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Time-driven activity-based costing in an outpatient clinic environment: Development, relevance and managerial impact

Nathalie Demeere[c], Kristof Stouthuysen[a,*], Filip Roodhooft[b]

[a] Hogeschool-Universiteit Brussel & Katholieke Universiteit Leuven, Stormstraat 2, 1000 Brussel, Belgium
[b] Katholieke Universiteit Leuven & Vlerick Leuven Gent Management School, Naamsestraat 69, 3000 Leuven, Belgium
[c] Deloitte Ltd., Berkenlaan 8a, 1831 Diegem, Belgium

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ABSTRACT

Healthcare managers are continuously urged to provide better patient services at a lower cost. To cope with these cost pressures, healthcare management needs to improve its understanding of the relevant cost drivers. Through a case study, we show how to perform a time-driven activity-based costing of five outpatient clinic's departments and provide evidence of the benefits of such an analysis.

1. Introduction

One of the key challenges to the continued viability of healthcare organizations is the development of relevant and accurate cost information on which to base strategic, pricing and management decisions [1–5]. Recently, healthcare organizations have started to invest in more sophisticated cost-accounting systems, such as activity-based costing (ABC) [see, for example, 6–10]. ABC is an advanced cost calculation technique that allocates resource cost to products based on resource consumption. Researchers have claimed that, since ABC may provide greater visibility into organizational processes and their cost drivers, it may allow managers to eliminate costs related to non-value added activities and improve the efficiencies of existing processes [7,8,11,12]. This process is also referred to as activity-based management.

While several articles have advocated the use of ABC by service organizations in general and healthcare organizations in particular [6,8–10], there is, nevertheless, need for some degree of caution. Lievens et al. [7] and King et al. [13], for example, argue that a potential drawback of ABC systems lies in the time and resource consumption associated with the development and management of these systems. Kaplan and Anderson [14] note that the high time and cost to estimate an ABC model and to maintain it – through re-interviews and re-surveys – has been a major barrier to widespread ABC adoption. In a similar vein, Everaert et al. [15] claim that many managers who have tried to implement ABC in their organizations, including healthcare managers, have abandoned the attempt in the face of rising costs and employee irritation.

In order to overcome the difficulties of ABC, Kaplan and Anderson [14,16], developed a new approach to ABC, called time-driven ABC (TDABC). A TDABC model can be estimated and installed quickly as estimates of only two parameters are required: (1) the unit cost of supplying capacity and (2) the time required to perform a transaction or an activity. The breakthrough of TDABC lies in the usage of time equations to estimate the time spent on each activity [17]. Through the inclusion of multiple time drivers, the time-driven approach to ABC can capture the complexities of organizations far more simply than the traditional ABC system could, which might well have had to account for varying transaction times by treating each variant of the process as a distinct activity [14]. Hence, TDABC seemingly provides many opportunities to design cost models in environments with complex activities, as in healthcare organizations, and service organizations, in general.

* Corresponding author. Tel.: +32 498089711.
E-mail addresses: kristof.stouthuysen@econ.kuleuven.be (K. Stouthuysen), filip.roodhooft@econ.kuleuven.be (F. Roodhooft).

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This paper describes the development and application of a TDABC system for an *outpatient clinic* in Belgium. The outpatient clinic is a consultation department where physicians with different specializations have their office hours and where patients, after having an appointment, receive medical advice. Depending on this advice further medical treatment or hospitalisation takes place. By definition, all outpatient facilities are alike in having no overnight patients.

While previous accounting studies have explored the development and the role of cost-accounting studies in more traditional hospital contexts [2], there has been relatively little analysis of the development and managerial impact of cost systems in an outpatient clinic. This lack of attention might be partly due to the absence of a legal framework to report and register all costs in an outpatient clinic environment [4]. Outpatient clinic services, however, are an important part of the healthcare services sector [18]. An increasing number of community-level outpatient clinics are satellites of larger medical centres or systems, and are thus part of a complex that can emphasize continuity of care. This trend toward increased outpatient health care corresponds with a growing workload at many outpatient clinics [18]. From an empirical standpoint, the outpatient clinic therefore offers an attractive context for this study.

The remainder of this paper is organized as follows. In Section 2, we briefly address the technique of TDABC. In Section 3, we present the TDABC outpatient clinic case. In Section 4, we describe how the TDABC information induced improved decision making in this case. We end with concluding remarks.

2. Theoretical background

2.1. From ABC to TDABC

Lately, hospital studies are applying more and more the basic principles of ABC to healthcare organizations. Proponents of ABC argue that it helps healthcare organizations more accurately understand their costs and helps avoid suboptimal and often disastrous decisions about prices, product mix and planning and control [4,6–10]. The core idea behind ABC is that the production of a cost object (e.g. products, customers) generates activities which consume resources (e.g. wages, equipment). More specifically, the assignment of overhead costs through ABC occurs in two stages. First, the ABC model relies on *resource cost drivers* [7] to assign costs to different activity cost pools (e.g., medical wage costs are allocated to different activities such as supervision or delivering nurse care). Second, the further allocation of costs is performed in a second stage using *activity cost drivers*, which measure the demands a cost object places on an activity [7]. Designing an ABC model typically involves the steps shown in Panel A of Table 1.

