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COST ANALYSIS OF STRABISMUS SURGERY BY ACTIVITY BASED COSTING

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ABSTRACT

The aim of this study was to estimate the cost of strabismus surgery through activity-based costing (ABC) and compare it with the tariffs approved by the Iranian Ministry of Health. Costing study was conducted in Nikookari Ophthalmology Hospital of Tabriz from April 2014 to April 2015 with a retrospective approach by activity-based costing method (ABC). The required data and information were collected interviewing experts, hospital officials, and relevant units, direct observation of activities, and reviewing the documents in the financial department and HIS software system. Then, the cost of strabismus surgery was estimated using Excel 2013. According to the findings of the present study, the amount and the share of the total costs of the activities identified in the main centers are as following: human resources (\$2,818,722), depreciation of medical equipment (\$277,233), consumable medicals and supplies (\$218,484), building depreciation (\$138,004), depreciation of non-medical equipment (\$43,640), consumable non-medicals and supplies (\$ 26,804), utilities cost (\$4,724), and costs of indirect units (\$ 864,455). Ultimately, the cost of a strabismus surgery was estimated to be \$ 464 which is \$ 236 higher than its approved tariff. The difference between the approved tariff and the cost of strabismus surgery in the studied hospitals was considerable. This price gap can negatively affect the performance and quality of services provided by hospitals in the long term. Since the costs of personnel, indirect costs, and depreciation of medical equipment account for 90% of total costs of strabismus surgery, hospital managers should pay more attention to these items in order to improve efficiency of their services and reduce costs.

INTRODUCTION

KEY WORDS

Activity based costing;
strabismus surgery;
Tabriz; cost analysis

The tendency of policymakers to satisfy people and increase pressure to improve efficiency and effectiveness have forced the managers of public sectors to pay special attention to issues such as determining the exact unit cost of goods and services, improvement of processes, evaluation of outsourcing or privatization options, and aligning activities with the strategic missions and programs. One of the most important service sectors is health sector which plays a decisive role in the general health of society. Costs in hospital as one of the most vital health sectors has a special place and there are many problems and challenges facing the establishment of balance between limitation of resources and costs and providing satisfactory and desirable services. Technological progress, population growth, and rising public expectations have caused an increasing growth in hospital costs and made managers to manage the costs in order to provide qualitatively acceptable services at the lowest cost and develop their activities [1-3].

Due to the fact that no country has sufficient resources to meet all needs of its population, hospital managers are in need of accurate and exact information to improve efficiency and performance. One of the important information that is needed by managers of hospitals is the cost information that allows the managers to make correct decisions regarding pricing of services. However, hospital administrators still rely on the information of traditional costing method which has been developed when competition was not stiff as today and quality and efficiency were among less important factors of success. Nowadays, due to present economic development as well as stiff competition, search for a new method of costing consistent with the present high competition and the increasing demands of health sector became more prominent. Therefore, the need for developing an appropriate and efficient costing method compatible with the diversities and complexities of activities which works well with evaluation of their effects on the cost and quality of various services were felt more than ever [4-8].

Nowadays, many companies have found that activity-based costing (ABC) is one of the best methods of costing. This method allows organizations to well benefit from their resources for providing products and services to their customers. As a tool for efficiency and cost control, ABC was developed between 1970 and 1980 in order to estimate the costs of different activities. The main motivation for using this method can be attributed to the accurate estimation of costs and full unit cost. The implementation of this method in health sectors supports its suitability for developing countries. In this method, it is assumed that cost targets create activities and activities consume the resources. Comparison between ABC and other methods shows that ABC is both more accurate in the allocation of costs (according to the specific cost driver for each activity)

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and more detailed in the unit cost of supporting and main activities. These features form a fundamental tool for improving the efficiency and quality of care services [9-13]. Given the considerable features of activity-based costing and its suitability for developing countries, the present study aims at estimating the cost of strabismus surgery in Nikookari Ophthalmology Hospital of Tabriz and its comparison with the tariffs approved by the Iranian Ministry of Health.

MATERIALS AND METHODS

Study design

Nikookari Ophthalmology Hospital of Tabriz is a specialized and teaching hospital with 82 beds, 60 approved beds with a bed occupancy rate of 50%.

Strabismus costing method

The present costing study was conducted in the above mentioned Hospital from April 2014 to April 2015 with a retrospective approach by activity-based costing method (ABC). The reason why the current study was carried out in this hospital was that it was possible to randomly select some cases from among several surgical operations performed here daily. The required data and information were collected through face-to-face interview with experts, hospital officials, and relevant units, direct observation of activities, and reviewing the documents in the financial department and HIS software system. The cost of strabismus surgery was estimated using ABC in Excel 2013. The steps of strabismus surgery costing in the present study were as follows:

Identification of all activities associated with providing the desired service

In this step, by studying the documents and instructions on how to provide services and face-to-face interviews with relevant experts, various types of offered services and their sequence from admission to discharge were determined.

