4%	561
Sum	22736215369	186.771	100%	128518

Table 5
Comparing the final cost (IRR) of services and revenue for imaging department divided by quarters.

Indices	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Total
Total relative value of services (K)	46815	47815	46075	46371	186771
Total cost of services	5977421531	6145051285	5921504763	5959509849	24003487428
Revenues based on approved tariffs	4092913792	4207694744	4054625960	4080649144	16435883640
Profit difference (loss)	1884507739	1937356541	1866878803	1878860705	7567603788

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cegh.2019.06.001.

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