While under traditional cost-accounting systems, overhead costs are treated as a homogeneous lump sum and are typically divided by a volume-related base (e.g., the total number of patient days), the ABC model achieves improved accuracy in the estimation of costs by using multiple cost drivers [19]. Additionally, the produced ABC information makes it more likely that healthcare managers will achieve greater understanding of processes and be more willing to pursue changes that increase the value and effectiveness of their organization [6–12].

Table 1
Activity-based costing versus time-driven activity-based costing.

Panel A: ABC	
Step 1	Identify the different overhead activities
Step 2	Assign the overhead costs to the different activities using a resource driver
Step 3	Identify the activity driver for ach activity
Step 4	Determine the activity driver rate by dividing the total activity costs by the practical volume of the activity driver
Step 5	Multiply the activity driver rate by the activity driver consumption to trace costs to orders, products or customers
Panel B: TDABC	
Step 1	Identify the various resource groups (departments)
Step 2	Estimate the total cost of each resource group
Step 3	Estimate the practical capacity of each resource group (e.g. available working hours, excluding vacation, meeting and training hours)
Step 4	Calculate the unit cost of each resource group by dividing the total cost of the resource group by the practical capacity
Step 5	Determine the time estimation for each event, based upon the time equation for the activity and the characteristics of the event
Step 6	Multiply the unit cost of each resource group by the time estimate for the event

Source: Everaert et al. [17].

Although the studies above found ABC providing healthcare management with a more detailed cost analysis and important cost- and value-enhancement opportunities, in practice ABC models are not easy to implement. For example, to build a traditional ABC model, you would survey employees to estimate the percentage of time they spend (or expect to spend) on the different activities and then assign the department's resource expenses according to the average percentage you get from your survey [16]. While this approach works well in a limited setting, difficulties arise when you try to roll this approach out on a large scale for use on an ongoing basis. The time and cost demands of creating and maintaining an ABC model on this large scale might then become a major barrier to widespread adaptation at most organizations [14,16]. And, because of the high cost of continually updating the ABC model, many ABC systems will be updated only infrequently, leading to out-of-date activity cost driver rates, and inaccurate estimates of process, product, and customer costs [20].

The accuracy of the cost driver rates when they are derived from individuals' subjective estimates of their past or future behavior has also been called into question [16,17]. Apart from the measurement error introduced by employees' best attempts to recall their time allocations, the people supplying the data – anticipating how it might be used – might bias or distort their responses. As a result, healthcare managers might argue about the accuracy of the model's estimated costs and profitability rather than address how to improve the inefficient processes, unprofitable products, and considerable excess capacity that the model has revealed [14,16].

Another problem is that ABC uses a single driver rate for each activity. Hence, it is difficult to model multi-driver activities. For example, patient registering costs at an outpatient clinic not only depend upon the number of patients registered, but also on the type of patient (known versus unknown). Working with an average cost per patient of €5 thereby provides inaccurate cost information. One could suggest splitting the activity into two activities, such as "registration of known patients" and "registration of unknown patients." However, splitting inflates the number of activities in ABC and creates difficulties in estimating the practical capacity for each sub-activity.[1]

The solution to the problems with ABC is not to abandon the concept. Instead, Kaplan and Anderson [14,16] developed a new approach to ABC, called time-driven ABC. The new procedure starts, as with the traditional ABC approach, by estimating the cost of supplying capacity. The TDABC approach identifies the different departments, their costs and their practical capacity. For healthcare operations, the practical capacity is expressed as the amount of time that employees can work, without idle time. Often practical capacity is estimated as a percentage, say 80% or 85%, of theoretical capacity [14–18,20]. By dividing the total cost by the practical capacity, the cost per time unit is calculated. Costs then are assigned to the cost object by multiplying the cost per time unit by the time needed to perform the activity, as shown in Panel B of Table 1.

The breakthrough of TDABC lies in the time estimation [18]. The time-driven ABC procedure uses an estimate of the time required each time the activity is performed. It is important to stress, though, that the question is not about the percentage of time an employee spends doing an activity (e.g., registering patients) but how long it takes to complete one unit of that activity (the time required to register one patient). In addition, not all patients are the same and require the same amount of time to register. Rather than define a separate activity for every possible combination of patient characteristics (known or unknown), or use a duration driver for every possible patient registration combination, the time-driven approach estimates the resource demand by a simple time equation. These time equations model how different *time drivers* (i.e. case-specific characteristics) drive the time spent on activity. In complex environments where the time needed to perform an activity is driven by many drivers, TDABC can include multiple drivers for each activity. As such, time equations greatly simplify the estimating process and produce a far more accurate cost model than would be possible using traditional ABC techniques.

