Research Paper

Volume : 5 | Issue : 7 | July 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

Estimating the actual costs of healthcare; the Time Driven Activity Based Costing method.

Economics

KEYWORDS: Time Driven Activity Based Costing, Time Equations, Profitability, Healthcare

Antonios Morfonios, Ph.D.

Founder of the Hellenic Institute of Health Economics, Stratigou Triggeta 2, Kallithea, Athens, Greece http://www.hihec.gr/ Contact: amorfonios@hihec.gr

ABSTRACT

The aging population, the rapid evolution of health technology, the prevalence of chronic diseases, the changes in demand and supply of care pose significant challenges to the healthcare systems. Professors Kaplan and Porter claimed they had the solution to the cost crisis in healthcare by introducing a new method that accurately measures costs and compare them with outcomes, the Time Driven Activity Based Costing (TDABC) methodology. The objective of this paper was to describe in details this new method at its application in healthcare. TDABC achieves its simplicity by building time equations based on observable processes. Only two parameters need to be estimated: the capacity cost rate and the capacity usage by each process. TDABC is a Simple-Multiperspective-Accurate-Realistic-Time-based (SMART) costing tool that may solve the cost crisis in healthcare.

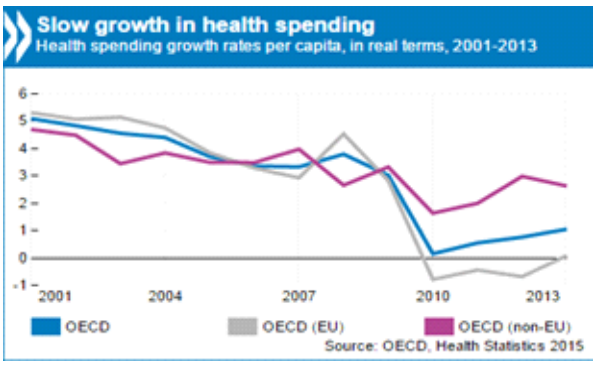
1. Introduction

1.1 Background

Under the view of the global financial and economic crisis, healthcare systems face the challenge to deliver high quality of care, better outcomes with limited resources. The aging population, the rapid evolution of health technology, the prevalence of chronic diseases, the changes in demand and supply of care are determinants with high impact on Health expenditure growth across all countries.

Per capita health spending was estimated to have increased by 1.0% in real terms across OECD countries in 2013, up from 0.7% in 2012 and near-zero growth in 2010 (Figure 1). Growth rates in 2013 remained well below pre-crisis levels: between 2000 and 2009 average growth in health spending reached 3.8%.With increases in health spending in line with overall economic growth, health expenditure as a share of GDP has remained stable in recent years. In 2013, health spending (excluding investment) as a share of GDP was 8.9%, ranging from 5.1% in Turkey to 16.4% in the United States. [1]

Figure 1. Average annual growth in per capita health spending, in real terms, 2001-2014



Determining with accuracy the healthcare costs is still difficult and there is no agreed costing methodology internationally. A major part of the problem is that healthcare organizations do not measure cost properly as they add costs around the departments and not around the patient. Efforts in the past at cost reductions on healthcare have been completely ineffective as they allocated costs improperly so the problem remains unsolved. **World Health Organization (WHO) states that "countries cannot manage what they** cannot measure". So how do we measure accurately healthcare cos**ts? Can we manage effectively health care costs without sacrificing health outcomes?**

Professors Kaplan and Porter (2011) from Harvard Business School claimed they had the solution to the cost crisis in healthcare by introducing a new way to accurately measure costs and compare them with outcomes, **the Time Driven Activity Based Costing (TDABC) methodology. TDABC** is the evolution of the conventional Activity Based Costing (ABC) and achieves its simplicity by building time equations based on observable processes, using existing databases and systems, and avoiding the costly step, required by conventional ABC, of interviewing and surveying employees about their time distributions. **TDABC uses time equations** that directly and automatically assign resource costs to the activities performed and transactions processed. The framework of the cost analysis is simple. It will focus on the patient as the fundamental unit of the analysis as the patient is triggering the demand for all these medical resources. Only two parameters need to be estimated: the capacity cost rate and the capacity usage by each process. [2]

1.2 Objective

The objective of this paper was to describe in details the principles of the TDABC methodology at its application in healthcare.

