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A New Costing System in Hospital Management: Time-Driven Activity Based Costing: A Narrative Review

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ABSTRACT

Background: Changes in the hospital environment, technology, and service delivery as well as the increased share of overhead costs have motivated hospital managers to look for useful means of calculating costs. A key element of the health system success is the accurate computation of costs. Determining the exact costs enables managers and policymakers to make proper decisions with regard to optimal allocation of resources. This study explores the results of the activity-based costing model (ABC) and time-driven activity-based costing model (TDABC) in calculating the cost of diagnostic departments in hospitals.

Methods: This was a narrative literature review paper. The data was gathered from the earliest documented scientific English and Persian articles, up to 2016, as well as relevant books based on keywords such as Activity Based Costing, Time-Driven Activity Based Costing and hospitals. Finally, a total of 543 studies were obtained after searching, then, to collect the relevant articles, the researchers considered a clear explanation of each part of articles about costing.

Results: The results showed that the ABC system was unable to account for new issues, which is the reason researchers presented the new TDABC method. Some advantages of this system are its simple and updatable system, its usability in large and small companies for both simple and complex processes, economic evaluation of activities and performance assessment.

Conclusion: The successful implementation of the TDABC model would provide an accurate cost report for goods and services, helping managers to evaluate the performance of diagnostic departments.

Keywords: Activity Based Costing, Costs, Hospital, Time-Driven Activity Based Costing

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Introduction

Timely access to accurate and appropriate cost data is one of the key challenges of health care organizations. Cost information are the base for pricing decisions and developing financial strategies (1).

In Iran, 6.7 percent of Gross Domestic Products (GDP) belongs to health sector (2) and hospitals as the largest and most expensive healthcare units are of paramount importance. Hospitals account for about 50-80 percent of total expenditures in the healthcare system (3). Nowadays, advanced technologies are increasingly growing and complexity and variety of these technologies are also increasing. Therefore, understanding changes and measuring them have an important impact on organizational costs and these variety and complexity in service organizations, such as hospitals, are more than producing organizations (4).

During the past years the cost of hospital services has increased significantly in most of the countries and has attracted the attentions to hospital costs (5). It requires an appropriate and efficient system that enable hospitals to identify variety and complexity of activities and measuring their impact on costs of service provision (4). Therefore, the need to have an appropriate costing system that can allocate costs to products and services will more precisely increase (6).

From the perspective of the health economics, determining the cost price has an important role in achieving a clear understanding of costs trends, developing operational budget, and efficient use of resources. Costing and cost analysis as a managerial tool could be helpful in investing decisions about activities and infrastructures (7).

Traditional costing systems, particularly those that are using in Iran hospitals, due to their nature, are not able to meet expectations cost of services based on fixed tariffs levied without considering the conditions. Also, because they are doing the calculations based on a series of fixed tariffs, regardless of the hospital's status, it is obvious that the current costing systems cannot provide appropriate information for decision-makers (8).

Costing methods have enjoyed significant progress during the recent years, Activity Based Costing (ABC) is one of the most recent ones (9). Theoretically, it is straightforward, understandable for users, but practically it is complex and costly. If an organization has decided to use the ABC method, information on all resources, activities and their motivator must be identified and documented, in some cases these may be more than 100 units. Thus, despite its advantages in providing more accurate information on expire cost, it is not widely accepted (10).

In order to address the disadvantages of the ABC, Time-Driven Activity Based Costing (TDABC) system was introduced by Caplan and Anderson (YEAR). The main goal of the TDABC is to help strategic decision-making and reducing the time of producing services and goods (11). Because of its simplicity, fast implementation, easy to update, and identifying unnecessary activities in cost calculations, it has attracted the attention of researchers. The TDABC can also be helpful for managers in resource planning (12). Therefore, in the current study researchers are intended to explain the new TDABC and its applications in costing diagnostic wards of hospitals and to compare it with traditional costing systems.

Materials and Methods

This study was based on the study of cost-based research on time-based activities in Iran and other countries.