[1] An alternative approach to handle heterogeneity in transactions by the ABC system, is the usage of duration drivers, which estimate the time required to perform the task [see, for example, 7]. Examples of duration drivers are set up hours, material handling time, direct labor hours and machine hours. While duration drivers are generally more accurate than transaction drivers (i.e., drivers that count the number of times an activity is performed), they are also more expensive to measure, so cost system designers have typically used transaction drivers whenever they reasonably approximate resource demands by each occurrence of an activity [16,19].

Consider again the example of patient registration. Now, assume that the time required to register a known patient is estimated to be 2 min. If a patient, however, is new, the department head estimates, either from experience or making several observations, that an additional 2 min will be required to register the patient. The time equation for this small example is given as:

$$\text{Patient registration time per patient} = 2 + 2_{\text{if unknown patient}}$$

Once a TDABC system is in place, department heads and healthcare managers can review the cost of the unused capacity and contemplate actions to determine whether and how to reduce costs of supplying unused resources in subsequent periods: they can then monitor those actions over time. Managers can also easily update their TDABC models to reflect changes in operating conditions. To add more activities for a department, they do not have to re-interview personnel; they can simply estimate the unit time required for each new activity [16,20]. In the following section, we further illustrate the estimation procedure and managerial impact of a TDABC model in a Belgian outpatient clinic.

3. TDABC in an outpatient clinic environment

3.1. Research setting and data gathering process

The outpatient clinic we studied, is situated in Belgium, has her own management and consists of 19 independent departments (i.e., specialties). For this study we collected data for five departments: *Urology, Gastroenterology, Nose-Throat and Ears, Plastic Surgery, and Dermatology*. These departments were chosen on the base of multiple criteria. First, as most of these departments were characterized by a medium to high number of patient visits and a growing workload, the clinic's managers argued that the overall profitability of a department did not only depend upon the quality of services, but also whether the gross margin was enough to cover the cost of serving the patient. Consequently, improved cost knowledge in these departments became more important. Second, we chose for these departments as most of the services they provide, comprise a non-technical (i.e. standard) and a technical consultation. Medical consultations are considered to be the key activities of the outpatient clinic. We define a standard, non-technical consultation as a formal meeting with a physician in which the patient receives medical advice after a medical check-up or disease examination. Next to a standard consultation, a technical consultation might be required. Technical consultations contain a special treatment (for example, a PUVA at Dermatology), a technical examination (for example, a gastroscopy at Gastroenterology) or a surgical intervention (for example, Plastic Surgery). As such, complexity in the service provision arises from the potential need for a technical consultation. Third, each of these departments was willing to provide access to all relevant information.

Based on the differences between non-technical and technical performances, we created two cost objects for each department, i.e. the service costs for patients that

Fig. 1. The main activities at the outpatient clinic.

receive a non-technical consultation and patients that receive a technical consultation. Providing the full service process (i.e., administration, consultation, pre- and after-consultation services), three types of organizational members were involved: the physicians, the nurses and the secretaries. While each department employs secretaries for the execution of administrative tasks, physicians for the consultation services and nurses for the pre- and after-consultation services, the Gastroenterology department employs mainly nurses for the execution of technical consultations. Furthermore, we did not include the cost of physicians into the total clinic's labour costs as Belgium has a mixed, public–private health care system with state-organized fee-for service reimbursements.

The activity data were gathered through direct observation and multiple interviews with both the physicians (i.e. department heads) and outpatient clinic managers. Cost data were obtained from the outpatient clinic's and the hospital's accountants. In order to derive the time equations for the TDABC model, we needed estimates of the required time to perform one activity. For that reason, we registered by stopwatch the different time consumptions for all relevant activities. Registration of the times was done during 1 week for the Urology and Gastroenterology departments (making use of decentralized secretariats) and 2 weeks for the Plastic Surgery, Nose-Throat and Ears and Dermatology departments (making use of a centralized secretariat). In order to obtain consistent results, new time registrations were performed 3 months later. Comparing the results of both periods, no statistically different results were found. After having collected all data, a TDABC model was developed for the non-technical and technical consultations of the five different departments within the outpatient clinic.

3.2. Developing the TDABC model

In this part of the paper, we explain the outpatient clinic TDABC analysis. In a first step we present an activity analysis and derive time equations for each relevant outpatient clinic' activity. Second, we provide an overview of all related outpatient clinic costs and identify the different costs per minute. In a third step, based on these time equations and costs per minute, we finally calculate the cost of different non-technical and technical consultations.

