

APPLICATION OF ACTIVITY-BASED COSTING METHOD IN THE ESTIMATE OF CATARACT SURGERY COST

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ABSTRACT

OBJECTIVE: Hospital managers need to have accurate information about actual costs to make efficient and effective decisions. Activity-based costing (ABC) is put forward as an alternative, more accurate costing method to calculate the cost of medical treatment. The objective of this paper is the application of an activity-based method to estimate the cost of cataract surgery in an ophthalmic hospital.

METHODS:

The present descriptive-analytical study was carried out at an ophthalmic hospital, in February and March of 2021, in Iran. Surgical operations for cataracts were considered. The required data were collected through conducting interviews with experts and relevant units, direct observation of activities, analysis of documents in the financial department, and the hospital information system (HIS) and financial software system of the hospital. The cost of surgical operations was estimated by activity-based costing (ABC).

RESULTS:

According to the findings, the amount and the share of the total costs of the activities identified in the main centers were as follows: human resources 54.24% of the total cost of cataract surgery which is the highest share of surgery costs; the cost of consumables was 32.57% of the total cost of cataract surgery is the second share of surgery costs.

CONCLUSIONS:

The research results showed that in this regard administrators should design and implement a comprehensive operational planning system in the hospital.

KEYWORDS

cataract, costs and cost analysis, hospitals

INTRODUCTION

Healthcare costing is challenging due to the complexity and diversity of patients and conditions. Various explanations for increasing healthcare costs include the aging population, and technological advances providing

new and more expensive treatments [1]. In the United States, growth in healthcare spending has outpaced growth in population, inflation, and the gross domestic product (GDP) [2]. In 2019, healthcare spending represented 17.7% of the GDP for a total of \$3.8 trillion, which equates to \$11,582 per person [3,4].

It is now recognized that surgical care has a central role in the management of many medical conditions [5]. Cataract, It is the most common cause of vision loss in the world. This disease reduces the individual and social function of a patient. Additionally, its surgery imposes a large cost on the patient's family and society. Also, cataract surgery is the most prevalent surgical procedure of all medical specialties with an estimated 3.7 million cases per year in the USA, 7 million in Europe, and 20 million worldwide [6]. Cataract epidemiology in Iran is not precisely defined. In a cross-sectional study in 22 districts of the city of Tehran, cataract was the most common disorder vision has been reported with a relative prevalence of 36%. The basis of another study on residents 40 years and older was done in the city of Tehran, in one-fifth of the population over 40 years cataract has been observed. The prevalence rate in women is 24.5%, and in men, about 22.1% reported that in both sexes with increasing age, its incidence has also increased, and in total about 3.5% of people because of this disease became visually impaired or blind. Cataract surgery for one million people every year is one of the indicators the World Health Organization has set the direction of controlling blindness caused by cataracts. Based on studies in Iran, this index increased significantly from 526 in the year 2000 has shown to be 1,331 in 2005. However, this index is less than the suggested limit of the organization as it is universal health [7,8]. Because of a history of patients with conditions that need surgical intervention being referred to higher-level hospitals and the perception that higher-level hospitals should provide surgery, surgical care is often viewed as expensive compared with the medical management of other diseases [9,10].

Therefore, it is necessary to calculate the cost of resources a patient consumes as they move along the care process [4]. The development of an adequate costing system is of extreme importance in hospitals. They feel the need to properly manage the resources at their disposal and control their costs to achieve management efficiently and effectively [11]. Assuming that a well-suited costing method can track the expenses involved in the intricacy of activities in organizations such as hospitals [12]. Dubron 2021, hospitals move toward an activity-based costing model for calculating of cost of health care [4,13].

The activity-based costing (ABC) system emerged in the 1980s as a costing method capable of overcoming traditional costing systems' limitations in the face of economic and technological developments [11]. Cooper

and Kaplan stated that ABC is a system designed to provide clearer information about the production, support activities, and product costs so that managers can focus their attention on products and processes with higher consumption of resources [14, 15]. ABC is a costing system in that the crucial objective is to provide management with more efficient and accurate information, both on the cost and profitability of the business processes themselves [16]. Park et al. added that ABC emerges as an innovation in management accounting to address traditional systems gaps [11,17].

