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**MEASURING DIAGNOSIS
AND PATIENT PROFITABILITY
IN HEALTHCARE:
ECONOMICS VS ETHICS**

Abstract. This paper focuses on issues relating to gauging profitability under circumstances in Czech healthcare organizations. At present, the trend in healthcare management is for more frequent utilization of advanced economic and cost accounting tools. These qualitatively improve the decision-making process in healthcare establishments, as well as aiding provision of accurate data on the cost and revenue of the outputs of hospital organizations, such as the various diagnoses and types of patients. Herein the authors present analysis of the profitability of such patient and diagnose-types (DRG) in selected hospital departments of Czech regional hospital. Revenue from insurance payments is compared with costs calculated via the Activity-Based Costing method so as to discern more accurately the proceeds of a given DRG and patient. The results of the study highlighted crucial differences between the income generated by individual cost objects (i.e. patients and DRGs). Utilizing such information could greatly benefit decision-making and enhance cost effectiveness of the hospital services. However, any healthcare establishment worldwide is strictly curtailed in this by the ethical standards it must uphold when making decisions on potentially raising profitability. The final part of the study discusses the findings of the profitability analysis performed by the authors in the given context of general healthcare organizations management.

Keywords: healthcare organization, hospital profitability, costing, hospital management, Activity-Based Costing, patient cost

JEL Classification: I11, M41

Introduction

Discerning the profitability of decentralized business units has long been an issue for management accounting (Drury 2001, Garrison et al. 2010). The accountants' objective is to support managers of an organization by providing data for the decision-making process; to wit any information on the profit generated by the sections of the business is highly crucial. Recent decades have witnessed a rise in the application of various managerial techniques by hospital organizations. They often rely on profitability analyses, performance measurement or accurate

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costing techniques in order to inform decision-making, increase profitability and heighten the cost efficiency of the various activities conducted.

Many academic studies related to the healthcare management issues provide extensive evidence on the increasing cost of healthcare in numerous countries. For instance, Chernew (2003) states that, for the majority of the post-WWII period, healthcare costs with adjustment for inflation rose at a much faster rate than GDP. Increased demands on the quality and extent of healthcare go hand-in-hand with reduced spending on healthcare systems, primarily caused by the finite resources of the public purse. Under such conditions, hospital organizations are pressurized to effectively manage their activities and outputs on restricted budgets. Similar experience we can observe in developing economies with relatively low healthcare insurance coverage (Rodríguez 2014).

Joumard et al. (2010) state that exploiting efficiency gains in healthcare will prove crucial to meeting the rapid growth in demand, without placing public finance on an unsustainable course. The efficiency of a hospital cannot be discerned as easily as that of a business enterprise, due to factors influencing the process of health provision (complexity of services, difficult cost and revenue allocation, etc.). The revenue for a medical establishment is generally based on funds from insurance payment systems, thereby not permitting simple price negotiation as would otherwise occur in business.

One of the greatest difficulties experienced by such an establishment when measuring profitability is the ability to perform accurate cost assignment using a proper cost calculation or costing technique. Many authors have highlighted the crucial matter of the costing methods (cost calculation) applied within hospital organizations. For instance, Edbrooke et al. (1997) point out the increasing need for a method that not only provides accurate costing of patients, but also permits resource utilization to be identified for all patients treated with different clinical specialities. Ridderstolpe et al. (2002) state that accurate cost calculation is necessary for controlling the cost of healthcare, set as it is against a backdrop of ever greater demand and resource constraints. Several management techniques and methods have been devised in the past few decades, which often reveal fresh opportunities for managing costs, even in sectors considered to be unvarying. These techniques thereby aid comprehension of any links between costs and service provision in order to improve the efficiency of existing operations.

This paper presents evidence on methods of profitability measurement under circumstances prevailing in selected departments of a Czech regional hospital. The accurate costing method known as Activity-Based Costing was applied to carry out such measurement, thereby allowing precise assignment of costs to the given patients and diagnoses. Naturally, accurately allocating costs results in calculating the profitability of individual cost objects with greater accuracy. Obviously, using analyses of profitability relating to particular cost objects (DRGs and patients) in order to inform managerial decisions with an eye to gaining profitable DRGs or patients is not ethically possible. Therefore, the closing part of the paper discusses potential utilization of profitability analyses by hospital organizations to aid in decision-making.