Using a comprehensive research strategy, it was tried to minimize the probable articles associated with the term "time-based cost" from the earliest documented scientific articles in the field of costing, both traditional and new, up to 2016 collected from valid databases. To research for bases, the key words related to

costing system include: hospital, cost, activity-based costing, time driven-based costing, accounting, cost effectiveness, cost analysis, traditional costing, cost allocation and the equivalents of these words in Persian and English were used to research in databases.

Databases based on their relationship with health care were:

Embase, MEDLINE, Pubmed, CINHAL, Scopus, OvidSP, Web of science, Science direct, SID, Google scholar, Cochrane database, WHO website, Magiran, Barakat knowledge network system, Irandoc.

Studies were selected regarding at least one of the following: regardless of the type of study, it was about costing and one of its methods; or studies that have the necessary information (abstract or full text); and studies that compared methods and methods of modern aboard; the following criteria were also used to evaluate the quality of studies for inclusion in the study:

- Having a clear explanation of the goals of the study (such as: research question, main goals and special research goals)
- Having a clear explanation of the study methodology (such as: review of studies, methodology, assumptions used)
- Having a clear explanation of the costing methodology (such as: perspective, resource measurement, valuation, inclusion of uncertainty)
- Having a clear explanation of the data source
- Having a clear explanation and details of the results.

Three screening steps were performed for identified studies. In the first step, the word "Activity-Based Costing" was searched and titles and abstracts were displayed. This research comprehensively included all studies that included activity-based costing and they explicitly referred to it as a key issue, and any study that was not abstracted around the activity-based focus was excluded from the studies.

In the second phase, the studies which were not related to health care were excluded, including studies in the fields of accounting and engineering, etc., or just in summary, the letter of the articles and their interpretations were available and also articles in languages except Persian and English were excluded from the study.

In the third phase, the full text of the remaining articles was read and the studies that explicitly did not address the subject of Time Driven cost-based were deleted.

A total of 543 studies were obtained after the research, and after the removal of repetitive articles, 321 cases remained; 194 of which were excluded due to the lack of reference to the TDABC in the title or in the abstract. After reviewing 127 remaining articles, 98 of them were omitted due to their failure to perform in health care centers and lack of criteria for entry into this phase of the study, and 29 articles were remained for review. Next, 11 papers were deleted because they did not test the empirical application of TDABC. Finally, 18 studies were reviewed (Diagram 1).

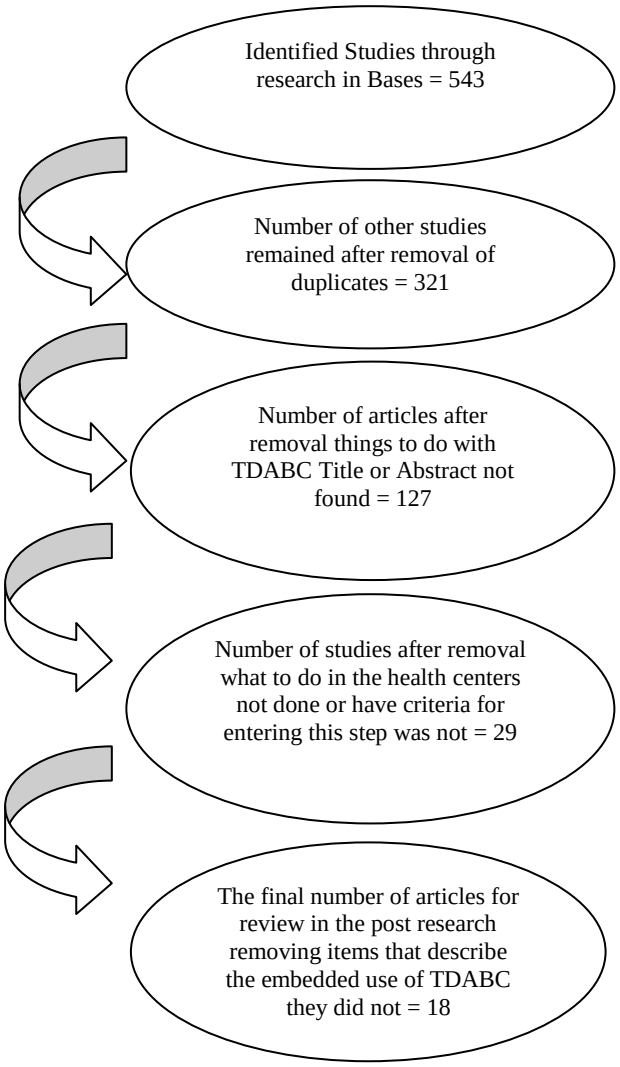

Diagram 1. Number of the studies that was were checked out.