Kalicanin pointed out that ABC's information is essential for hospital managers when evaluating alternative ways of managing the business and making comparisons with other hospitals [11,18]. Arora, Raju and Kaplanog added that, because the information is more detailed, facilitating decision making makes it possible to reduce costs and identify activities that do not add value to reduce or eliminate them [19-20]. Thus, the ABC costing method can improve the hospital's performance in different ways, such as helping hospitals become more efficient and effective, providing information on where resources are being spent and where the money is being earned or lost, and identifying the activities that add or do not add value to the product or service [11]. The aim of this research is to estimate the cost of cataract surgery in a super specialty ophthalmology hospital.

METHODS:

This research is a descriptive-analytical study with a retrospective, cross-sectional design. It was conducted between February and March of 2021 in a super specialty ophthalmology hospital in Tehran to calculate the total cost of cataract surgery using activity-based costing.

The main cost centers are those directly involved in providing medical services to patients. In this research, the ophthalmology operating room and the inpatient care unit are considered the main activity centers. Support centers are those that provide general services and support to care centers. These include hospital management as well as various departments such as administrative affairs, accounting, reception, insurance, discharge, admission and medical records, facilities, information technology, telecommunication/call center, services, security, catering, and warehousing/supplies.

In this research, costs, according to management needs, are identified and traced under eight categories, each with several subcategories. These categories are as follows: personnel costs (including salary, overtime, paid time off, pension, and benefits of medical and non-medical staff); the cost of medical consumables (including medicine and medical consumables); the cost of non-medical consumables (including office supplies, toiletries, spare parts); building, property and medical equipment repair and maintenance cost; overheads (including water, electricity, gas, telephone, energy, and internet); depreciation (including buildings, medical tools, and equipment, computers, furniture, telecommunication equipment, mechanical, electrical, and heating/cooling equipment); contractual service fees (including building lease, food, clothing, medical transport, waste management, financial software, and health information system); and others (including all administrative and financial costs not included in other categories[21-24]. Cost data is collected from accounting software and the health information system (HIS). All direct and indirect costs of

hospital services related to cataract surgery are included in the analysis.

In this research, cost drivers include the adjusted number of patients and staff as well as the total area of each activity center.

After direct tracing, the costs realized in each activity center (e.g., personnel costs, medical and non-medical consumable costs) are traced to the main activity and support centers. Costs that are not directly traceable (not connected to the relevant activity center) are allocated through indirect tracing. The total cost of each activity center is calculated as the sum of direct and indirect costs. The tracked costs of each of the support cost centers were distributed to the main cost centers with appropriate cost drivers based on one-way cost allocation (Table 1).

To calculate the cost of per cataract surgery, the total cost of the ophthalmology operating room and inpatient care unit is divided by the number of patients. Excel 2016 software is used to help with the organization of data and calculations.

TABLE 1: PREDETERMINED ALLOCATION BASIS

Department	Cost Allocation Basis
Hospital management	Adjusted the number of patients and staff
Accounting	Adjusted the number of patients and staff
Revenue and Discharge	Adjusted the number of patients
Reception	Adjusted the number of patients
Property	Adjusted the number of staff
Nursing Station	Adjusted the number of patients and staff
Admission and Medical Records	Adjusted the number of patients
Administrative Affairs	Adjusted the number of staff
Services	Adjusted the number of patients and staff
Warehousing	Adjusted the number of patients and staff
Security	Adjusted the number of patients and staff
Call Center	Adjusted the number of patients and staff
Facilities	Adjusted the number of patients and staff
Information Technology	Adjusted the number of patients and staff
Telecommunications	Adjusted the number of patients and staff
Catering	Adjusted the number of patients and staff

FINDINGS

The data relating to the ophthalmology operating room, the inpatient care unit, and support departments between February and March 2021 are analyzed. During this period, 8,350 patients have been referred for cataract surgery.

Using direct costing, the ophthalmology operating room and the inpatient care unit account for 57% of the total costs, while support centers account for 13%. It must be noted that the remaining 30% of the cost of the hospital is accounted for by the other operating departments.

Next, the share of each of the main units from the costs of each support center is determined according to the allocation basis. Among the support centers, the service department accounts for the highest cost (19%), and the procurement department for the lowest cost (0.8%).