Costing in activity centers

The costs identified in this study are as following:

- A) **Human resources cost:** First, information on the staff working in each unit was gathered. Then, the cost of permanent employee together with the cost of employees hired on a contractual basis working in each unit was extracted from the payroll system and the financial software. Finally, pension, premium, overtime payment, and remuneration were added to obtain total personnel cost.
- B) **Utilities cost:** Total cost of utility services which includes water, electricity, gas, and telephone was estimated by referring to the accounting unit. Cost of water, electricity, and gas was determined on the basis of the area and telephone and internet costs were divided by the number of lines available.) Due to the unavailability of information about the equipment and according to references this cost driver was used.
- C) **Consumable medications and supplies, consumable non-medicals and supplies:** a list of all items delivered to various wards of the hospital was prepared. This list included medical supplies and medicines, technical equipment and goods, devices, and general goods. Considering the price and the number of items, total cost of each activity center was estimated.
- D) **Medical and non-medical equipment depreciation cost:** A list of equipment available in each activity center and detailed information on their purchase time, price, and maintenance were prepared. Equipment was divided into two groups; equipment that their useful life had not finished and those that their useful life had finished. With the help of experts, equipment was re-evaluated and their useful life was determined. To determine the depreciation of equipment, the method of Sum-of-years' digits is a depreciation method was used.
- E) **Building depreciation:** Firstly, according to the hospitals' map and with the help of technical experts, the area of each activity center was determined. Since the technical management experts of Tabriz University of Medical Sciences declared that the useful life of the building is finished, approximate monthly rental cost of the hospital was estimated. Then, the cost of each hospital ward was determined based on its area.) Considering that the purchase price of the equipment was not available, to calculate the cost, first the inflation was applied and the price was updated)

Identification of appropriate cost driver

Appropriate cost drivers for each of the main and overhead activity center have been identified.

Allocation of costs to activity centers

Cost Allocation was done in two steps. First, the cost of each overhead activity center was allocated to strabismus surgery centers. Then, the cost of main strabismus surgery centers was allocated to activities and services.

Calculation of the cost of strabismus surgery

The following formula was used: $[\text{Total cost of operation room} \times (\text{Number of strabismus surgeries} \times \text{Relative value of strabismus surgery})] / \text{sum of (Relative value of each surgery conducted in the operation room} \times \text{Number of that surgery)}$

RESULTS

Camel First, after reviewing the hospital processes, interviewing experts and officials, and observation of activities, hospital units were divided into two main (direct) and support units (overhead and indirect). Then cost drivers related to main strabismus surgery unit and supporting unit were identified. They have been shown in [Table 1] and [Table 2].

Table 1: Main center of strabismus surgery

row	Cost center	
1	Patient Admission	
2	Diagnostic activities	Laboratory
3		Electrocardiography
4	preoperational procedures (in ward) and patient care	
5	surgeries	
6	Patient Discharged	

Table 2: Secondary center of strabismus surgery, Cost driver, Cost

Supporting Units	Cost drivers	Costs(\$)
Presidency and management, accounting, administrative services, telephone center, security	The number personnel	312597
Kitchen	The number of staff, days of care	82929
Warehouse equipment, facilities and food	The number of delivered items in terms of activity center	17480
Pharmacies and drug warehouse	The number of delivered items	39584
Security station, information and facilities	The physical size of each unit	164012
Laundry	The number of staff, days of care	14025
Informatics	The number of computers in each department	11119
Medical Equipment	The number of existing equipment in departments	12111
Nursing Office	Number of employees covered by the nursing office	35870
Oxygen stock	The number of cylinders in each section	10542

For the allocation of costs in the first stage, the cost of supporting activity centers was allocated to the patient's direct activity centers. After allocating overhead costs to the activity centers mentioned in this study, total cost of patient's main activity centers was obtained [Table-3].

Table 3: The costs of the main center of strabismus surgery

Row	Activity Center	Cost of human resources	Depreciation of building	Depreciation of medical equipment	Depreciation of non-medical equipment	Non-medical Consumable Materials	Medical consumable materials	utility facilities	Indirect costs	total	
1	Admission	134116	26162	0	2,052	7472	0	1,757	114140	285699	
2	Diagnostic activities	Laboratory	51579	9811	2,609	1,734	965	3188	237	28533	98656
		Electrocardiography	9442	981	195	457	51	350	24	5,676	17175
3	Preoperative and postoperative care	307920	71945	7821	16836	9,362	20218	1,915	504642	940660	
4	surgery	2283947	26162	266608	21846	8667	194728	720	187558	2990237	
5	Discharge	31718	2,943	0	714	285	0	71	23905	59636	

In the second stage of allocation, the cost of main activity centers was allocated using appropriate cost drivers to the activities.