Results

Foster (1991) conducted a research to investigate the traditional costing systems and how they operate. In this regard the financial managers of some US-large companies were interviewed. The results showed that traditional costing systems were not able to provide adequate information for managers; therefore, 51% of managers believed that traditional systems did not provide adequate information on costing and pricing of products, 45% believed that the information were not precise and real and were not suitable for decision-making, 34% noted that because traditional costing systems were not able to evaluate staff performance, create dissatisfaction among them, 27% believed that provided information were not adequate and appropriate to analyze competition, and 11% believed that these systems were not compatible with organization strategies (13). Therefore, researchers started to develop a new efficient system for new needs of managers (14); which led into a new system, called Activity Based Costing or ABC (15). The ABC is intended to answer the following questions:

1.What activities do consumed organization resources have?

2.How much does it cost to do organization activities and process?

3.Why does the organization need to do activities and process?

4.What level of activities is needed to produce products and provide services? (16)

Disadvantages of the ABC model:

In the early years of the ABC introduction, it was recognized as a useful costing system for firms and organizations; however, because of technological advances, changing the working environment, changing the type of costs (overhead costs reduced and labor costs increasingly increased) lost its efficiency (17). The challenges that the ABC system was facing were as follow:

1.To attribute costs of resources to activities, activities and resource motivators must be identified. Thus, it increases costs and is time consuming.

2.Because the researcher's ideas and preferences are important factors in evaluating the time spent for activities, accrediting the costs allocated to activities is difficult.

3.Analyzing details of accounts and data collection process is time consuming and costly.

4.Updating the system after changes is difficult, that reduces the explanation power of the model.

5.Unused capacity of activities are ignored (10,17).

The Appearance of the TD-ABC model:

To address the above mentioned problems, Kaplan and Anderson developed the TDABC. It estimates the system costs using 2 factors: (1) Capacity Cost Rate; and (2) Time (17).

The TDABC omitted the resource cost of activities and included the time equations in order to reduce motivators and complexity of operations. This time equations, shows the required time to operate the procedures. Therefore, the main focus of the TDABC is on process, not on activities, which simplifies the costing system (10).

Advantages and disadvantages of the TDABC are briefly mentioned in Table 1 (14, 18).

If required time for performing activities could not be scheduled appropriately or if activities do not perform in a harmonized pattern, the TDABC will not be useful. This is the main point that led into introduction of the TDABC for diagnostic departments (19).

TD-ABC Implementation Steps:

TDABC implementation process can be divided into 7 steps, as shown in table 2 (20).

Table 1. Advantages and disadvantages of the TDABC

Disadvantages	Advantages
1. Because the information required for the TDABC are collected from two different sources, management and staff, provided information are less trustable than the ABC. 2. Some ethical issues may not be considered in the TDABC that may result in some derivations from reality, since there is a possibility that staff report the required time inappropriately and the management of collected information could be subjective.	1. Precise models could be created easier and faster. 2. The system could integrate with enterprise resource planning and customer relationship management, and more dynamism. 3. Easier update with regard to orders, process and customers. 4. Ability to objectify efficiency and used capacities. 5. Through forecasting demand for resources provides the ability for budgeting based on resources and capacities. 6. Provides the ability for easier and cheaper maintenance. 7. It can be applied to all industries and corporations with different complexities in customers, process, and products. 8. In traditional systems, identified costs are divided on all users, but in the TDABC, the identified costs are divided based on the duration of using and the cost of unused capacities will not be divided automatically; however, these costs report clearly and are prepared for managerial purposes; 9. Costs are highly transparent and explainable for managers. It's an appropriate cost model that can show the required amount of efforts for each product or customer, as it's a simple method for managers.