Personnel cost includes the salary, overtime, paid time off, pension, and benefits of all medical and non-medical staff working in the ophthalmology operating room, the inpatient care unit, and all support departments, including specialists, general practitioners, nursing staff, surgical team, patient escorts, administrative staff, security guards, and service personnel. Personnel cost constitutes 55%, 55%, and 66% of the total costs of the ophthalmology operating room, the inpatient care unit, and the support departments, respectively. The share of the ophthalmology operating room and the inpatient care unit of the personnel cost of the support departments is 23% and 16.59%, respectively.

The medical consumable costs (medicine/medical consumables) of the ophthalmology operating room, the inpatient care unit, and all support departments constitute 38%, 22.5%, and 2.7% of their total costs, respectively. The share of the ophthalmology operating room and the inpatient care unit of the medical consumable costs of the support departments is 40% and 35%, respectively. In support departments, these costs are related to gloves, masks, and personal disinfectants used in the wake of the COVID-19 pandemic.

Non-medical consumables include office supplies, toiletries, and spare parts used in the ophthalmology operating room, the inpatient care unit, and all support departments. The non-medical consumable costs constitute 1.41%, 3%, and 0.077% of the total costs of the ophthalmology operating room, the inpatient care unit, and all support departments, respectively. The share of the ophthalmology operating room and the inpatient care unit of the non-medical consumable costs of the support departments is 26% and 19%, respectively.

Building repair and maintenance cost includes maintenance of the building, property, and medical equipment in the ophthalmology operating room, the inpatient care unit, and all support departments. Building repair and maintenance cost constitutes 0.8%, 7%, and 11% of the ophthalmology operating room, the inpatient care unit, and all support departments, respectively. The share of the ophthalmology operating room and the inpatient

care unit of the Building repair and maintenance costs of the support departments is 38% and 28%, respectively.

Overhead costs includes water, electricity, gas, telephone, energy, and internet in the ophthalmology operating room, the inpatient care unit, and all support departments. Overheads cost constitutes 0.1 %, 0.45% , and 1.19 % of the total costs of the ophthalmology operating room, the inpatient care unit, and all support departments, respectively. The share of the ophthalmology operating room and the inpatient care unit of the overhead costs of the support departments is 40% and 30%, respectively.

Depreciation cost includes buildings, medical tools and equipment, computers, furniture, telecommunication equipment, mechanical, electrical, and heating/cooling equipment in the ophthalmology operating room, the inpatient care unit, and all support departments. Depreciation cost constitutes 1.12 %, 5.6%, and 4 % of the total costs of the ophthalmology operating room, the inpatient care unit, and all support departments, respectively. The share of the ophthalmology operating room and the inpatient care unit of the depreciation cost of the support departments is 34%, and 11%, respectively.

Contractual service fees cost includes building lease, food, clothing, medical transport, waste management, financial software, and hospital information in the ophthalmology operating room, the inpatient care unit, and all support departments. Contractual service fees cost constitutes 3 %, 4 %, and 11 % of the total costs of the ophthalmology operating room, the inpatient care unit, and all support departments, respectively. The share of the ophthalmology operating room and the inpatient care unit of the contractual service fees cost of the support departments is 40 %, and 28 %, respectively.

The other costs include all administrative and financial costs not included in other categories. Other groups constitute 0.5 %, 2.42 %, and 4 % of the total costs of the ophthalmology operating room, the inpatient care unit, and all support departments, respectively. The share of the ophthalmology operating room and the inpatient care unit of the others' cost of the support departments is 49 %, and 38 %, respectively.

DISCUSSION

The results of this research showed that personnel costs constitute 58% of the total cost of each cataract surgery. A

similar study conducted at Al-Zahra Hospital in Isfahan reported that personnel costs account for 62.33% of the total cost of cataract surgery [25]. However, Sadri et al. showed that only 11.69% of the average cost of each cataract surgery at the Kensington Eye Institute is related to personnel costs [26]. In the studies conducted by, Xue et al., they stated that personnel was the highest cost category for the U.S. based sites, while consumables were the highest cost category for South Asian sites. In addition, both personnel and consumables accounted for significant cost differences between the two sites in the United States [27]. Other studies reviewed the cost of medical services have also shown that personnel costs account for the largest portion of the total cost of services, ranging from approximately 46.6 to 66 percent [28-34]. According to a report by the World Health Organization, about two-thirds of costs in the health sector are related to the health workforce, and according to international standards, wages and benefits account for about 55-65% of the total operating expenses of hospitals [35].