3.2.1. Activity analysis and time equations

To construct appropriate time equations a thorough activity analysis of the outpatient clinic and the five departments was performed. We identified five main outpatient clinic's activities (Fig. 1), possibly extended by several optional activities depending on the nature of the consultation (technical or non-technical). First, patients make an appointment for a new consultation by phone or at the office window. This activity is the take-off for several administrative procedures (for example, registering the appointment, starting-up a patient's file, . . .). In a second step, secretaries receive the patients when they announce their presence. Final preparations of the patient's file are made and if necessary emergency treatment documents are filled in. As a third step, we consider the consultation activity. Relevant medical materials and cabinets are prepared, patients are guided towards the consultation room and depending on the nature of the consultation additional activities like anaesthesia or local surgery take place. In a fourth step, the activities after the consultation are defined. For example, while some patients pay their consultations at the window, others make a new appointment for a new consultation within the same or a different consultation department. Patients might also need additional information at the window or by the phone about the upcoming consultation. Also activities like cleaning of the cabinets and typing letters to the physicians are part of this "after consultation" activity. The last step of the basic flow model includes the classification of patients' files and, if necessary, laboratory results in the archives.

For each of these standard and optional activities we registered the required time to perform the activity (Table 2). The total time – in min – per main activity is then the sum of the time required to perform the standard and optional activities, taken into account that certain characteristics could influence the presence of different variables in the time equation. For that reason these characteristics are represented by dummy variables, which are equal to zero or one. Furthermore, the time equations are set up chronologically, implying that both the main activities and the optional activities occur in the order of the position in their time equation. To get an idea of the method of working, the time equations for the technical and non-technical consultations of the Gastroenterology department are derived in Table 2.

3.2.1.1. Non-technical consultations. A consultation starts with making an appointment, usually done by telephone (1.18 min) or at the office window, which takes 0.50 additional minutes. A second step consists of receiving patient. This procedure takes standard 1.95 min for a current patient. The non-standard transactions will take the following extra times: 1.75 min for a new patient, 1.92 min for an emergency treatment of a current patient and 0.17 min for a new emergency patient. The third main activity is the consultation in itself, which takes approximately 19.97 min.[2] The time of a consultation can be extended by 1.02 min, if the patient needs after his consultation a supplementary (on the same day) consultation at another department. A fourth main activity contains the payment of the consultation at the window (2.57 min). The following activities are

[2] Due to the Belgian privacy law, we were not allowed to follow the patient during a consultation. Nevertheless, we were able to register outside the consultation room the average time of a physician's visit.

Table 2
Time equations per main activity for the Gastroenterology department.

Type of consultation	Main activity	Total time needed per activity (in min)
Non-technical consultation	Making an appointment	1.18 + (0.50 × appointment at the window)
	Receiving patients	1.95 + (1.75 × new patient) + (1.92 × emergency treatment for current patient) + (0.17 × emergency treatment for new patient)
	Consultation	19.97 + (1.02 × a direct supplement consultation at another department)
	After consultation	2.57 + (65.02 × typing a letter to physician) + (1.85 × asking additional information by phone) + (1.18 × asking additional information at the window) + (0.31 × cleaning the cabinets)
	Classification of files	2.15
Technical consultation	Making an appointment	1.18
	Receiving patients	6.45
	Consultation	[25.28 + (2.83 × preparing materials) + (3.30 × placing of the patient in the operating room) + (67.35 × machine minutes) + (30.15 × use of medical materials) + (30.15 × use of laboratory results) + (28.83 × use of cabinets)] + [(6.42 × anaesthesia) + (3.30 × post-anaesthesia care unit) + (6.42 × use of cabinets)] + [1.98 × surgery]
	After consultation	0.38 + (3.55 × cleaning the cabinets) + (8.08 × typing a letter to physician) + (1.85 × asking additional information by phone) + (1.18 × asking additional information at the window)
	Classification of files	4.67 + (12.17 × classification of surgery laboratory results)

a summation of activities that might occur. For example, patients might need additional information at the window (1.18 min) or by the phone (1.85 min) about the upcoming consultation. Typing a letter to the physician (65.02 min) is also part of the main "after consultation" activity. This letter contains a medical diagnosis and is unique for each patient. The specificity of this letter bans the use of standard letters. The relevant physician hereby dictates the secretary what to type. Next, the physician controls the letter and if necessary makes adaptations so that the secretary can finalize the letter. A last step of the basic flow model is the classification of the patient files in the archives (2.15 min).

3.2.1.2. Technical consultations. For the technical consultations, the first two main activities only consist of a standard activity, i.e. making an appointment at the window (1.18 min) and receiving the patient (6.45 min). The third main activity is a standard technical consultation which is divided in a range of sub-activities: making use of the machines (67.35 min), preparing the materials (2.83 min), placing the patient in the operating room (3.30 min) and making use of the operating room (28.83 min). Using medical machinery, high time consumptions are noticed due to the amount of time needed to prepare the machine and sterilize it immediately after usage. Additionally, two activities are defined, namely consultations with surgery (1.98 min) and consultations with anaesthesia consuming 6.42 extra minutes of the consultation time, 3.30 min of the post anaesthesia care unit and 6.42 min of the extra use of the cabinets. The fourth main activity deals with the activities after the consultation containing the logging out of the patient (0.38 min) and the cleaning of the cabinets (3.55 min). If the patient needs some additional information, this information is given by phone (1.85 min) or at the window (1.18 min). Some physicians might also ask for a detailed report about the technical procedure which was followed (8.08 min). The process flow finishes with the files classification (4.65 min) and might be lengthened with 12.17 extra minutes when the laboratory results need to be classified.