Literature review

Running a hospital profitably has been a hot topic for discussion in recent decades. Hospital profitability is primarily negatively affected by diminishing revenue streams of the hospitals caused by restricted policies on healthcare systems. Many different studies worldwide have investigated the influence of miscellaneous effects on the profitability of hospital operations. For instance, Rauscher (2012) studied the impact of managing working capital on the same. Singh et al. (2012) looked into how the revenue cycle time affected it. Most studies emphasize

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the crucial role of costs on such profitability, especially under conditions of fixed revenue governed by the healthcare insurance system (Ortiz, 2012).

Many papers relating to the cost of hospital operations highlight the importance of measuring the profitability, cost and revenue sources of individual decentralized units, such as individual diagnoses and patients. The ability to accurately gauge the profitability of given diagnoses of patients, which ultimately contribute to overall organizational profitability, is highly dependent on the accuracy of the costing method applied. For instance Šimrová et al (2014) presents the comparative study of the cost and reimbursement of the lung-cancer treatment among selected health service providers.

Several literature sources present findings on various methods used to estimate costs for patient-related services provided by hospitals worldwide. These include the use of average costs, obtained by dividing total annual expenditure by patient throughput (Bams and Miranda, 1985), the use of severity of illness and workload scoring systems (Zimmermann et al., 1993) and the use of billing systems (Finkler, 1982). Carvalho Jericó and Castilho (2010) state that most hospitals applying cost management systems use the absorption method. Absorption costing is based on simple allocation of all organization's cost using a simple allocation base. This is most common costing technique utilized across diverse industries (Popesko and Novák, 2011). Indeed, the advantage of absorption costing is its broad applicability and ease of use. Nevertheless, absorption costing is often criticized for its inaccuracy. Cao et al. (2006) has made a comment that although the VBC (volume-based costing) method benefits from simplicity, it often returns approximate and inaccurate results caused by inaccurate overhead cost allocation.

Traditional costing methods often distort the indirect costs that are allocated to given products, and accounting reports do not usually provide any managerial interpretations of such deviations in indirect costs. Strong criticism against traditional costing methods was voiced by Kaplan and Johnson (1987) in 1987. They pointed at the inaccurate overhead cost allocation. Despite this, traditional costing methods are still frequently used in practice, mostly for their undemanding utilization and low requirements on input data. Their limitations could prove important when applying costing systems in the service sector.

The problems associated with traditional costing methods resulted in the creation of Activity-Based Costing (ABC), first presented by Kaplan and Johnson (1987), which allocate the overhead cost of organization to the products via defined structure of activities. ABC brought with it important benefits in the accuracy of cost allocation, as well as facilitating measurement of the outputs of organizational activities. Important difference between traditional costing and ABC is that overhead costs are not allocated using an inaccurate allocation base, but through the activities actually performed within an organization.

In general, ABC is based on the concept that performing a service consumes activities that in turn consume resources (Goldberg 2011). According to Wodchis (1999), traditional costing techniques allocate costs to all units based on an average unit cost, or they pool indirect costs and allocate them to services, this in proportion to the volume of services or direct costs. Andrade (1999) states that ABC more precisely reflects the costs of operations in a company; doing so in a more consistent manner than traditional methods. Therefore, it comes as no surprise that it has proven increasingly popular as an alternative to traditional costing. Agyar (2007) states that ABC provides better quality information for management than traditional accounting. The biggest disadvantage presented in many studies is that traditional methods of cost accounting could over- or underestimate the costs of services, as overhead costs could vary with the complexity of delivering services and not due to the volume of services. (Hankins, 2004; Lucey, 2002). In order to more accurately determine the efficiency of an ABC model, a traditional cost accounting system has to be utilized in parallel (Agyar, 2007).

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Implementing an advanced costing system, such as ABC, results in collecting accurate data on profitability or facilitates precise analysis for covering the costs of the cost objects analysed, such as the aforementioned DRGs or patients. Profitability analysis for standard businesses tends to lead to activities being diminished that relate to products with unprofitable cost objects, with emphasis being placed on profitable cost objects (or patients). Profitability analysis could also generate better information for handling price negotiations, thereby providing an impetus to increase the price of unprofitable products. However, all of these managerial implications of profitability analysis remain off bounds for healthcare organizations.