In this study, medical and non-medical consumables accounted for 37.27% and 0.75% of the total cost of each cataract surgery, respectively. Medical consumables are a major factor driving the cost of health care services, which can be due to the lack of proper consumption patterns, incorrect or incomplete storage, and poor use of consumables [28]. Ferdowsi found that consumables account for 23.83% of the total costs of each cataract surgery [25]. In Al-Zahra Hospital, Isfahan, consumables accounted for 23.83% of the total costs of each cataract surgery (1,992,852 rials). In Arowin et al.'s study, the cost of materials and consumables for an MRI activity was calculated to be 3.5% of the total cost using break-even analysis [36]. In the studies conducted by Xue, they said even though consumables are the most cost driver at AEH-P and TIO, HOPD and ASC still incur a much higher consumables cost compared with these sites. They said, excluding pricing differences, the use of disposable items also plays a role in elevated costs in the United States [27]. In the studies conducted by Janati to estimate the cost of eye surgeries in the Nikookari medical training center, medical equipment depreciation cost ranks third after personnel costs and indirect costs [37].

Regarding depreciation, the results showed that this cost category accounts for 1.6% of the total cost of each cataract surgery. This is calculated solely based on the studied period. Alinejad et al. found that depreciation is mainly driven by wear and tear of equipment and

installation of new equipment, and failure to properly use the equipment and physical space will increase these costs [38]. In Al-Zahra Hospital, depreciation was reported to account for 3.4% of the total cost of cataract surgery [25]. In this study, overheads accounted for 0.14% of the total cost of each cataract surgery. In a similar study by Ferdowsi, the overhead cost of each surgery was calculated to be 4.13% of the total cost [25]. In the studies conducted by Janati to estimate the cost of eye surgeries in the Nikookari medical training center, the second part of major costs belonged to indirect costs. Analyzing the components of these costs can greatly help the hospital manager in providing the required information for the budgeting activity center and the entire hospital system. A study done in Ireland showed that more than 50% of the total costs were indirect costs [37, 39].

The results of this study also showed that repairs and maintenance, contractual service fees, and other costs account for 1.69%, 3.4%, and 0.7% of the total cost of each cataract surgery, respectively. According to the results of Janati research about estimating the cost of eye surgeries in the Nikookari medical training center, the share of costs belonging to utility cost is 0.11% [37]. Khoshnoud et al. found that maintenance cost constitutes 6.88% of the total cost of each X-ray image [40]. Additionally, Zahiri et al. reported that the cost of building/equipment maintenance is 1.6% of the total cost of an oncology unit [41].

Hospital administrators are trying to make funding decisions to provide optimal service outcomes. ABC can shed light on hospital operations in different ways: Firstly, it can reveal which service lines are feasible and potentially cost-saving [42]. Hospitals may choose to invest further in these service lines and use those saved dollars to reinvest in other areas essential to their communities. Conversely, it can provide new insights into service lines that may be underperforming, and this can only be achieved appropriately through ABC. In addition, the process maps developed for ABC allow hospitals to understand their workflow, which would facilitate procedural improvements.

Secondly, adopting a standard and accurate costing methodology for hospitals can also help hospital administrators and clinicians better understand how they perform against their peers. Over time, this could help all hospitals improve healthcare delivery efficiency across several service lines [26,43].

CONCLUSION

Implementing a standardized costing approach is an excellent first step. However, to make informed policy and expenditure decisions, the costing methodology needs to be standardized and accurate. Applying ABC across hospitals and service lines would lead to a greater understanding of the cost at the service or procedure level. It would also help administrators better understand health human resource utilization as every input in the process is tracked and converted into associated costs. Accurate costing can facilitate informed policy decisions, such as allocating procedural volumes to the most cost-effective settings.