3.2.2. Identification of cost per minute

In the second part of the TDABC analysis, we need to identify for each resource how much one time unit (i.e. 1 min) per activity actually costs (Table 3). All cost rates hereby are based on the practical capacity instead of the theoretical capacity. As mentioned above, the theoretical capacity equals the theoretically available working minutes while the more realistic practical capacity is set at 80% of the theoretical capacity, a standard number in the management accounting literature [14,16,20].

Costs are divided into four basic resource pools: secretary costs, machine costs, medical material costs and cost of cabinets. As mentioned above, in this study the labour costs will be restricted to the labour costs of the nurses and the secretaries. Next to these costs, two extra resource pools are identified for Gastroenterology, namely costs for operating rooms and nurses' labour costs. These two resource pools are necessary because a technical consultation at Gastroenterology takes place in an extra operating room and requires additional medical staffing. As an example, we again focus on the Gastroenterology department. Next, we compare the major differences in the costs per minute across the five departments.

Secretary costs consist of four types of costs, namely labour costs, cost of a secretary room, office materials costs and other secretary costs, which are allocated to the patients based on the practical capacity of the secretaries. The total secretary labour cost hereby considers three persons working at different time rates (100%, 2 × 75%) resulting in a theoretical capacity of 256,500 available minutes per week. The practical capacity then equals 221,007 working minutes. The secretary cost per minute is calculated by dividing the total secretary costs by the practical capacity and equals 0.6892€/min. Plastic Surgery, Dermatology and Gastroenterology make use of different *machines* for which we take the practical capacity in machine working hours (min). From the 684,000 min the six machines theoretically might work, we only take 547,200 min into

Table 3
Cost per minute per year (€/min).

	Gastroenterology	Dermatology	Nose-Throat and Ears	Plastic Surgery	Urology
Secretary costs	0.6892	0.5708	0.4594	0.4541	0.6303
Machine costs	0.0426	0.0193		0.0781	
Costs for medical materials	0.1834	0.0221	0.0228	0.0198	0.1200
Costs for cabinets	0.1320	0.0972	0.0869	0.0444	0.1112
Costs for operating rooms	0.1320				
Nurses labour costs	0.5968				

account for the calculations, which leads to a cost of 0.0420€/min for the Gastroenterology department. The cost *per minute for the usage of medical materials* at the Gastroenterology department is 0.0583€/min for the technical medical materials and of 0.1834€/min for the non-technical medical materials. Next, in order to attain the cost per minute for the usage of the cabinets, we divide the *costs of the cabinets* by the total number of practical consultation minutes (136,800 min) and end up with a cost of 0.1320€/min. The same cost per minute is used for the extra operating room (0.1320€/min). The *nurses labour cost* per minute for Gastroenterology is calculated by dividing the total nurses labour cost by the 182,400 practical working minutes (theoretical capacity amounts 228,000 min) and results in a cost of 0.5968€/min.

As can be noticed, across the five departments, the biggest difference in the cost per minute is situated on the level of the machine costs. This difference is attributable to the different functionalities and the different pattern of usage of the machinery across departments. Comparing the labour secretary costs per minute, we also see a higher cost at the Gastroenterology department, which is explained by the higher seniority of the secretaries. The relative high cost per minute of the non-technical medical materials by Urology is explained by the higher purchasing cost of this type of medical materials.

3.2.3. Calculating the cost per patient

In a third step, we calculate the specific cost per patient. Based on Tables 2 and 3, we are able to calculate the cost of the activities for a non-technical and a technical consultation (Tables 4 and 5). These technical and non-technical cost tables contain standard and optional activities which are allocated to the patients depending on the treatment and services they receive. Consultation costs are split into the cost per activity and the time per activity. Based on the information we gathered, the different time equations were filled in.

The costs of standard non-technical consultations can be found in Table 4. As can be seen, the cost for a standard non-technical consultation fluctuates between 5.19€ (Plastic Surgery) and 13.78€ (Urology).[3] While the standard activities are similar between the departments, this is not the case for the time rates per activity, nor the nature of the costs. By making use of linear combinations, we are able to make a distinction between different types of patients. For example, we see that a patient that makes maximal use of the Plastic Surgery activities costs 8.09€, which reflects an increase in the standard cost for making an appointment at the window, receiving laboratory results, an additional consultation at another department and asking additional information by phone or at the window. For Gastroenterology, the maximum cost amounts to 67.58€.

