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Economic feasibility of computerized campimetry equipment and costs of the procedure

Alicia D. Pereira[1].

ABSTRACT

This article describes a case study on the economic feasibility and acquisition of a Computerized Campimetry equipment in a private eye health facility. Health costs have increased significantly and good planning should involve analyzing these costs, using current information and making adequate predictions for the future. Computerized campimetry is used for diagnosis and monitoring of various eye diseases, especially those that affect peripheral vision, such as glaucoma. The research resulted in a new piece of equipment, with significant innovations in relation to the main devices available on the market and at a lower cost. The objective is to evaluate the economic feasibility and calculate the costs of the visual field procedure, using a methodology to improve pricing. It is understood that economic viability and pricing are related to the structural decentralization of the hospital organization. In addition, it is important to highlight the engagement of all employees and physicians to perform the medical procedure.
Considering the spread of fixed costs in view of the diversity of services provided, the data used were collected through the analysis of managerial financial reports and interviews with employees. The proposed cost model methods identified a cost-benefit ratio. However, it was found that the pricing is satisfactory and emphasizes the importance of monitoring and controlling fixed and variable costs within the institution.
The results of the application of the proposed costing system are feasible and the institution considered to be of the largest size proved to be the best cost-benefit ratio, in view of the dissemination of fixed costs in view of the diversity of services performed. Regarding the cost-price ratio, it was found that procedures are profitable and others that generate poor results or losses, emphasizing the need for cost control for the evaluation of services, in order to use it as a price marker in negotiations with health plans. The conclusion of the proposed model is advantageously applicable. To the extent that it contributes to the dissemination and use of cost information, it supports operational management and control and generates preponderant information in negotiations with service takers.

Keywords: Cost Analysis, Ophthalmic Procedures, Pricing and Economic Feasibility.

INTRODUCTION

In recent years, medicine has made extraordinary advances. Innovative diagnostic techniques have emerged that can (at very high cost) identify problems that previously remained hidden. There are new (and expensive) healing therapies, modern (and equally expensive) techniques that prolong the lives of patients, who not so long ago had zero expectation of survival. Health professionals have never been so specialized. Thanks in part to medicine, the world is getting older. These are fantastic advances for

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humanity. These scientific and technological advances have brought strong impacts and, as a result, increased human survival.

Fig.1 [2] Humphrey Field Analyzer HFA II-i Series automated campimeter.

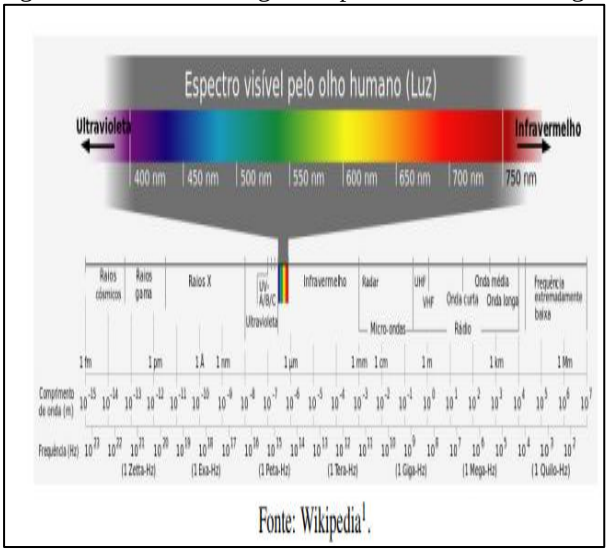
Source: Zeiss (2024).

On the other hand, there was a great impact on health costs. The objective of this study is to identify the critical points and the importance of the visual field equipment and its economic feasibility of costs *versus* price of the computerized campimetry procedure, applying the results in the comparison of prices of health plans. To this end, a new methodology is assigned to the equipment for the specialty and subspecialty of ophthalmology. Studies carried out on the equipment show that the cost performance of the procedure requires a certain number of interruptions in the service of the eye examination. The survey corresponds to a period of four (4) months – from January to April 2024. The equipment samples the nominal voltages of the data. In interviews with employees of the technical area in search of confirming certain details, some data were found in the searches of the programs and records and in the filtering processes in *software*.

Characterization and analysis of failure points and defects is a method used to prevent failures and analyze the risks of a process. However, it is an important tool in identifying failures and correcting them, thus increasing the reliability of customers and processes.