Considering that the costs of human resources, medicine, and medical equipment, make up more than 80% of the costs, the hospital management must attend to both the improvement of the effectiveness and decreasing the costs.

One of the suggestions in this regard is to design and implement a comprehensive operational planning system in the hospital. So that according to this planning, operations related to an order, follow-up, and control of consumables can be done according to different departments of the hospital, and by specifying the consumables of each department during the period, the costs are determined exactly and then by comparing it with the standards, Identified the causes of deviation. In addition, by using this system, it is possible to identify the efficiency and performance of the devices and capacities in use by creating work standards in different departments of the hospital and providing the necessary solutions to improve this situation.

However, if health system administrators would like to understand better how funds would be utilized and inform better decision-making, ABC could be beneficial.

LIMITATION:

The main problem in calculating the cost of health care services is the lack of required information. Currently, few costs remain unaccounted for due to the weaknesses of hospital information systems, which can significantly affect management decisions. Training hospital management on how to use the information related to the cost of services can play a vital role in controlling costs and increasing revenue while providing the basis for better decisions.

CONFLICT OF INTEREST:

The authors had no conflict of interest in the various stages of this research.

ETHICAL CONSIDERATIONS

This study was not conducted on human research subjects or human participants. Data were employed from hospitals' databases based on our data requirements template, which was without personally identifiable information.

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AUTHORS' CONTRIBUTIONS:

Azadeh Chatrouz, Sareh Daneshgar, and Azam Lari contributed to the design, concepts, and definition of intellectual content. Azadeh Chatrouz, Sareh Daneshgar, and Azam Lari collected, compiled, and interpreted the data. Sareh Daneshgar did the statistical analysis. Azam Lari prepared the manuscript and all the authors read it before approving the manuscript.

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References:

1. Allin O, Urman R, Edwards A, Blitz J, Pfeifer K, Feeley T, Bader A. Using Time-Driven Activity-Based Costing to Demonstrate Value in Perioperative Care: Recommendations and Review from the Society for Perioperative Assessment and Quality Improvement (SPAQI). *Journal of Medical Systems*. 2020; 44: 25. <https://doi.org/10.1007/s10916-019-1503-2>
2. OECD. Organization for economic co-operation and development. *Stat Heal Status*. 2017.
3. CMS. Centers for Medicare & Medicaid Services. National health expenditures 2019 highlights. <https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/National-Health-Expend-Data/NHE-Fact-Sheet>
4. Fang C, Mazzocco J, Sun D, Shaker J, Talmo C, Mattingly D, Smith E. Total Knee Arthroplasty Hospital Costs by Time-Driven Activity-Based Costing: Robotic vs Conventional. *Arthroplasty Today*. 2022; 13: 43-47.
5. Ruhumuriza J, Odhiambo J, Riviello R, Lin Y, Nkurunziza T, Shime M, Maine R, Omondi J, Mpirimbanyi C, Paix Sebakarane J, Hagugimana P, Rusangwa C, Hedt-Gauthier B. Assessing the cost of laparotomy at a rural