In Table 5 we report the results for technical consultations. The cost for a technical consultation equals 4.50€ for Dermatology, 7.06€ for Plastic Surgery and 51.41€ for Gastroenterology. The costs for a technical consultation are with exception for the Dermatological department higher than for a non-technical consultation (i.e. 6.92€ for Dermatology, 5.19€ for Plastic Surgery and 13.22€ for Gastroenterology). This exception is explained by the fact that a technical Dermatological consultation mainly consists of linking the patient with the PUVA machine for a predetermined time. As a result, the consultation will pass by without the intervention of a nurse or physician, which leads to a lower cost per consultation. For the non-technical Plastic Surgery consultation the physician needs to have an in-depth discussion with the patient about his or her personal motivation for Plastic Surgery. This in-depth discussion (non-technical) will take more time as a treatment after surgery (technical).

4. The benefits of TDABC: some management implications

The TDABC system provided accurate and relevant information to both healthcare managers and physicians which assisted them in operational improvements (Section 4.1), making a profitability analysis per department (Section 4.2), deciding on future investments (Section 4.3).

4.1. Operational improvements

The TDABC approach, with its time equations, offers some specific advantages, as these equations create more cost transparency than a conventional cost-accounting system or a traditional ABC system. As the time equations clearly show which activities demand more time, healthcare managers may get an idea of which activities lead to higher costs. Consequently, a TDABC model offers operational insights concerning activities and their added value. This way, the outpatient clinic's management could take appropriate actions to lower the time required to handle some actions, especially in the more demanding departments like Gastroenterology and Urology. An internal benchmark exercise (which became possible

[3] The total cost for Plastic Surgery, for example, is found by the sum of 0.74€ for making an appointment; 1.02€ for receiving the patient; 2.78€ for the consultation and 0.64€ for the classification of the files. A similar way of working is followed for the other departments.

Table 4
Cost table of non-technical consultations (€ per patient).

	Gastroenterology		Dermatology		Plastic Surgery		Nose-Throat and Ears		Urology	
	Time (min)	Cost (€)	Time (min)	Cost (€)	Time (min)	Cost (€)	Time (min)	Cost (€)	Time (min)	Cost (€)
Standard activities										
Making an appointment (telephone)	1.18	0.89	1.63	0.93	1.63	0.74	1.63	0.75	1.40	0.88
Receiving new patients	1.95	1.47	1.92	1.28	1.92	1.02	1.92	1.03	2.97	1.87
Consultation	19.97	6.57	16.8	3.89	25.8	2.78	18.9	3.20	31.65	7.71
After consultation	2.57	1.93								
Classification of files	2.15	2.37	1.42	0.81	1.42	0.64	1.42	0.65	5.26	3.32
Subtotal		13.22		6.92		5.19		5.64		13.78
Optional activities										
Making an appointment at the window	0.50	0.37	0.07	0.04	0.07	0.03	0.07	0.03	0.07	0.70
Emergency patients (new patient)	0.17	0.13	0.17	0.09			0.17	0.08		
Emergency patients (current patient)	1.92	1.44	1.58	0.90			1.58	0.73		
Receiving current patients	1.75	1.31	0.52	0.11	0.52	0.09	0.52	0.09	0.52	2.22
Direct supplement consultation at another department	1.01	0.13	1.20	0.68	1.20	0.54	1.20	0.55	1.32	0.83
Typing a letter to the physician	65.02	48.83							5.53	3.78
Receiving laboratory results			2.15	1.13	2.15	0.90	2.15	0.91	1.40	0.88
Asking additional information										
At the phone	1.68	1.26	1.32	0.75	1.32	0.60	1.32	0.60	1.40	0.82
At the window	1.18	0.89	1.63	0.93	1.63	0.74	1.63	0.75	2.52	1.03
Subtotal		...		...		...		...		...

due to the TDABC information) also introduced an open communication between the department heads and managers concerning possible operational improvements. For example, when looking at the different standard times, healthcare managers were surprised that the standard times for *classification* were twice as high at the Gastroenterology and Urology departments in comparison with the other departments. The main reason for this was that the latter made use of a centralized secretariat with an internal rotation system for secretaries. This system allowed

Table 5
Cost table of technical consultations (€ per patient).

	Gastroenterology		Dermatology		Plastic Surgery	
	Time (min)	Cost (€)	Time (min)	Cost (€)	Time (min)	Cost (€)
Standard activities						
Making an appointment (window)	1.68	1.26	1.68	0.97	1.68	0.77
Receiving current patients	6.45	4.85	0.22	0.12	2.45	1.11
Consultation	25.28	34.79	14.80	3.11	19.68	3.76
After consultation	0.38	0.29	0.28	0.16	1.70	0.77
Classification of files	4.65	3.45	0.25	0.14	1.42	0.64
Typing a letter to the physician	11.23	6.77				
Subtotal		51.41		4.50		7.06
Optional activities						
Consultation with anaesthesia		6.65				
Surgery	12.17	6.77				
Direct supplement consultation at another department	1.02	0.13	1.20	0.68	1.20	0.54
Asking additional information						
At the phone	1.26	1.26	1.32	0.75	1.32	0.60
At the window	1.18	0.89	1.63	0.93	1.63	0.74
Subtotal		...		...		...