Calculation of the costs of these centers and their allocation to patients were done as follows:

Admission

Annual cost per patient admission was 285,699\$. Of which 85% goes for inpatient admission and 15% for outpatient admission. Therefore, total cost for admission of outpatients was estimated to be \$ 242,844. The number of patients admitted to the studied hospital was 11243. As a result, the cost for hospitalization of each patient was 22\$.

Diagnostic activities cost

Laboratory cost

Laboratory cost amounts to \$ 98,656 per year. Since the same tests are performed for all patients at this hospital, laboratory cost was considered to be the same for all patients. In total, 13824 patients had referred to the laboratory and the cost obtained for each patient was \$ 7.

Electrocardiography service cost

Total cost of electrocardiography unit per year was estimated to be \$ 17,175. In 2013, 6130 cases of electrocardiography have been recorded and the cost for each patient was estimated to be \$ 3.

Preoperative and postoperative care

The costs related to preoperative and postoperative care was estimated to be \$ 940,660. Allocation of the costs related to this part was based on the number of occupied days for a bed. Occupied bed days in the studied hospital was 16036 and the cost for each day of hospitalization was calculated to be \$ 59. Given that the stay duration of strabismus surgery is 2 days, the cost per patient was obtained 117\$.

Surgery cost

These costs include the cost of the recovery room, sterilization and operating room. To estimate the cost of strabismus surgery in the operation room, the following formula was used:

$$\frac{[\text{Total cost of operation room} \times (\text{Number of strabismus surgeries} \times \text{Relative value of strabismus surgery})]}{\text{sum of (Relative value of each surgery conducted in the operation room} \times \text{Number of that surgery})}$$

The total cost of a strabismus surgery is \$ 162,777. Total number of strabismus surgeries conducted in the studied hospital was 529. Thus, the cost of each strabismus surgery was found to be \$ 308.

Patient discharge cost

A total of 8046 patients had been discharged from the studied hospital in 2013 and the cost for discharge of any patient was \$ 7.

Finally, the cost of each strabismus surgery was obtained to be \$ 464. This is \$ 235 more than the tariff for this surgery approved by the Iranian Ministry of Health. [Table 4]

Table 4: Comparison of the tariffs approved by the Ministry of Health and Activity Based Costing

Surgery Name	Global Surgery Tariff in 2013	Activity Based Costing	The difference
Strabismus surgery (one or both eyes)	229	464	-235

The share of costs related to the main and secondary activity centers has been shown in [Fig. 1].

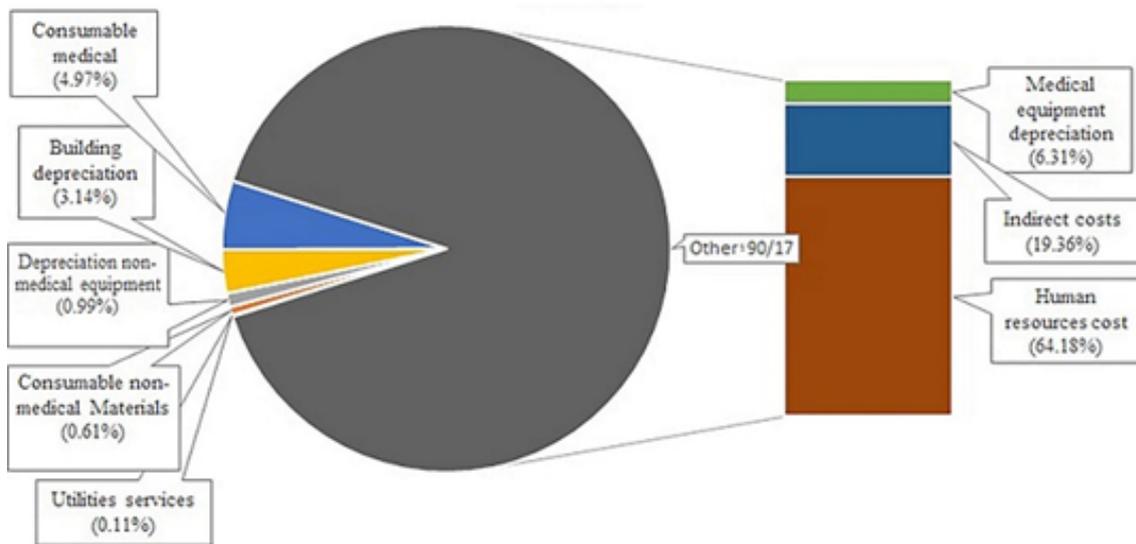


Fig. 1: The share of costs in the main surgery centers of Nikookari Ophthalmology Hospital of Tabriz

DISCUSSION

Camel The present study aimed to estimate the cost of strabismus surgery in Nikookari Ophthalmology Hospital of Tabriz and compare it with the tariff approved by the Iranian Ministry of Health. Based on the study results, the cost of strabismus surgery in the studied hospital was obtained \$ 464.