2. The TDABC model

Activity Based Costing was originally introduced in 1980's in order to accurately measure the costs of individual patients. Using the ABC method all events or transactions that create costs are recognized as activities and a specific cost driver, which is an index for allocating indirect costs appropriately to the cost object corresponds to each activity. Despite its attractive proposition this method encountered many problems: the interviewing and surveying process was time consuming and costly, the data for the ABC model were subjective and difficult to validate, the data were expensive to store, process and report, the ABC model could not be easily updated to accommodate changing circumstances. In this regard, **TDABC, a new costing approach** was introduced by Kaplan and Anderson (2004) to overcome these problems and to create a new accurately costing methodology. [3]

TDABC simplifies the costing process by eliminating the need to interview and survey employees for allocating resource costs to activities before driving them to cost objects. The new model **assigns resource costs directly to the cost objects** using an elegant framework requiring only two sets of estimates: first: it calculates the cost of supplying resource capacity and second: it uses the capacity cost rate to drive departmental resource costs to cost objects by estimating the demand for resource capacity that each cost object requires. **TDABC uses time as its primary cost driver** since most resources, such as personnel and equipment, have capacities that can be readily measured by the amount of time they are available to perform work. **The time equations** in a **TDABC** model provide managers with a capability for simulating the future. The equations capture the principal factors that create demands for process capacity including changes in process efficiencies. TDABC can be implemented from various perspectives such as patient's

perspective, payor's or provider's. Managers can use their TDABC model to perform dynamic what-if analysis of various scenarios and also can obtain accurate cost and profitability information to set priorities for process improvements. [4] In general, we can state that **TDABC *is a Simple-Multi-Perspective-Accurate-Realistic-Time-based (SMART)*** costing tool. (Table 1.)

SIMPLE: only two parameters need to be estimated; capacity cost rate and the quantity of time (capacity) the patient uses of each resource at each process
MULTIPERSPECTIVE: It can be implemented from different perspectives; patients's, provider's, payor's etc.
ACCURATE: cost estimation driven by time per process
REALISTIC: action study based on observation
TIME-BASED: building time equations through observable processes

Table 1. The SMART TDABC costing tool

3. Method

To estimate the total costs of treating patient population's, Kaplan and Porter (2011) suggest **seven basic steps** which are described in details in the literature and are shown below (Image 1): **[2]**

1. Select the medical condition→ **2.** Define the care delivery value chain→ **3.** Develop process maps of each activity in patient care delivery→ **4.** Obtain time estimates for each process→ **5.** Estimate the cost of supplying patient care resources→ **6.** Estimate the capacity of each resource, and calculate the capacity cost rate→ **7.** Calculate the total cost of patient care.

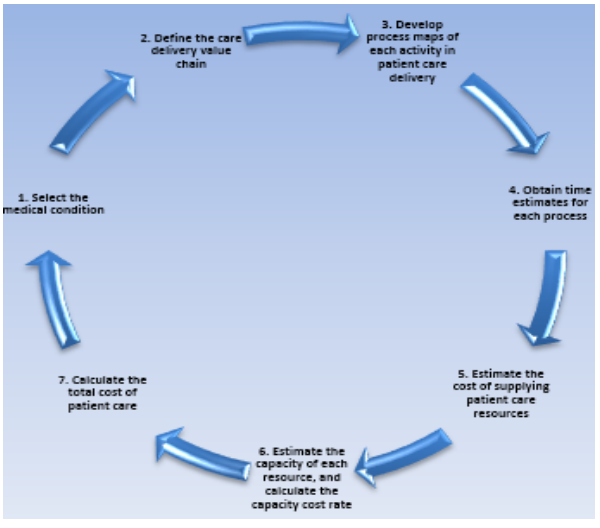


Image1: The cycle of cost measurement process in TDABC

To estimate the total cost of the complete cycle of care only two parameters need to be calculated: the capacity cost rate and the quantity of time (capacity) the patient uses of each resource at each process. Both parameters can be estimated easily and objectively.

The capacity cost rate for each resource-that is how much it costs per minute, for a resource to be available for patient related work - will use the following equation: [4]

$$Capacity\ cost\ rate = \frac{cost\ of\ capacity\ supplied}{practical\ capacity\ of\ resources}$$

The numerator in the capacity cost rate calculation aggregates all the costs associated with the pilot healthcare organization including the compensation of frontline employees and their supervisors, occupancy, technology and other equipments costs, and the costs of corporate staff functions that support the work performed in the departments. The cost of frontline employees and supervisors will be defined as the total amount of salaries and fully accrued fringe benefits such as payroll taxes, medical insurance and pension benefits. The technology and equipment cost will be defined as the cost of equipment, including computing and telecommunication resources used by employees and their supervisors. Occupancy cost will be defined as the cost of supplying space for employees and their equipment and supervisors. Other indirect and support resources will be defined as the assigned expenses from company support departments such as human resources, finance and information technology. [4]

The denominator in the capacity cost rate calculation represents the practical capacity of the resources that perform work in the departments. If the pilot healthcare organization is consisted of departments whose output is paced both by employees and equipment, when the output is paced by the work of employees the practical capacity will be measured by the quantity of minutes that employees are available to perform actual work. In addition, when the pace of work is determined by equipment capacity, practical capacity will be measured by the quantity of machine time available for work after subtracting downtime for, say, maintenance and repair.[4]

Determining the practical capacity for employees-the denom-inator in the capacity cost rate equation-requires three time estimates, which are gathered from HR records and other sources and uses the following equation: [2]

$$Monthly\ Practical\ Capacity\ of\ Resource = \frac{a}{12} \times (b - c)$$

Where:

a is the total number of days that each employee actually works each year

b is the total number of hours per day that the employee is available for work.

c is the average number of hours per workday used for non patient-related work, such as breaks, training, education, and adm-inistrative meetings.