Table 6
Gross profit of standard consultations (€).

	Government's tariffs	Consultation		Gross profit	
		Minimum service	Maximal service	Minimum service	Maximal service
Urology	17.81	13.78	24.04	4.05	−6.23
Gastroenterology	27.19	13.22	67.58	13.97	−40.39
Dermatology	23.96	6.92	11.55	17.04	6.92
Plastic Surgery	17.81	5.19	8.09	12.62	5.19
Nose-Throat and Ears	17.81	5.64	9.38	12.17	5.64

secretaries to concentrate themselves on a specific job such as classification work, the telephone or the reception of patients, while after 2 h they were forced to switch jobs. As a result, secretaries got more motivated (different jobs) and could better organize their work. In that way, processing times of the activities and thus costs decreased significantly. A second reason was the univocal classification system and the more adequate accommodation the secretaries could count on. The waiting times for *telephone services* were, due to a more adequate accommodation (for example, secretaries could use head-sets to telephone), lower at the centralized departments. To solve the issues above, healthcare managers and department heads decided to centralize the secretariats for Gastroenterology and Urology, introduce an internal rotation system and put head-sets available for all secretaries to improve the telephone accessibility and reduce telephone times.

The clinic's management also felt that *typing letters* at the Gastroenterology department took too long. To tackle this problem, the Urology department head argued to use a voice recognition system. As she said: *"Using a voice recognition system makes life so much easier. As we all need to write down a lot of patient's information, a voice recognition system will significantly lower the time to reconstruct the patient's story including his treatment. At the Urology department the introduction of these voice recording tools decreased standard times for typing a letter drastically." [Outpatient clinic, Urology department head]*

Furthermore, TDABC results provided the outpatient clinic's managers with a proxy for the cost of a *consultation activity*. They figured out that a consultation activity absorbs about 53% of the total cost of a non-technical standard consultation, while this is about 67% of the total cost of a technical standard consultation. This higher percentage in costs of a consultation activity within the technical consultation was explained by the higher use of medical materials and sophisticated machinery for technical consultations. A capacity analysis of the computers showed that the intensity of using the computers was rather low. As a solution, the digitalization of the medical files was suggested. A comparison of standard costs at service level also reflected some serious differences between the centralized and non-centralized secretariats due to *economies of scale*. As the cost of the centralized services lies in average 2.2€ lower for a non-technical consultations, this meant a cost saving of 33% at patient level (Table 5).[4] Next to centralizing the secretaries for Gastroenterology and Urology, the departments were encouraged to make more use of the central hospital purchasing function. In turn, this must lead to higher purchasing volumes and more just-in-time deliveries.

4.2. A profitability analysis per department

In order to adequately assess the outpatient clinic financial position, the gross profit per patient was calculated. Therefore, we compared the different consultation costs with the government's payments at the moment of this study. Table 6 gives the results of this analysis and shows a gross profit for a standard consultation between 4.05€ and 17.04€. For the more demanding patients of Urology and Gastroenterology the results are negative and equal −6.23€ and −40.39€, respectively. Although the government's tariffs cover the costs of simple consultations, this amount will not cover the more complex consultations (for example, Urology and Gastroenterology).

4.3. Future investment decisions

Next to the small changes above, clinic's management and department heads paid special attention to the TDABC data in designing the new building plans for the new outpatient clinic. In doing so, they concluded that the new outpatient clinic needed to contain less squared meters for the supporting activities and more squared meters for the consultation activities. By this, the clinic's management and department heads hoped to centralize all secretariats and increase the personal patients' care. Furthermore, through the multifunctional use of the cabinets – namely as a meeting room, study space or as place for completing the hospitalisation files – the occupancy rate would also be kept as low as possible. Also the construction of a library was considered. Next to this, additional optimisation projects for the storage of materials, the organization of the pharmacy and a univocal classification system for all departments were discussed. In that way, the TDABC system played a significant role in the prioritization and cost justification of improvement projects.

5. Conclusion

In this paper we try to explain the development, the relevance and the managerial impact of TDABC in an outpatient clinic environment. The TDABC system seems to

[4] For the technical consultations we were not able to make a further analysis of the effective economies of scale based on the incomparability of the activities for a technical consultation (Table 5).

be well suited since it incorporates next to the advantages of the traditional ABC system some extra features like faster model adaptability, a simpler set-up and a higher reflection of the complexity of the real-world operations. The TDABC model in this paper was set up for five different departments: *Urology, Gastroenterology, Plastic Surgery, Nose-Throat and Ears and Dermatology*. Based on cost Tables 4 and 5, the cost for a standard technical consultation appears to range from 5.19€ to 13.78€, while the cost for a non-technical consultation ranges from 4.50€ to 51.41€. The cost of a standard consultation shows already the influence of the specificity of the consultation, the differences in the usage of activities and machinery and the differences in the cost per time unit. Optional activities might then increase the cost between 0.13€ and 6.77€ for a technical consultation and 0.03€ and 48.83€ for a non-technical consultation.