Light visible to humans is only a small band of the entire electromagnetic spectrum, whose length ranges from approximately 400 to 700 nanometers.

Fig. 2 [3] The electromagnetic spectrum and visible light.



For the characterization and analysis of the numerical values, an excel spreadsheet was developed that served as a basis for research and that was associated with the software with recent records of attendances and binders (printed) to analyze the pricing. It was also necessary to verify whether the clinic had control of the routines of care performed, or if it would be possible to implement them, from the reception of the patient to the final conclusion of the service, considering that the calculation of costs involves this entire process. The methodology applied consisted of activities developed with the clinic, in which the employees involved in the processes were trained to collect information on a monthly basis. Subsequently, the data were processed in an electronic spreadsheet (Microsoft Excel software). The data presented were collected from January to April 2024, using interviews with employees, analysis of monetary and non-monetary reports, from accounting, managerial and statistical information, and on-site observations.

TABLE I - COMPOSITION OF SERVICES FOR HEALTH PLANS

Atendimentos para Planos de Saúde (exceto SUS). Janeiro a Abril 2024				
Código Tuss	Descrição	Quantidade realizada Binocular	Total Faturamento	Tiket Médio
40103137	CAMPIMETRIA COMPUTADORIZADA	312	R$57.336,99	R$ 183,77

Own source, Instituto de Olhos de Goiânia 2024.

(A) Survey of attendance data for cost calculation.

Processing after analysis and validation of the data collected. The next phase of the work was the processing of the information and the respective calculation of the costs per cost center. In order to facilitate understanding, some steps have been developed, as follows:

(A) Structuring of the cost spreadsheet;

(B) Recording of direct costs;

(C) Apportionment of indirect costs.

This step consists of the distribution of cost items that are not identified directly on a cost center. The amount of the item to be prorated is divided by the total of the criterion, thus finding an index. This ratio is multiplied by the proportion of each cost center, locating the cost apportionment amount of the equipment.

FIXED AND VARIABLE COST CENTERS

TABLE II - BREAKDOWN OF COSTS

Identificação: Elaboração: 15/05/2024 Revisão: 15/03/2025 Versão: 4.00.01	PRECIFICAÇÃO DE EXAMES OFTALMOLÓGICOS DE IMAGEM Departamento Emitente: Custos e Processos Interessados: Superintêndencia e Diretoria	LOGA EMPRESA
Responsável: Alicia Dias Pereira		
40103137 Campimetria computadorizada		
COMPOSIÇÃO DOS CUSTOS		
Margem de lucro pretendido ou atingido :	49%	
Preço de Venda	R$	183,77
(-) Impostos	R$	17,46
(=) Receita Líquida	R$	166,31
(-) Custo Prestação de Serviço/Honorário Méd	R$	60,53
(=) Lucro Bruto (Margem de Contribuição)	R$	105,78
(-) Depesas Administrativas	R$	16,33
(=) Lucro Líquido	R$	89,45

Source: *Microsoft Excel* is the 2024 own spreadsheet software.

TABLE III - BREAKDOWN OF FIXED AND VARIABLE COSTS

Identificação: Elaboração: 15/05/2024 Revisão: 15/03/2025 Versão: 4.00.01	PRECIFICAÇÃO DE EXAMES OFTALMOLÓGICOS DE IMAGEM Departamento Emitente: Custos e Processos Interessados: Superintêndencia e Diretoria	LOGA EMPRESA

Responsável: Alicia Dias Pereira

40103137 Campimetria computadorizada

COMPOSIÇÃO DOS CUSTOS

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(-) Depesas Administrativas	R$	16,33
(=) Lucro Líquido	R$	89,45

CUSTOS VARIÁVEIS

Material / Medicamentos e OPME:	R$	2,59
Gaze Medicinais	R$	-
Total dos Custos Variáveis (A):	R$	2,59

CUSTOS FIXOS

Salário Pessoal	R$	17,99
Depreciação de Microscopio	R$	2,52
Energia	R$	4,16
Água	R$	1,18
Ar-condicionado	R$	1,01
IPTU	R$	0,45
Sistema/Internet	R$	0,44
Sistema/Telefone	R$	0,38
Depreciação Predial	R$	1,93
Material de Escritório/Gerais	R$	1,78
Limpeza Setor	R$	0,84
Manuteção Aparelho / Mão de Obra	R$	4,35
Total dos Custos Variáveis (B):	R$	37,03