Adopting a strictly business-orientated approach to patients might be comprehended as highly discriminatory, especially as non-discrimination is a fundamental principle of medical ethics; represented, as it is, by the principles of justice and equity, while also manifest as a legal requirement for practicing medicine (Beauchamp and Childress, 2009). Problems related to conflicts that arise between financial managerial decisions and the ethics of healthcare have been investigated recently by many authors without any general conclusion (Vicol et al., 2013; Rueegger et al., 2012; Onuigbo, 2012). However, ethical standards are also becoming very common in the business environment, along with the development of Corporate Social Responsibility (CSR) activities by enterprises (Fischer, 2004; Ghasemi and Nejati, 2013).

Methods and materials

As previously mentioned, the objective herein was to analyze the profitability of selected patients and DRG categories in certain hospital departments, in order to discern any possible managerial implications of the given profitability analysis and discuss the resulting ethical consequences. The authors used case study research to perform an application of Activity-Based Costing, so as to calculate the costs of individual patients and DRGs more accurately. The case studies were conducted at an Ear, Nose & Throat (ENT) department (Popesko and Novak, 2013), as well as dermatology and neonatology departments. The general characteristics of the case studies are displayed in Table 1.

Table 1. General characteristics of case studies performed

Case study	A	B	C
Department	Dermatology	Neonatology	ENT
Total costs	647,658 €	1,863,374 €	733,434 €
Number of employees	20	94	27
Number of beds	21	44	26
Number of hospitalized patients	456	2593	987
Number of activities - primary	11	11	11
Number of activities - support	5	5	5

Source: own work.

The case studies adhered to several consequential steps, as follows. Initially, three departments at the Czech regional hospital were chosen as typical examples of hospital departments. Secondly, the objective was determined as calculating the cost of a selected sample of patients using the Activity-Based Costing approach.

The following step involved gathering all necessary information, both financial as well as from management accounting. The documentation and information gathered was as follows:

- Costs of financial accounting for the given departments and centres

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- Costs of management accounting for said departments and centres
- Lists of medicines and medical aids supplied to the same
- Lists of fixed assets with costs and depreciation schedules
- Technical documentation for construction work
- Selected invoices
- Overview of the employees of the departments and their salaries
- Information on non-financial indicators, e.g. the number of treatments given, of hospitalization cases, of bed-days, of procedures, of admissions and discharges of patients, etc.

The next stage required all the traditional steps of Activity-Based Costing to be conducted, along with the profitability analysis of selected patients, encompassing:

- Defining the structure of activities, taking into consideration a limit to the total number of activities of 20 per department and ensuring a uniform structure of activities, i.e. the logical structure of activities was similar across the various departments
- Allocating the cost registered in the accounting system and other additional evidence to defined activities, using varied forms of resource cost drivers
- Calculating the activity rates for the given activities, using standardized cost drivers and data sources for calculating activity output measures
- Calculating costs of selected patients within specific DRG groups
- Calculating DRG/patient profitability as a comparison of DRG/patient cost and reimbursement received from health insurance

Finally, the case studies were summarized according to their characteristics, followed by outlining any general requirements and the necessary implementation procedures, which led to formulating the standardized steps to be taken.

The profitability calculation pertaining to the ABC approach was performed in six sequential stages, as discussed below.

First stage – defining activities

It was necessary to design activities that would reflect significant cost activities in the given hospital department. The entire ABC system is more complex and less clear if too many activities are identified for a department. Therefore, the authors of the study proposed a list of activities that needed to be adapted by the departments. A general description of these appears in Table 2.

Table 2. General structure of proposed activities

Activity code	Name of activity	Description of activity
101	Outpatient examination	All standard operations carried out during examination of the patient at the clinic, except specialized examinations
111 - 11X	Specialized examination or treatment	Tasks conducted during specialized examinations or treatment at the department
201	Patient admission	All standard operations carried out when admitting the patient to the hospital, including giving a standard examination; it does not involve specialized examinations
211 - 21X	Hospitalization	All activities related to a specific instance of hospitalization, except the cost of treatment(s)
221 - 22X	Treatments or surgery	All activities related to specialized treatment or surgery
290	Patient release	All standard operations carried out at the point of releasing the patient

Source: own work.