The TDABC system challenged healthcare managers and department heads to identify and analyze the underlying activities that drove the overhead costs. As such, the TDABC analysis allowed managerial recommendations concerning improvement opportunities [14–17,20]. Secretaries were centralized, telephone accessibility was improved by putting head-sets available and voice recognition systems were introduced for all physicians to reduce the typing times of letters. Furthermore, we also saw the TDABC approach introduced a healthy competition and an open communication between the different departments concerning possible operational improvements. The introduction of interactive meetings on business and operational matters in that way promoted inter-hierarchical and more important inter-disciplinary (between physicians and managers) communication. Finally, while the interaction between cost-accounting systems and strategy has been frequently viewed as a passive one [21], in this study the TDABC information clearly improved the department heads and healthcare managers' understanding of the different organizational processes. As such, the clinic's management was able to pursue strategic changes that increased the value and effectiveness of the current and future outpatient clinic.

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References

[1] Kesteloot K, Lievens Y, Van Der Scheuren E. Improved management of radiotherapy departments through accurate cost data. Radiotherapy and Oncology 2000;55(3):251–62.
[2] Eldenburg L, Krishan R. Management accounting and control in health care: an economic perspective. In: Chapman C, Hopwood A, Shields M, editors. Handbook of management accounting research, vol. 2. Oxford: Elsevier; 2007. p. 859–83.
[3] Gil D, Hartmann F. How CEOs use management information systems for strategy implementation in hospitals. Health Policy 2007;81(1):29–41.
[4] Cardinaels E, Roodhooft F, Van Herck G. Drivers of cost system development in hospitals: result of a survey. Health Policy 2004;69(2):239–52.
[5] Eldenburg L, Kallapur S. Changes in hospital service mix and cost allocations in response to changes in Medicare reimbursement schemes. Journal of Accounting and Economics 1997;23:31–51.
[6] Ross T. Analyzing health care operations using ABC. Journal of Health Care Finance 2004;30(3):1–20.
[7] Lievens Y, Van Den Bogaert W, Kesteloot K. Activity-based costing: a practical model for cost calculation in radiotherapy. International Journal of Radiation Oncology Biology Physics 2003;57(2):522–35.
[8] Cappetini R, Chow C, McNamee A. On the need and opportunities for improving costing and cost management in healthcare organizations. Managerial Finance 1998;24(1):46–59.
[9] Udpa S. Activity-based costing for hospitals. Health Care Management Review 1996;21(3):83–96.
[10] Chan Y. Improving hospital cost accounting with activity-based costing. Health Care Management Review 1993;18(1):71–7.
[11] Carolfi I. ABM can improve quality and control costs. Cost and Management 1996;(May):12–6.
[12] Ittner C, Lanen W, Larcker D. The association between activity-based costing and manufacturing performance. Journal of Accounting Research 2002;40:711–26.
[13] King M, Lapsley I, Mitchell F, Moyes J. Costing needs and practices in a changing environment: the potential for abc in the National Health Service. Financial Accountability and Management 1994;10(2):143–60.
[14] Kaplan R, Anderson S. Time-driven activity-based costing. Harvard Business Review 2004;82:131–8.
[15] Everaert P, Bruggeman W, De Creus G. Sanac Inc.: from ABC to time-driven ABC (TDABC)—an instructional case. Journal of Accounting Education 2008;26:118–54.
[16] Kaplan R, Anderson S. The innovation of time-driven activity-based costing. Journal of Cost Management 2007;21(2):5–15.
[17] Everaert P, Bruggeman W, Sarens G, Anderson S, Levant Y. Cost modeling in logistics using time-driven ABC. Experiences from a wholesaler. International Journal of Physical Distribution & Logistics Management 2008;38(3):172–91.
[18] Schulpen G, Vierhout W, Van Der Heide D, Landewe R, Winkensa P, Wesselingh-Megens A, et al. Patients at the outpatient rheumatology clinic: do they really need to be there? European Journal of Internal Medicine 2003;14:158–61.
[19] Babad Y, Balachandran B. Cost driver optimization in activity-based costing. The Accounting Review 1993;68:563–4.
[20] Pernot E, Roodhooft F, Van Den Abbeele A. Time-driven activity-based costing for inter-library services: a case study in a university. The Journal of Academic Librarianship 2007;33(5):551–6.
[21] Kober R, Ng J, Paul B. The interrelationship between management control mechanisms and strategy. Management Accounting Research 2007;18:425–52.