- district hospital in Rwanda using time-driven activity-based costing. *BJS Open*. 2018; 2: 25–33.
6. Rossi T, Romano MR, Iannetta D, et al. Cataract surgery practice patterns worldwide: a survey. *BMJ Open Ophthalmology*. 2021; 6. Doi: 10.1136/bmjophth-2020-000464
 7. Ashrafi E, Alipor F. Distribution of cataract and its causes. *Ophthalmic nurse*. 2012 Jan;1(3):7-8.
 8. Fekri Y, Ojaghi H, Sharghi A, Ranjbar A, Zahirian Moghadam T. A study of Morphology of Cataract in Surgery Candidates in Ardabil: Iran. *Journal of Ardabil University of Medical Sciences* 2020, 20(1): 127-1233.
 9. Chao TE, Sharma K, Mandigo M, Hagander L, Resch SC, Weiser TG et al. Cost-effectiveness of surgery and its policy implications for global health: a systematic review and analysis. *Lancet Glob Health*. 2014; 2: e334–e345.
 10. Lofgren J, Kadobera D, Forsberg BC, Mulwooza J, Wladis A, Nordin P. District-level surgery in Uganda: indications, interventions and perioperative mortality. *Surgery*. 2015; 158: 7–16.
 11. Quesado, P.; Silva, R. Activity-Based Costing (ABC) and Its Implication for Open Innovation. *J. Open Innovation Technology, Market and Complexity*. 2021; 7: 41. <https://doi.org/10.3390/joitmc7010041>
 12. Porter ME, Lee TH. The Strategy That Will Fix Health Care. *Harvard Business Rev*. 2013; 91(10):50–70.
 13. Dubron K, Verschaeve M, Roodhooft F. A time-driven activity-based costing approach for identifying variability in costs of childbirth between and within types of delivery. *BMC Pregnancy Childbirth*. 2021; 21:705.
 14. Cooper, R. Implementing an activity-based cost system. *J. Cost Manag*. 1990; 4: 33–42.
 15. Kapan, R. One Cost System isn't enough. *Harv. Bus. Rev*. 1988; 1: 61–66.
 16. Argyris, C.; Kaplan, R. Implementing New Knowledge: The Case of Activity-Based Costing. *Account. Horiz*. 1994; 8: 83–105.
 17. Park, Y.; Jung, S.; Yousef, J. Time-Driven Activity-Based Costing Systems for Marketing Decisions. *Stud. Bus. Econ*. 2019; 14: 191–207.
 18. Kalicanin, D. Activity-Based Costing as an information basis for an efficient Strategic Management Process. *Econ. Ann*. 2013; 58: 95–119.
 19. Arora, A.; Raju, M. A Comparative Analysis of Perceived and Actual Benefits from Implementation of Activity Based Costing in Selected Manufacturing Units in India. *Rev. Prof. Manag*. 2018; 16: 55–61.
 20. Kaplanog, V. Application of activity-based costing to a land transportation company: A case study. *Int. J. Prod. Econ*. 2008; 116: 308–324.
 21. Sanaie Mohamadi M.H, Satari B, Hasanzadeh V, Emad Alsharieh M. Management and cost reduction, focusing on the natural classification of costs Entrepreneurial businesses with a value creation approach. *Shabak* 2015; 3(10): 89-98.
 22. Zafarzadeh S, Mollanazari, Khadivar A. University Cost Management by Integrating Activity-Based Costing and System Dynamics Approach. *Journal of Accounting Knowledge* 2022; 13(1):1-30.
 23. Zarei E, Gholamhosseini A, Ghandi N. Estimation of direct and indirect costs of one-year treatment for psoriasis outpatients in Iran: a study in Razi Hospital in 2017-2018. *Jdc* 2021; 12(3): 164-179.
 24. Farzad M, Raeispour Rajabali A. Calculation of Diabetic Patients' Prime Cost of Dialysis Using ActivityBased Costing Method in Rare Diseases Center of Zabol, Iran. *Journal of Diabetes Nursing* 2020; 8(1): 1045-1056.
 25. Ferdosi M, Ghozeood A, Nematy A, Sha'bani N, Hosseinzadeh E. Computing Cost Price for Cataract Surgery by Activity Based Costing (ABC) Method at Hazrat - E -Zahra Hospital, Isfahan University of Medical Sciences, 2014. *Manage Strat Health Syst*. 2016; 1(1): 29 -34.
 26. Sadri H, Vanderhyden J, Sinigallia S, Souche B, Shan M. Time-Driven Activity-Based Costing for Cataract Surgery in Canada: The Case of the Kensington Eye Institute. *Healthcare Policy*. 2021; 16(4): 97-108.
 27. Xue J, Hinkle J, Reeves M, Zheng L, Natarajan V, Vyas Sh, Upreti Oli R, Oliva M, Kaplan R, Milstein A, Tabin G, Goldberg J, Schulman K. A Cost Comparison of Cataract Surgeries in Three Countries — United States, India, and Nepal. *NEJM Catalyst*. 2021; 2(9).
 28. Alinejad H, Rezaeian M, Pakzad H, Sayadian S, Askari M, Alinejad M. Computing Cost Price of Health Care Services of Patients with Covid-19 Disease in Ali Ibn Abi Taleb Hospital of Rafsanjan in 2020 through Activity-Based Costing (ABC): A Descriptive Study. *JRUMS*. 2021; 20 (4):451-468. URL: <http://journal.rums.ac.ir/article-1-5825-fa.html>
 29. Beyranvand R, Ebadi Fard Azar F, Emamgholipour S, Arab M. Unit -Cost Calculation of Delivered Services Based on Activity Based Costing (ABC) Method Compared with Approved Tariffs in Physiotherapy Department of Sina Hospital Affiliated to Tehran University of Medical Sciences in 2013 -2014. *Journal of Hospital*. 2016; 15(2): 58.