DEPARTAMENTOS AUXILIARES CUSTOS INDIRETOS

Faturamento	R$	0,91
Total dos Departamentos	R$	0,91

TOTAL DOS CUSTOS (A + B + C): R$ 40,53

VALOR DE VENDA PORTE HONORÁRIO MÉDICO

HONORÁRIO MÉDICO (R$)	R$	20,00
	R$	20,00

R$ 20,00

GAZES MEDICINAIS (C)

MATERIAIS

Item	Und. Consumo	Consumo	Custo Unitário	Custo Total
COTONETE HASTE FLEXIVEIS	UN	10	0,03	0,34
LUVA CIRURGICA 8.5 COM PO	UN	1	2,25	2,25
			MATERIAIS COMUM (R$)	2,59

Source: *Microsoft Excel* is the 2024 own spreadsheet software.

THE COST CENTRES OF THE EQUIPMENT

Comparing the cost composition among other equipment, it can be observed that the cost is low. However, today's campimeters are expensive, large, delicate devices (making them difficult to transport) and some components require periodic maintenance to ensure their calibration. On the other hand, technological development has allowed the construction of portable devices that facilitate and popularize ophthalmological examinations.

In this work, a sample of the costs of the campimeter equipment, whose manufacturer is Zeiss, in 2024 was developed. At the end of the exam, a report is generated with a result for the patient and, at the end of the day, the number of tests that were performed is determined.

The above analysis aims to illustrate some of the possible uses of cost calculation as a management tool to evaluate the performance of the equipment and the percentage of the contribution margin of the procedure.

Fig. 3 - Humphrey Field model automated campimeter

Source: Instituto de Olhos de Goiânia.

THE COST OF THE CAMPIMETRY PROCEDURE

As knowledge of unit costs, it is possible to highlight a benefit generated by cost information, i.e., supplying the clinic by the price list.

Although there are variables that influence the sales price, cost information plays an unquestionable role in the formation of the sales price, as it generates subsidies for the evaluation of the clientele, both in terms of the volume of activities and for the analysis of the results provided by the sale of services [10,11].

In addition to serving health insurance and private patients, the company's environment must present a favorable structure to meet a higher production.

THE CONTRIBUTION MARGIN

There is an important piece of information generated by the proposed model, the calculation of the contribution margin obtained by the composition and revenue values.

PREVENTIVE MAINTENANCE

Preventive maintenance on healthcare equipment is crucial to ensure its proper functioning, for patient safety, and to avoid high costs with corrective maintenance or replacements. Although the importance of this practice is unquestionable, it is recommended to revisit the guidelines and manuals of the National Health Surveillance Agency (ANVISA) or the Brazilian Association of Technical Standards (ABNT) specific to medical equipment and hospital maintenance, which can address preventive maintenance in a more direct way and applied to the context of campimetry equipment.

MANAGEMENT OF MEDICAL TECHNOLOGY

It is essential to qualify and train other employees in the use of tools and equipment, which is one of the functions of the clinical engineer within a hospital, after all, he is the one who has the technical

knowledge necessary to instruct the health team. In hospital management, the presence of clinical engineering can greatly facilitate the processes of purchasing and acquiring equipment.

Care management consists of situations and procedures of support and care for the patient during the time he remains in the hospital.

Fig. 4

Medical Technology: Instituto de Olhos de Goiânia. (05-2024).

ORGANIZATION AND STANDARDIZATION OF INFORMATION

In order to organize and standardize the analysis, the study was developed in phases: information collection; data processing and validation; calculation of the costs of the procedures and analysis of the performance of the equipment.