After calculating the capacity cost rate, all processes will be mapped in the healthcare delivery chain and will be categorized as value-added or non value-added. Process maps include all the capacity supplying resources (personnel, equipment, facilities) that are involved at each process both those directly used by the patient and those required to make the primary resources available. Next, time equations will be developed in order to measure the quantity of time the patient uses of each resource at each process in his full cycle of care. All measurements will be obtained by 2 methods: direct observation using a stopwatch and interviewing or surveying employees.[4]

The time estimation will be expressed by a simple algebraic equation as below: [2]

$$Process\ time = (to + t_1q_1 + t_2q_2 + t_3q_3 \ldots + t_iq_i)$$

Where:

t_o is the standard time for performing the basic activity measured in minutes

t_i is the estimated time for the incremental activity I

q_i is the quantity of incremental activity

Next, **Unused Capacity (U_c)** will be estimated. Unused Capacity will be defined as the amount of capacity that is available in the primary activity of healthcare by subtracting the **Activity Usage(A_U)**

Volume : 5 | Issue : 7 | July 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

from the Activity Availability (A_A) [5] It will be stated by the following equation:

$$U_c = A_U - A_A$$

Thus, we will provide the relationship between the costs of the resources used and the costs of resources supplied in an effort to increase efficiency in the pilot healthcare organization.

After bringing cost and time data together in the TDABC software, tests will be performed in order to establish the validity of the data and we will explore the reasons of any anomalous and unexpected results. Validation will be established financially and operationally. For the financial validation, we will sum both the costs assigned to the objects and the cost of unused capacity and must equal the general-ledger expenses. For the operational validation, we will check the accuracy of the time equation estimates by comparing the model and the actual times, process by process and we will investigate those that indicate large amounts of unused or overused capacity. [4]

To estimate the Profitability (Pf) of the pilot healthcare organization we will divide the total revenues per total costs. The ratio will be expressed by the following equation: [6]

$$Pf = \frac{Revenues}{Costs}$$

4. Literature review

Lorena Siguenza-Guzman et. al. (2014) reviewing **36** empirical researches on TDABC from 2004-2012, found that **31% (total 9) of the published case** studies on TDABC **were case studies investigated in the healthcare sector**. [7]

Demeere et al. (2009) performed a TDABC analysis on five outpatient clinic's departments in Belgium (Gastroenterology, Plastic Surgery, Urology,Nose-Throat and Ears and Dermatology). They concluded that TDABC analysis allowed managerial recommendations concerning improvement opportunities in organizational processes and supported strategic changes that increase the value and the effectiveness of the current and future outpatient clinic. [8]

In 2010, the Institute for Cancer Care Innovation (ICCI) began measuring the true cost of cancer care delivery by following the patient treatment cycle from initial referral to survivorship or supportive care. In order to more accurately and transparently capture costs, the ICCI piloted the use of the TDABC methodology. Albright et. al.(2013) reported that TDABC provided a more accurate and transparent approach to developing cost and capacity rates for cancer care delivery to aid in identifying the greatest opportunities for improvement, as well as providing a mechanism for creating episode-based bundles of care that are reflective of actual treatment being provided. [9]

McLaughlin et al (2014), under the mentorship of the Harvard Business School and in collaboration with local clinician sponsors, created 2 teams at UCLA Health (UCLA) in order to pilot the TDABC model in service lines that already had ongoing value-improvement and care-redesign projects. One team studied the microvascular compression syndrome (trigeminal neuralgia, hemifacial spasm, glossopharyngeal neuralgia) service line (neurosurgery pilot). The second team studied the benign prostatic hyperplasia (BPH) service line (urology pilot). They stated that the experimentation and implementation phases of the TDABC model succeeded in engaging health care providers in process assessment and costing activities and that the TDABC model proved to be a catalyzing agent for cost-conscious care redesign. [10]

Laviana et al (2016) utilized TDABC to calculate the costs for men with low risk prostate cancer. They considered TDABC to be feasible for analyzing cancer services and provides insights into cost-reduction tactics in an era focused on emphasizing value. [11]

5. Conclusion

In this paper, a brief description of TDABC at its application in healthcare was given. TDABC has been a novel approach on cost analysis that accurately measures costs and compare them with outcomes. TDABC is a flexible costing method which can be implemented from various perspectives such as payer's perspective (private or public), healthcare provider's (private or public) or patient's. TDABC provides decision makers with opportunities for process improvement, cost reductions, better management of care and new reimbursements approaches resulting in making "value for money" judgements in healthcare. Future research through TDABC method is recommended in order to address more benefits to healthcare organizations and to create new knowledge for better care with lower cost. TDABC is a Simple-Multiperspective-Accurate-Realistic-Time based (SMART) costing tool that may solve the cost crisis in healthcare.

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