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After the “primary activities” had been defined, the following step involved discerning and describing “secondary activities”. These took the form of hospital service departments, e.g. X-ray, microbiology or blood transfusion, as these provided services to other primary care departments.

Next, “infrastructural activities” were ascertained, covering all activities related to administration and infrastructure of the hospital organization. Such as:

- Management and administration;
- Human resources management;
- Information systems and technologies;
- Facility management;

The costs related to these activities were allocated to the cost object (patients) defined by applying different allocation mechanisms. Here, such primary activities were assigned directly to the patients. The costs of secondary activities were consumed by the patients in the primary department that instigated such consumption. In order to accurately determine the volume of these costs consumed by individual patients, it was necessary to determine the primary departments’ demand on said outputs from the relevant secondary departments. This means that it was necessary to allocate the costs of the secondary activities to the primary departments and then to the patients. Finally, the costs of the infrastructural activities were allocated to all the primary and secondary activities.

Second stage - Assigning costs to activities

The previous stage covered defining individual activities that would finally be allocated to the relevant patients as cost objects. After identifying the major activities, overhead costs were allocated to these defined activities. The eventual output of this phase involved determining the total cost of activities. Allocation was made through the resource-cost drivers discerned. Costs were allocated to activities via several resource-cost drivers (RCD), such as the labour consumption of physicians based on activities, and the square metres of floor space given over to activities, etc. All costs were assigned to activities using the “activity cost matrix”, which displays the links between indirect costs and activities.

Table 3. Calculation of the total cost of an activity using the activity cost matrix

	activity 1	activity 2	activity 3	...	activity n	Total of cost element
cost element 1	$X_{1.} * K_{11}$	$X_{1.} * K_{12}$	$X_{1.} * K_{13}$	...	$X_{1.} * K_{1n}$	$X_{1.}$
cost element 2	$X_{2.} * K_{21}$	$X_{2.} * K_{22}$	$X_{2.} * K_{23}$	...	$X_{2.} * K_{2n}$	$X_{2.}$
cost element 3	$X_{3.} * K_{31}$	$X_{3.} * K_{32}$	$X_{3.} * K_{33}$	...	$X_{3.} * K_{3n}$	
...	
cost element m	$X_{m.} / K_{m1}$	$X_{m.} / K_{m2}$	$X_{m.} / K_{m3}$	...	$X_{m.} / K_{mn}$	$X_{m.}$
Total of activity	X_1	X_2	X_3	...	X_n	$X_{..}$

X_i – total of cost element i

K_{ij} - key to the division of i-th cost element and j-th activity in %

Source: own work.

Third stage - Identifying cost drivers and their output measures

Once the total cost of an activity had been quantified, it was necessary to define the appropriate cost drivers for each activity. The system as designed applies three different types of

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cost drivers. These cost drivers were simply acquirable from the hospital information system. Afterwards, it was necessary to identify the output measures of individual activities.

These cost drivers are mostly non-financial in form and represent the activity performance level. Most of these non-financial data can be obtained from medical registers, such as the following reference values:

- Number of tests
- Number of treatments given
- Number of patients admitted
- Number of patients discharged
- Number of patient days
- Number of hospitalized patients
- Number of operations
- Number of hours

Fourth stage - Determining the unit cost of an activity

After the above stages have been completed, it is possible, on the basis of this information, to calculate the unit costs of activities – “activity rates”. These could be calculated by simple division of the total activity cost by the activity output measure determined. Activity rates can be worked out by the single formula:

$$\text{Activity rate} = \text{Total activity cost} / \text{Activity output measure}$$

Table 4 displays the activity rates calculated for the ENT department of the selected hospital.

Table 4. Examples of activity rates (ENT dept.)