SURVEY OF INFORMATION FROM THE CLINIC

The work related to the data collection was developed in stages, as follows:

(A) Evaluation and definition of the organizational structure;

(B) Division of cost centers between productive, auxiliary and administrative, and evaluation of the activities carried out in each of them;

(C) Definition of the composition of costs and expenses and classification of costs between fixed and variable;

(D) Definition of production units;

(E) Establishment of the bases for the apportionment of indirect costs and expenses;

(F) Establishment of the apportionment bases of the support and administrative centers;

(G) Preparation of data collection reports;

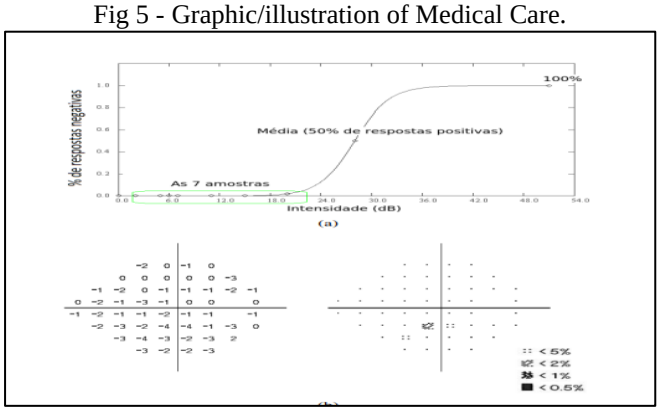
(H) Collection of cost data by cost center, in each of the sectors pertinent to the desired information;

(I) Collection of statistical data, physical structure of the clinic and production.

DATA PROCESSING

After the analysis and validation of the collected data, the next phase of the work consisted of processing the information and calculating the costs per cost center.

Fig 5 - Graphic/illustration of Medical Care.



Eye Institute of Goiânia.

After knowing the direct and indirect costs of each of the cost centers, the next step is to transfer the costs from the auxiliary and administrative cost centers to the production cost centers and to process the costs of the computerized campimetry procedure.

Then, the direct costs are recorded, the indirect costs are apportioned, the auxiliary and administrative centers are apportioned, and these three components are added together, arriving at the total cost of each of the productive cost centers. At that time, all the costs of the auxiliary and administrative centers were absorbed by the production centers. Therefore, the sum of the productive cost centers corresponds to the total costs of the clinic.

CALCULATION OF THE COSTS OF THE PROCEDURES

(A) Appropriation of direct costs to procedures;

The direct costs are clearly defined for each of the procedures, with emphasis on the costs of material, medicines and fees paid to doctors and technicians per service performed.

(B) Apportionment of depreciation costs of procedures;

The settlement of depreciation costs to the respective procedures was calculated at a rate of 10% per year, and distributed according to actual production. When the equipment performed two or more types of examinations, the time of use for each eye was considered.

(C) the absorption of fixed costs;

The absorption of costs (structure) by the procedure performed was distributed in proportion to the hours used by services performed.

(D) Calculation of the cost of the procedures;

After allocating the variable and fixed costs (direct and indirect), these items are added together, dividing them by the total number of procedures performed. In this way, the unit cost of the procedure is reached, ending the entire stage of calculating the costs to find this indicator. The general formula is:

Contribution Margin = Sales Value – (Variable Costs + Variable Expenses).

Explaining this calculation a little, the contribution margin is how much will be "left" from your sales price, after subtracting the variable costs and expenses of the product or service (such as costs of sale, raw materials, taxes and taxes).

The result will be the gross profit from the sale and should be used to pay off the fixed costs and expenses of your business.

PERFORMANCE EVALUATION AND ANALYSIS

(A) Calculation and evaluation of the contribution margin;

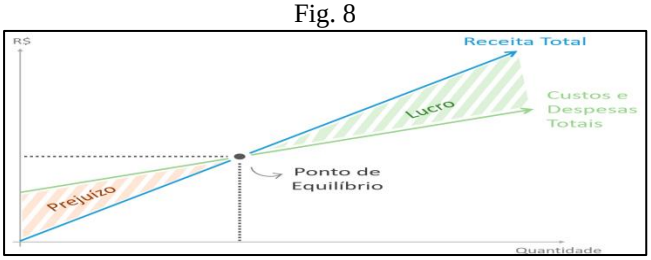
(B) Definition of the break-even point;

(C) Comparison of price *versus* cost.

THE BREAK-EVEN ANALYSIS

Regarding the calculation of the necessary amount of production for the clinic to reach the break-even point, this calculation is made after the rupture of this link.

Fig. 8



New Business Source. Break-even point 2024.