30. Alamshah SA. Calculating the cost of services of laboratory in alami herandi clinic of Isfahan Social Security Organization using time-driven activity-based costing and comparing it with the approved tariffs in 2015. *Journal of Health Accounting*. 2017; 6(1): 88.
31. Mobasheri M HS, Rafiee A. Calculation of the Final Cost of the Services Offered in Crusher Unit of Ayatollah Kashani Hospital of Shahrekord Using Activity-based Costing Technique. *Special Issue of Health and Technology Management*. 2016; 8(1): 205.
32. Bahador F, Mahmoudi G, Jahani M. Determining the price of services the cardiac care unite ward by activity-based costing. *Journal of North Khorasan University of Medical Sciences*. 2017; 8(4).
33. Markazi Moghaddam N, Goudarzi R, Meshkani Z. Surveying activity based costing of final units (a case study in one of the armed forces hospitals). *Journal of Hospital*. 2016; 15(1): 41.
34. Sedaghatjoo F, Ardekani SS, Moradi M. Determining the cost of services in the ICU ward of Yazd's Shohadaye Kargar social security hospital in 2011. *Advances in Environmental Biology*. 2013; 33(6): 246.
35. Hidayah N, Dewi A, Listiowati E. Remuneration as a strategy to improve service quality, cost-effectiveness, and organizational Performance of Private Hospitals. *Enfermería Clínica*. 2020; 11(2): 269.
36. Arowin R, Asghari S, Khalesi N, Reissi Dehkordi P. Estimated cost of MRI and costing based on ABC activity at Imam Ali Hospital in Bojnourd in 2016. *Journal of North Khorasan University of Medical Sciences*. 2019; 11(1): 10.
37. Janati A, Farough Khosravi M, Imani A, Javadzadeh A.R, Mazhar Gharamaleki M. Cost Analysis of Eye Surgeries and Comparison with Approved Governmental Tariffs. *HealthScope*. 2017; 6(2): e39948. doi: 10.5812/jhealthscope.39948.
38. Take K, Tedeschi RG, Shakespeare -Finch J, Krosch D, David G, Kehl D, et al. Posttraumatic growth (PTG) and posttraumatic depreciation (PTD) across ten countries: Global validation of the PTG-PTD theoretical model. *Personality and Individual Differences*. 2020; 5(1): 46.
39. Doyle G, Duffy L, McCahey M. An empirical study of adoption/nonadoption of activity based costing in hospitals in Ireland. Canada: Administration Sciences Association of Canada, Dalhousie University. 2008.
40. Khoshnoud Khankahdani H, Parandin k. Comparative Cost-sharing Approaches in Calculating the Cost of Services by Using Activity Based Costing (ABC) Method in Radiology Department of Shiraz Ordibehesht Hospital. *Governmental Accounting*. 2015; 3(2): 83-92.
41. Zaheri M.A, Amini P, Meshkani Z. Comparing the total price of the services provided by the oncology department to costing methods Traditional and activity-based costing (case study: Tawheed Hospital, Kurdistan Province). *Journal of health accounting*. 2018; 7(2):67-81.
42. Henrikus, W.P., P.M. Waters, D.S. Bae, S.S. Virk and A.S. Shah. Inside the Value Revolution at Children's Hospital Boston: Time-Driven Activity-Based Costing in Orthopaedic Surgery. *The Harvard Orthopaedic Journal*. 2012; 14: 50-57.
43. Kruse, F.M., S. Groenewoud, F. Atsma, O.P. van der Galiën, E.M.M. Adang and P.P.T. Jeurissen. Do Independent Treatment Centers Offer More Value Than General Hospitals? The Case of Cataract Care. *Health Services Research*. 2019; 54(6): 1357-65. doi:10.1111/1475-6773.13201.