	Activity	Cost driver	Total activity costs	Output measure	Activity rate
101	Outpatient examination	# of treatments	€ 20 306	1 269	€ 16.00
111	Specialized examination – sonography	# of treatments	€ 10 203	305	€ 33.45
112	Blood testing and vaccination	# of treatments	€ 79 409	4 757	€ 16.69
201	Patient admission	# of patients admitted	€ 44 071	2 592	€ 17.00
211	Hospitalization – Physiological Care	# of bed days	€ 452 406	11 948	€ 37.86
212	Hospitalization – Intermediate Care Unit	# of bed days	€ 451 529	2 685	€ 168.15
213	Hospitalization – Intensive Care Unit	# of bed days	€ 445 473	2 198	€ 202.69
221	Respiratory support	# of bed days	€ 118 340	1 645	€ 71.94
222	Infusion support	# of bed days	€ 72 424	1 232	€ 58.79
223	Monitoring	# of bed days	€ 132 456	4 883	€ 27.13
290	Patient release	# of patients discharged	€ 92 263	2 566	€ 35.96

Source: own work.

Fifth stage - Calculating the cost of a patient

This step included calculating the costs of a selected cost object, i.e. a patient, and was considered the objective for implementing the costing system. Cost of patient is the total cost that had been consumed by the patient within his stay at hospital. In order to assign the cost to a defined cost object, it was necessary to identify the volumes of individual activity outputs consumed by a specific patient. In other words, the number of individual activity output measures consumed by an individual patient had to be obtained. All necessary data regarding the consumption of activities by individual patients are normally obtainable from the hospital's information system. Information on the volume of output of activities usually forms part of medical reports - the length of hospital stay, number of examinations, etc.

The cost of a patient might easily be calculated as the sum of the direct cost consumed by the patient (usually consisting of material and medicines directly allotted to the specific patient) and the activity cost. Activity costs are calculated as the sum of individual activity rates multiplied by the activity units consumed by the given patient. The following formula illustrates how the total cost of a patient could be calculated:

$$CoP_k = DCoP_k + \sum_{j=1}^n AR_j \times AV_{kj}$$

CoP_k – Total cost of patient k

$DCoP_k$ – Direct cost of patient k

AR – Vector of activity rates

AV_{kj} – Volume of the activity j consumed by patient k . If patient k does not consume activity j , then AV_{kj} equals 0.

Sixth stage - Calculating the profitability of the patient and DRG

Here, the calculated cost of a patient was compared with patient revenue streams, ascertained as being the reimbursement received for the patient from a health insurance scheme. Due to the high number of differing DRGs and individual patients, the authors of the study firstly chose a sample of diagnoses at each department analyzed, and then calculated the cost of a selected sample of patients within these given diagnoses. The costs of individual patients were compared with the reimbursements received from health insurance schemes. Afterwards, the average cost and reimbursements for chosen diagnoses were calculated.

Results

After performing of the stages outlined above, all final data were summarized in Table 5. As explained in the methodology part of the paper, three different departments at the hospital were selected for analysis (ENT, Dermatology and Neonatology). Within each of these, the authors chose the most relevant DRGs. For example, three DRGs were determined as suitable from the ENT department, with tonsil surgery and partial deafness being sub-divided into acute and non-acute treatment, meaning a total of 5 DRGs for analysis. Three DRGs were also decided on from the Dermatology department, all of them classified under inpatient and outpatient treatment. The Neonatology department does not function with many DRGs, but individual patients (newborns) are appraised independently.

For the purposes of this analysis, individual patients were placed under two major categories, with 13 different patient categories (DRGs) being analysed in total. For each form of DRG, the authors selected a sample of 10 - 30 patients, the cost of whom was separately

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calculated using the designated ABC system. Table 5 displays the following data: average cost per patient sample; the highest and lowest patient cost; and standard deviation, which highlights cost variability between the given patients. The data also includes figures for average reimbursement per patient and a given DRG's profitability, which was arrived at as the average profit per patient (reimbursement – (minus) cost) divided by the calculated cost. The profitability of the DRG group permits comparison of the percentage of the profit/loss generated and the total cost of a patient.