AS FOR PRICE *VERSUS* COST EQUIPMENT

According to the interviewee's report regarding the criteria and procedures of cost accounting, the cost system separates fixed and variable costs. Following the bibliography, the interviewee considers as fixed those that, with the constant structure, do not vary with the quantity produced, such as, for example, expenses with water, electricity, telephone and consumables. These variables are those that, during the period of a study, present a variation directly proportional to the amount produced, such as, for example, the radiological films and the number of exams performed in the ophthalmology service. Regarding direct and indirect costs, the interviewee explains that there is also separation and that the cost system uses the RKW method (Reichskuratoriun für Wirtschaftlichtkeit) by which the final cost centers aggregate the

direct and indirect costs of the base and middle areas. The allocation of indirect costs is made through apportionment criteria based on direct labor or other fixed criteria.

Fig 5: Model Humphrey Field Analyzer HFA II-i Series.

Source: Zeiss (2024). Source: Zeiss (2024).

AS FOR PRICE *VERSUS* COST

Many discussions take place between buyers and service providers at the time of negotiating the price list, however, in the vast majority of cases, there is no conceptual foundation that provides concrete data for a healthy negotiation. The lack of cost information centralizes the discussion on assumptions and conjectures, without finding a favorable solution for both parties [9,10].

One of the purposes of great relevance of this work is the comparative analysis between the prices practiced in the market and the actual cost of the procedures. The objective is to make some contribution to alleviate the conflict situation in this scenario, providing some conceptual information, so that decisions are guided by concrete and significant data.

DISCUSSIONS

The present work elucidates the importance of management information in the face of a market increasingly pressured by the high technology imposed by the sector, which is experiencing a moment of transition and strong competition. As a result, the need for investments to remain competitive is essential. On the other hand, the increasing scarcity of resources puts in conflict the model that until now has allowed institutions to obtain excellent returns. Thus, we can infer that medical clinics that intend to prosper in this context should opt for a process of managerial modernization, with the adoption of professional instruments.

RESULTS AND DIFFERENTIALS

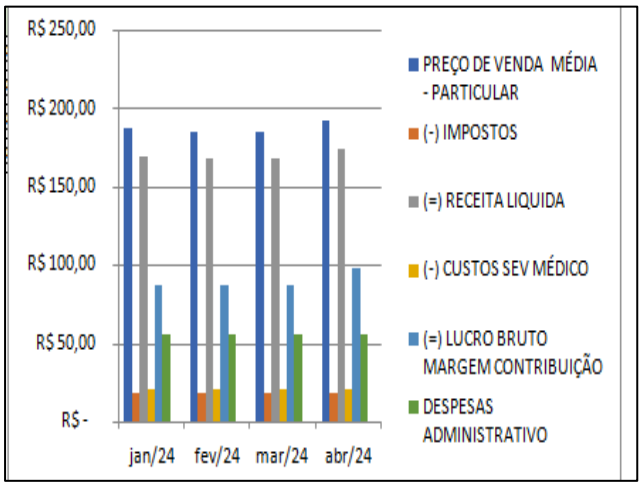
The application of the proposed costing system is feasible for the clinic and proved to be the best *cost-benefit* ratio.

Fixed costs were priced in view of the diversity of services performed. Regarding the *cost-price* ratio, there were profitable procedures and others that generated poor results or losses. The sample can be used to validate other procedures in the field of ophthalmology.

CONCLUSION

This article was prepared and validated in a graduate program of the School of Mechanical Engineering and Computing (EMC) of the Federal University of Goiás (UFG), in the face-to-face modality, contemplating the main contents of scientific methodology, using institutional design strategies, with well-defined and written learning objectives, active learning methodologies and formative assessments. The proposed model is applicable with advantages, as it contributes to the dissemination and use of cost information, supporting management and operational control, generating preponderant information in negotiations with the services provided in the area of ophthalmology.

Chart Conclusion 2



Data from the attendance survey, 2024.

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BIOGRAPHIES

Alicia Dias Pereira, born in São Luis de Montes Belos - Goiás, on 02/18/1977. Graduated (2006), Post-Graduation (2023) in Electrical Engineering from the School of Engineering of Goiânia-GO, Federal University of Goiás. She works as Hospital Billing Manager and Hospital Cost Manager: Instituto de Olhos de Goiânia.

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There is always an opportunity that is seen as an opportunistic event, capable of improving the current state of a human being, a new situation that brings benefits.