Table 2. The TDABC implementation steps

Steps	Topic	Description
Step one	Identifying resources groups and services process and subgroups	Resource groups show departments and parts of the organization that generally have different functions.
Step two	Estimating the expire cost of resources which are using by resource groups and departments.	In this step it is necessary to identify resources pooling, related costs and operational costs. Based on Caplan and Anderson (1999) resources pooling could be divided into two parts, direct and indirect. Operational capacity shows the real available time.
Step three	Calculating the cost rate of producing resources that are using.	Cost rate is equal to total cost of resources divided by operational capacity
Step four	Equal time development	Required time for performing activities must be determined. In most of the industries, the required time to perform an activity is closely linked to quality and efficiency.
Step five	Estimating the demand for resources, based on the costs issues	Demand for resources is conditioned on outputs. in order to improve implementation, shorter time periods can be used to investigate demand for resources
Step six	Calculating the total cost	The total calculates in this step. It is equal to estimated time of activity × operational production cost rate
Step seven	Concepts and managerial applications	Reviewing and analyzing results by managerial views

Example

The following example provided a detailed explanation of the TDABC (11):

There are 6 tests essential in hospital for each patient who had opened and closed gallbladder surgeries. At the same time each of the surgery need 5 tests, in addition, 105 patients without surgical operations need approximately 140 tests. Therefore, in 4 groups of patient in the general surgery department totally 228 tests per month were required (by the way, the cost of laboratory tests is 1368/7 $ in a month). In this respect, the laboratory staff needed about 2498 minutes to perform these tests; each of laboratory staff work 2496 hours or 149760 minutes in the hospital each year, they spent 22464 minutes (15% of their time) to rest and training, and 127296 minutes per year which is equivalent to 10608 minutes per month, remains. There are 5 personnel in the laboratory and they do the same services in an equal level for other departments of hospital. Therefore, the operating capacity of laboratory personnel for each unit is calculated as follows:

Practical capacity of the laboratory personnel = 5 laboratory personnel / 20 departments × 10608 min = 2652 min per month

Thus, laboratory personnel spend 2652 minutes as the practical capacity for the activity of laboratory test. In addition, the capacity cost rate should be computed as follows:

Capacity cost rate = $1368.7 / 2652 min = $0.516 / min

The calculations show that only about 94.19% (2498 min / 2652 min = 0.9419) of the practical capacity was used by the laboratory staff for productive and useful work and 154 minutes (2652 _ 2498 = 154 minutes) is found as the unused capacity in the hospital. In addition, $79.5 (0.516 / min ×154 minutes) is obtained as the cost of unused capacity.

The reports from TD-ABC show that estimating and elapsing time of each activity, cost, cost price services and resources must manage request and demand of activities. It also refers to the different

between supply capacity and used capacity. Administrators will be also able to review the cost of unused capacity and do something to reduce the supply of resources and related costs.

The exact cost estimation is necessary for intervention for economic assessment. In this study, a complete map of Time-Driven Activity-Based Costing was presented as an appropriate tool to allocate costs in costing issues. The TDABC model, compared to the traditional models, is using stimulants time to allocate cost to activities, and by placing the stimulants in the time equation, consider all differences in certain activities.

Choosing each of methods of costing such as Activity Based Costing or Time-Driven Activity Based Costing is depending on large structures like: the situation of information and financial systems in the organization, organizational structure, the accuracy required in determining the cost of the products. The accuracy of information is in addition to simply of running costing systems and can have many benefits for managers. The results show that the TD-ABC model do not need to identify all resources, activities and drivers, and it detoxifies the complexity, costly in implementation and the problems of updating of the activity based costing model. In addition, in order to integrity of the TD-ABC, this model must be used in the departments that do their activities in a same period of times, and according to this, time-driven activity based costing was explained just for diagnostic sections (NOT clinical sections) in hospitals.

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Conflicts of interest

The author has no conflict interest.

Authors' contributions

Etemadi S, Mohammadi B, and Akbarian Bafghi M.j designed research; Etemadi S and Hedayati poor M conducted research; Tasavon Gholamhosseini M analyzed data; and Etemadi S, Akbarian Bafghi M.j wrote the paper. Akbarian Bafghi M.j had primary responsibility for final content. All authors read and approved the final manuscript.

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