Table 5. Profitability analysis of the selected DRGs

DPT	DRG	# of patients in sample	average cost	Max cost	Min cost	Standard deviation	Average reimbursement	Profitability
ENT	Endoscopy surgery	10	€ 1 249.59	€ 1 798.32	€ 685.92	329.14	€ 1 234.68	-1.21%
ENT	Non-acute tonsil surgery	10	€ 873.64	€ 1 026.47	€ 808.14	72.41	€ 597.64	-46.18%
ENT	Acute tonsil surgery	10	€ 1 173.76	€ 1 659.10	€ 905.85	220.05	€ 597.64	-96.40%
ENT	Non-acute partial deafness	10	€ 422.69	€ 509.53	€ 339.24	53.24	€ 455.32	7.17%
ENT	Acute partial deafness	10	€ 392.69	€ 544.13	€ 273.90	82.32	€ 455.32	13.76%
Derma-tology	Psoriasis - outpatient	10	€ 199.10	€ 496.76	€ 18.35	164.66	€ 353.90	43.74%
Derma-tology	Psoriasis - inpatient	15	€ 882.98	€ 1 370.44	€ 219.84	323.35	€ 641.38	-37.67%
Derma-tology	Varicose ulcers - outpatient	10	€ 138.46	€ 467.52	€ 12.23	152.52	€ 153.21	9.63%
Derma-tology	Varicose ulcers - inpatient	15	€ 1 031.60	€ 1 623.29	€ 396.60	377.57	€ 633.80	-62.77%
Derma-tology	Eczema and other - inpatient	15	€ 463.49	€ 786.84	€ 188.23	222.42	€ 378.27	-22.53%
Derma-tology	Eczema and other - outpatient	30	€ 27.38	€ 94.13	€ 6.12	23.05	€ 21.88	-25.10%
Neona-tology	Preterm newborn - low obstetric weight	10	€ 14 260.75	€ 23 067.93	€ 6 798.58	5223.37	€ 34 446.28	58.60%
Neona-tology	Preterm newborn	10	€ 2 744.68	€ 4 052.95	€ 1 669.93	790.41	€ 3 360.88	18.33%

Source: own work.

Discussion

As can be seen in Table 5, the profitability of the DRG groups varies widely. The lowest figure appears for acute tonsil surgery in the ENT department, where reimbursement covers just 51% of the calculated cost. However, the cost of a preterm new-born with low obstetric weight exceeds reimbursement by almost 2.5 times.

As mentioned previously, profitability analysis in business often leads to increased focus being placed on products, customers and segments with a high profitability rate. That means that a traditional business, which is able to accurately analyse the profitability of its various business units, concentrates on developing profitable business units, restricting somehow any unprofitable ones. Another managerial implication of such profitability analysis pertains to information for setting prices. A business could use the information outputs of profitability analysis when negotiating prices with clients, thereby bolstering the profitability of any underperforming business units.

However, managing a healthcare organization is very different, not only due to the diversity of the establishment, but also as profitability analysis cannot inform similar managerial business-orientated decisions. Ethical principles are at stake and must be respected. Quite simply, it is impossible to manage a customer (patient) portfolio as all patients are equal in the eyes of the law. Consequently, such establishments are faced with very few options on performing any kind of price negotiation. Often the reimbursement stream from the health insurance system adheres to a fixed, inflexible arrangement, not permitting any negotiation.

Despite such significant limitations in utilizing profitability analysis, healthcare organizations could still reap some benefits. The analysis performed and precise data on the costs of patients and DRGs could bring about better understanding of any connections between organizational costs and performed outputs. Hospital managers and physicians would be more able to evaluate the costs of the patients and DRGs analyzed. Therefore, it would be possible to make better informed decisions at a managerial level on the forms of treatment offered, the structure of investigation into any issues, and other matters which might be optional. Furthermore, analyzing the costs of activities might result in boosting the performance of the same, or furthering utilization of current assets and equipment.

Conclusion

The research performed herein illustrates how Activity-Based Costing could be used to conduct superior profitability analysis of selected patients and DRGs in hospital organizations. The authors focused on the conflict between the high-quality accounting data gathered and the limited scope available to management. Despite the fact that decision-making by hospital managers, especially when economics are concerned, is significantly impinged by ethical constraints, such precise financial data would promote better comprehension of internal cost behavior. The paper also highlights the disparity that exists between individual patients sharing a diagnosis, which is also an important factor to be considered in the decision-making process. Greater awareness of processed costs, outputs and related expenses is one way to potentially make efficiencies within hospitals, as this is indispensable to encouraging better management and furthering an establishment's sustainability.

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