According to the findings, personnel cost (64.18%) comprised the highest share of allocated costs. In the studies conducted by Negrini et al. [14] and Lievens et al.[15], human resources cost has been reported to be 49% and 43.3% of total costs. In a study carried out in the intensive care unit of a hospital in Germany, personnel cost (42%) accounted for the highest share of the total costs [16]. These findings confirm the results obtained in the present study. Although the share of human resources cost relative to total costs have varied in these studies, personnel cost in all of them accounted for the highest share of total costs. Improving performance of human resources as critical part of provision of services can play critical role in reduction of unit cost.

The second major part of costs belonged to indirect costs (19.68%). Analyzing the components of these costs can greatly help the hospital management in providing required information for budgeting the activity center and the whole hospital system. Given the high share of indirect costs in the cost of services, efficient use of resources to increase productivity and provide further services reduces the shared average cost of services and leads to lower total cost of services. For instance, by sharing activity centers' cost (presidency and management, accounting, administration, telephone center, and security) in the current study to the laboratory activity center, based on the sharing of the number of employees, the figure of \$ 28,533 was obtained. By dividing this figure to the number of surgeries done in the same period, the average cost of these centers for providing each service will be \$ 2 on average. Increasing the number of tests to 20000 services, the average cost per test would be only \$ 1.5. These calculations can also be done regarding other overhead parts. In fact, by determining the parts that have the highest impact on the cost of services, the costs can be controlled and reduced.

Medical equipment depreciation cost (6.31%) ranks third after personnel costs and indirect costs. This is one of the significant findings of the present study which can be attributed to excessive obsolescence of equipment, installation of new equipment (the highest depreciation of equipment occurs in the first years and the last years of their useful life), and existence of specialized equipment in this hospital and high cost of their maintenance.

Other shares of costs belonged to medical supplies and medicine (4.97%), building depreciation (3.14%), depreciation of non-medical equipment (0.99%), consumable non-medical (0.61%), and utilities cost (0.11%), respectively. Lower ratio of energy costs in comparison with other hospital costs may be the result of governmental subsidies paid to the health sector. Since the studied hospital is a teaching one and teaching tariff should be taken into consideration. Energy cost should also studied without considering the subsidies.

According to the results of the present study, the cost of strabismus surgery is considerably higher than the tariff approved by the Ministry of Health. In a study conducted by Suthummanon et al. [17] in the medical sector of Thailand, it was shown that there is a considerable difference between the cost of services and the costs estimated by Activity Based Costing (ABC). Also, the results of a study carried out by Antikainen [18] showed that the costs estimated on the basis of ABC are higher than the approved tariff which was attributed to not considering the cost of unused capacities which agrees with the findings of the present study. The price difference in the present study could be due to the weakness in tariffing system in Iran which not follows an accurate and scientific method for determining the rate of services. Investment cost is another reason which includes the depreciation of property, building, and equipment which is one of the major costs in determining the cost of services. However, since most of the facilities existing in hospitals are state-funded and public hospitals provide medical services to patients as nonprofit institutes, the costs related to depreciation of property, building, and equipment are not estimated and taken into account, which can lead to a considerable difference in the cost of services.

CONCLUSION

The difference between the approved tariff and the cost of strabismus surgery in the studied hospital was considerable. This suggests non-recognition of the actual costs of strabismus surgery and lack of proper financing by the Ministry of Health. This price gap can negatively affect the performance and quality of services provided by hospitals in the long term. Since the costs of personnel, indirect costs, and depreciation of equipment account for 90% of the total costs of strabismus surgery, to improve efficiency of the services and reduce costs hospital managers should pay more attention to these items.

One of the proposals in relation to the calculation of the cost of hospital services is concerned with the development and application of a comprehensive system in hospitals which can improve the system of costing which in turn brings about more accuracy to estimating costs. Using this system, operations related to ordering, follow-ups, and control of consumables in different wards of a hospital can lead to improvement in management process. In addition, by determining the consumables in each ward during a certain period, costs can be exactly calculated and the reasons for deviations and weaknesses can be identified by juxtaposition and comparison of the obtained figures with standards. Also, by developing work standards in different wards of a hospital, efficiency and performance of human resources can be improved, unused potentials can be identified, and solutions necessary for improving the status quo can be proposed.

CONFLICT OF INTEREST

There is no conflict of interest to be declared by the authors.

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